

**SECURITIES AND EXCHANGE COMMISSION**  
Washington, D.C. 20549

**Amendment No. 1**  
**to**  
**FORM S-1**  
**REGISTRATION STATEMENT**  
**UNDER**  
**THE SECURITIES ACT OF 1933**

**ShockWave Medical, Inc.**

(Exact Name of Registrant as Specified in Its Charter)

**Delaware**  
(State or Other Jurisdiction of  
Incorporation or Organization)

**3841**  
(Primary Standard Industrial  
Classification Code Number)

**27-0494101**  
(I.R.S. Employer  
Identification Number)

**5403 Betsy Ross Drive**  
**Santa Clara, California 95054**  
**(510) 279-4262**

(Address, Including Zip Code, and Telephone Number, Including Area Code, of Registrant's Principal Executive Offices)

**Douglas Godshall**  
**President & Chief Executive Officer**  
**ShockWave Medical, Inc.**  
**5403 Betsy Ross Drive**  
**Santa Clara, California 95054**  
**(510) 279-4262**

(Name, Address, Including Zip Code, and Telephone Number, Including Area Code, of Agent For Service)

*Copies to:*

**Alan F. Denenberg**  
**Stephen Salmon**  
**Davis Polk & Wardwell LLP**  
**1600 El Camino Real**  
**Menlo Park, California 94025**  
**(650) 752-2000**

**Charles S. Kim**  
**David Peinsipp**  
**Kristin E. VanderPas**  
**Cooley LLP**  
**4401 Eastgate Mall**  
**San Diego, California 92121-1909**  
**(858) 550-6000**

**Approximate date of commencement of proposed sale to the public:** As soon as practicable after the effective date of this Registration Statement.

If any of the securities being registered on this form are to be offered on a delayed or continuous basis pursuant to Rule 415 under the Securities Act of 1933, check the following box.

If this form is filed to register additional securities for an offering pursuant to Rule 462(b) under the Securities Act, check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering.

If this form is a post-effective amendment filed pursuant to Rule 462(c) under the Securities Act, check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering.

If this form is a post-effective amendment filed pursuant to Rule 462(d) under the Securities Act, check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering.

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 7(a)(2)(B) of the Securities Act.

**CALCULATION OF REGISTRATION FEE**

<b>Title Of Each Class Of Securities To Be Registered</b>	<b>Amount to be Registered(1)</b>	<b>Proposed Maximum Offering Price Per Share(2)</b>	<b>Proposed Maximum Aggregate Offering Price(1)(2)</b>	<b>Amount Of Registration Fee(3)</b>
Common Stock, par value \$0.001 per share	5,750,000	\$16.00	\$92,000,000	\$11,150.40

(1) Includes 750,000 shares that the underwriters have the right to purchase from us solely to cover over-allotments.

(2) Estimated solely for the purpose of computing the amount of the registration fee pursuant to Rule 457(a) under the Securities Act of 1933.

(3) The registrant previously paid \$8,484 of this amount in connection with the initial filing of this registration statement.

**The Registrant hereby amends this registration statement on such date or dates as may be necessary to delay its effective date until the registrant shall file a further amendment which specifically states that this registration statement shall thereafter become effective in accordance with Section 8(a) of the Securities Act of 1933 or until the registration statement shall become effective on such date as the Commission, acting pursuant to said Section 8(a), may determine.**

The information in this preliminary prospectus is not complete and may be changed. We may not sell these securities until the registration statement filed with the Securities and Exchange Commission is effective. This preliminary prospectus is not an offer to sell these securities and it is not soliciting an offer to buy these securities in any state where the offer or sale is not permitted.

SUBJECT TO COMPLETION, DATED FEBRUARY 25, 2019

5,000,000 Shares



## Common Stock

This is the initial public offering of shares of common stock of ShockWave Medical, Inc.

We are offering 5,000,000 shares of our common stock. Prior to this offering, there has been no public market for our common stock. It is currently estimated that the initial public offering price per share will be between \$14.00 and \$16.00. We have applied to list our common stock on the Nasdaq Global Market under the symbol "SWAV."

We are an emerging growth company under the federal securities laws and will be subject to reduced public company reporting requirements. See "Prospectus Summary—Implications of Being an Emerging Growth Company."

Investing in our common stock involves a high degree of risk. See "[Risk Factors](#)" beginning on page 14.

	Per Share	Total
Initial public offering price	\$	\$
Underwriting discounts and commissions <sup>(1)</sup>	\$	\$
Proceeds, before expenses, to us	\$	\$

(1) See "[Underwriting](#)" for additional disclosure regarding the estimated underwriting discounts and commissions and estimated offering expenses.

Certain of our existing investors have options to purchase up to an aggregate of approximately \$10.5 million in our common stock in a concurrent private placement at a price per share equal to the initial public offering price. There can be no assurance that these stockholders will exercise these options and, even if such options are exercised, that they will be exercised for the full amount of shares. The sale of shares in the concurrent private placement, if any, will not be registered under the Securities Act of 1933, as amended. The closing of this offering is not conditioned upon the closing of the concurrent private placement. Any shares of common stock purchased in the concurrent private placement will not be subject to any underwriting discounts or commissions.

We have granted the underwriters the right to purchase up to an additional 750,000 shares of common stock solely to cover over-allotments, if any.

The underwriters expect to deliver the shares against payment in New York, New York on \_\_\_\_\_, 2019.

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

**Morgan Stanley**

**Wells Fargo Securities**

**BofA Merrill Lynch**

**Canaccord Genuity**

, 2019

## TABLE OF CONTENTS

	<u>Page</u>		<u>Page</u>
<a href="#">Prospectus Summary</a>	1	<a href="#">Management</a>	141
<a href="#">The Offering</a>	9	<a href="#">Executive Compensation</a>	149
<a href="#">Summary Consolidated Financial Data</a>	12	<a href="#">Director Compensation</a>	158
<a href="#">Risk Factors</a>	14	<a href="#">Certain Relationships and Related Party Transactions</a>	159
<a href="#">Special Note Regarding Forward-Looking Statements</a>	71	<a href="#">Principal Stockholders</a>	161
<a href="#">Market, Industry and Other Data</a>	73	<a href="#">Description of Capital Stock</a>	164
<a href="#">Use of Proceeds</a>	74	<a href="#">Material U.S. Federal Income and Estate Tax Consequences for Non-U.S. Holders of Common Stock</a>	171
<a href="#">Dividend Policy</a>	76	<a href="#">Shares Eligible for Future Sale</a>	174
<a href="#">Capitalization</a>	77	<a href="#">Underwriting</a>	176
<a href="#">Dilution</a>	79	<a href="#">Legal Matters</a>	187
<a href="#">Selected Consolidated Financial Data</a>	82	<a href="#">Experts</a>	187
<a href="#">Management's Discussion and Analysis of Financial Condition and Results of Operations</a>	84	<a href="#">Where You Can Find More Information</a>	187
<a href="#">Business</a>	99	<a href="#">Index to Consolidated Financial Statements</a>	F-1

---

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

This prospectus includes industry and market data that we obtained from periodic industry publications, third-party studies and surveys, filings of public companies in our industry and internal company surveys. These sources may include government and industry sources. Industry publications and surveys generally state that the information contained therein has been obtained from sources believed to be reliable. Although we believe the industry and market data to be reliable as of the date of this prospectus, this information could prove to be inaccurate. Industry and market data could be wrong because of the method by which sources obtained their data and because information cannot always be verified with complete certainty due to the limits on the availability and reliability of raw data, the voluntary nature of the data gathering process and other limitations and uncertainties. In addition, we do not know all of the assumptions regarding general economic conditions or growth that were used in preparing the forecasts from the sources relied upon or cited herein.

Certain market and industry data used in this document, where noted, is attributable to Millennium Research Group, Inc. ("MRG"). MRG asserts copyright protection over the use of such information and reserves all rights with respect to its use. This information has been reprinted with MRG's permission and the reproduction, distribution, transmission or publication of such information is prohibited without its consent.

**Until \_\_\_\_\_, 2019 (25 days after the date of this prospectus), all dealers that buy, sell or trade our common stock, whether or not participating in this offering, may be required to deliver a prospectus. This is in addition to the dealers' obligation to deliver a prospectus when acting as underwriters and with respect to their unsold allotments or subscriptions.**

## PROSPECTUS SUMMARY

*This summary highlights information contained elsewhere in this prospectus. This summary may not contain all of the information that you should consider before deciding to invest in our common stock. You should read this entire prospectus carefully, including the “Risk Factors” section and the consolidated financial statements and the notes to those statements. Except as otherwise indicated herein or as the context otherwise requires, “ShockWave Medical,” “ShockWave Medical, Inc.,” the “Company,” “we,” “us” and “our” refer to ShockWave Medical, Inc. and its consolidated subsidiary.*

### Company Overview

We are a medical device company focused on developing and commercializing products intended to transform the way calcified cardiovascular disease is treated. We aim to establish a new standard of care for medical device treatment of atherosclerotic cardiovascular disease through our differentiated and proprietary local delivery of sonic pressure waves for the treatment of calcified plaque, which we refer to as intravascular lithotripsy (“IVL”). Our IVL system (our “IVL System”), which leverages our IVL technology (our “IVL Technology”), is a minimally invasive, easy-to-use and safe way to significantly improve patient outcomes. Our Shockwave M5 IVL catheter (“M5 catheter”) was CE-Marked in April 2018 and cleared by the U.S. Food and Drug Administration (“FDA”) in July 2018 for use in our IVL System for the treatment of peripheral artery disease (“PAD”). Our Shockwave C2 IVL catheter (“C2 catheter”), which we are currently marketing in Europe, was CE-Marked in June 2018 for use in our IVL System for the treatment of coronary artery disease (“CAD”). We have ongoing clinical programs across several products and indications which, if successful, will allow us to expand commercialization of our products into new geographies and indications. Importantly, we are undertaking ongoing clinical trials of our C2 catheter intended to support a pre-market application (“PMA”) in the United States and a Shonin submission in Japan for the treatment of CAD. We anticipate having final data from these ongoing clinical trials intended to support a U.S. launch of our C2 catheter in the first half of 2021 and a Japan launch in the second half of 2021.

### The Opportunity

Atherosclerosis is a common disease of aging in which arteries become narrowed (“stenotic”) and the supply of oxygenated blood to the affected organ is reduced by the progressive growth of plaque. Atherosclerotic plaque is comprised of fibrous tissue, lipids (fat) and, when it progresses, calcium. This calcium is present both deep within the walls of the artery (“deep” or “medial” calcium) and close to the inner surface of the artery (“superficial” or “intimal” calcium).

The first two indications we are targeting with our IVL System are occlusive PAD, the narrowing or blockage of vessels that carry blood from the heart to the extremities, and CAD, the narrowing or blockage of the arteries that supply blood to the heart. In the future, we see significant opportunity in the potential treatment of Aortic Stenosis (“AS”), a condition in which the heart’s aortic valve becomes increasingly calcified with age, causing it to narrow and obstruct blood flow from the heart.

The PAD population in the United States has been estimated to be at least eight million people, according to the National Institutes of Health. The global PAD device market size for treatment of occlusive disease is estimated at approximately \$2.9 billion and is expected to grow approximately 3% annually due to the fundamental drivers of an aging population and increasing prevalence of diabetes. The “calcium” segment of the PAD market represents a significant percentage of the market, with 50% or more of the population having moderate-to-severe calcium in their vessels, according to our estimates. Current technologies are often not able to safely and effectively treat heavily calcified vessels. Accordingly, we believe our IVL System to treat PAD has a total addressable market opportunity of over \$1.7 billion.

The global device market in coronary intervention for CAD is estimated to be nearly \$10 billion, according to MRG. The most common treatment for patients is percutaneous coronary intervention (“PCI”). This involves a suite of devices to facilitate successful angioplasty and stenting, the most commonly used device being drug-eluting stents (“DES”). Moreover, there are nearly four million PCI procedures performed globally every year, and the number of PCI procedures is growing at a rate of more than 5% annually. We believe our IVL System can help grow this market through the improved treatment of patients undergoing PCI in whom the currently available solutions pose a higher degree of clinical risk, as well as through increased adoption of IVL by cardiologists compared to currently available plaque modification devices. A study published in the *American Journal of Cardiology* in 2014 demonstrated that more than 30% of patients undergoing PCI have calcified lesions and this percentage is growing. Minimizing complications is particularly important in the coronary vessels, but current plaque modification devices carry meaningful safety risks and are inherently challenging to use, which is why these devices are used very sparingly for PCI procedures in patients with calcified coronary disease. Despite significant under-penetration of the market, these devices still represented a market of nearly \$100 million in 2018 within the United States alone, according to MRG; we believe this market is significantly larger globally. Due to the increasing prevalence of calcified cardiovascular disease, the market growth for plaque modification devices exceeds that of PCI procedure growth. We believe the safety, ease of use and efficient impact on calcium of our IVL System will result in rapid adoption and market expansion in markets in which our C2 catheter is introduced. We believe there is an over \$2 billion total addressable market opportunity for our IVL System to treat CAD.

The global market for Aortic Valve Replacement (“AVR”), the main treatment for AS, is growing rapidly, and is dominated by the emergence of Transcatheter Aortic Valve Replacement (“TAVR”) devices. According to an article published in the *Journal of Thoracic Disease* in 2017, the global market for TAVR is over 125,000 procedures performed worldwide in 2018 and is expected to grow to nearly 300,000 by 2025. We believe our IVL System may be able to improve the treatment of AS among patients in whom currently available solutions are inadequate. We are currently developing an IVL catheter which we believe can safely and effectively treat patients with AS. If successful, this represents a potential total addressable market of over \$3 billion for our IVL System to treat AS.

### **Current Challenges**

The primary approaches to treat vascular disease are angioplasty balloons (“balloons”), drug-coated balloons (“DCB”), bare metal stents and DES. These devices all work by using pressurized balloons to expand the diseased blood vessels. Calcified plaque creates challenges for these therapies in achieving optimal outcomes in treating PAD and CAD because the calcified vessels fail to expand under safe pressures. This, in turn, can lead to acute failure, damage to the blood vessel, which increases the rate of restenosis (re-occlusion of the vessel following endovascular treatment) or complications requiring adjunctive tools, future re-interventions or conversion to bypass surgery. These complications are significantly increased when treating calcified cardiovascular disease and include dissections, embolization, restenosis, vessel perforations and vessel recoil.

Plaque modification devices (including atherectomy and specialty balloons) have enhanced the treatment of some moderately calcified cardiovascular lesions by improving the ability of stent and balloon therapies to effectively expand in the vessel. Atherectomy devices are designed to break or remove superficial calcium by cutting or sanding the calcium in order to improve vessel expansion. Specialty balloon devices incorporate metallic elements like wires and cutting blades onto standard angioplasty balloons; these devices are intended to make discreet cuts in the plaque and surrounding tissue in order to improve vessel expansion. Despite improvements in plaque modification devices, significant limitations remain, including being difficult to use and creating complications and inconsistent efficacy. Further, because medial calcium is encased in the vessel wall, the existing plaque modification devices are unable to impact medial calcium without damaging the vessel. Combined, these limitations decrease the utilization of plaque modification devices for treating calcified

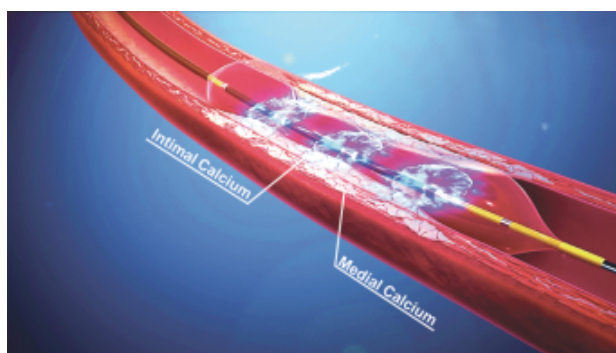
cardiovascular disease, thereby reducing the clinical benefit of angioplasty and stent therapies compared to their use in non-calcified anatomies.

Calcified iliac and femoral arteries can hinder the delivery of large endovascular devices for other catheter-based procedures, including those that treat aortic aneurysms (Endovascular Aneurysm Repair and Thoracic Endovascular Aneurysm Repair procedures), severe aortic stenosis treated with TAVR and cardiac support devices for high-risk PCI (e.g. Impella). The standard practice for these procedures is to gain vascular access in the femoral artery and insert large diameter sheaths that facilitate the delivery of the treatment devices to the aorta or the heart. However, when significant calcium is present in these arteries, it can prevent delivery of the devices, and thus may require more invasive treatments, increase complications or prevent the device from being used altogether. For example, in up to 20% of patients, the transfemoral approach through the iliac and femoral arteries is not viable for TAVR delivery or creates risk of vessel trauma due to the extent of vascular calcification, according to a 2018 study in the *Journal of the American College of Cardiology*.

### Our Solution

We have adapted the use of lithotripsy to the cardiovascular field with the aim of creating what we believe can become the safest, most effective means of addressing the growing challenge of cardiovascular calcification. Lithotripsy has been used to successfully treat kidney stones (deposits of hardened calcium) for over 30 years. By integrating lithotripsy into a device that resembles a standard balloon catheter, physicians can prepare, deliver and treat calcified lesions using a familiar form factor, without disruption to their standard procedural workflow. Our differentiated IVL System works by delivering shockwaves through the entire depth of the artery wall, modifying calcium in the medial layer of the artery, not just at the superficial most intimal layer. The shockwaves crack this calcium and enable the stenotic artery to expand at low pressures, thereby minimizing complications inherent to traditional balloon dilations, such as dissections or tears. Preparing the vessel with IVL facilitates optimal outcomes with other therapies, including stents and drug-eluting technologies. Using IVL also avoids complications associated with atherectomy devices such as dissection, perforation and embolism. When followed by an anti-proliferative therapy such as a DCB or DES, the micro-fractures may enable better drug penetration into the arterial wall and improve drug uptake, thereby improving the effectiveness of the combination treatment.

### Our IVL System



*(Left) Our IVL System consisting of a generator, connector cable and IVL catheter  
(Right) Our IVL System delivering lithotripsy directly to a calcified vessel*

Our IVL System includes a generator, connector cable and a family of IVL catheters designed to treat PAD and CAD. Our IVL System employs our IVL Technology to crack calcium through short bursts of sonic pressure waves, which are generated within the IVL catheter, travel through the vessel and crack calcium with an effective

pressure of up to 50 atmospheres (“atm”) (a unit of pressure) without harming the soft tissue. Our IVL catheters utilize multiple lithotripsy emitters that are integrated into a standard, semi-compliant balloon-catheter platform. The IVL catheter is advanced to the target lesion and the integrated balloon is inflated with fluid at a low pressure to make contact with the arterial wall. IVL is then activated through the generator with the touch of a button, creating a small bubble within the catheter balloon which rapidly expands and collapses. The rapid expansion and collapse of the bubble creates sonic pressure waves that travel through the vessel and crack the calcium, allowing the blood vessel to expand under low static pressure.

We believe there is a significant opportunity to apply our IVL Technology as a platform to treat a wide array of indications throughout the cardiovascular system. Ultimately, our plan is to have a family of IVL catheters that can treat calcium-related diseases across a wide variety of vasculatures and structures.

### **Our Products and Ongoing Development**

The interchangeability of specific catheters enables delivery of IVL therapy of diseased vasculature throughout the body. Our IVL catheters are cleared or approved for use in a number of geographies. Development programs are underway to expand indications and geographies:

- M5 catheters (“medium” vessel, five-emitters): for treating above-the-knee PAD in the United States and internationally.
- C2 catheters (coronary, two-emitters): for treating CAD in select international markets. We received an investigational device exemption (“IDE”) to conduct a pivotal global study, which is intended to support U.S. FDA and Japanese Shonin approval of the device. We commenced enrollment of the study in early 2019.
- S4 catheter (“small” vessel, four-emitters): for treating PAD Below-the-Knee (“BTK”) in the United States, Europe and select international markets. We have 510(k) clearance and CE Mark and we are currently engaged in a limited market evaluation of the product to test its performance in the heavily calcified and challenging BTK environment.

Our IVL catheters resemble in form and function a standard balloon angioplasty catheter, the device most commonly used by interventionalists. This familiarity makes our IVL System easy to learn, adopt and use on a day-to-day basis.

A development program and initial clinical work are also currently underway to explore the ability of our IVL Technology to directly treat calcified aortic valves to safely reduce the symptoms of and potentially delay or negate valve replacement treatment for AS.

Since inception, we have focused on generating clinical data to demonstrate the safety and effectiveness of our IVL Technology. These initial studies have consistently delivered low rates of complications regardless of which vessel was being studied. In addition to gaining regulatory approvals or clearances, the data from our clinical studies strengthen our ability to drive adoption of IVL Technology across multiple therapies in existing and new market segments. Our past studies have demonstrated that our IVL Technology reduces residual stenosis and vascular complications in infrapopliteal and femoropopliteal PAD, with outstanding durability and sustained improvement in functional outcome in 115 patients. Our past studies have also guided optimal IVL procedure technique and informed the design of our IVL System and future products in development. In the treatment of CAD, our past studies have demonstrated both safety and effectiveness of our IVL System in heavily calcified coronary lesions prior to stenting in 60 patients. Feasibility studies have shown the potential of our transcatheter aortic valve lithotripsy system (our “TAVL System”) to safely improve the aortic valve area and reduce transvalvular gradients in AS. We are currently enrolling patients in multiple studies to support applications for and clearances in a variety of indications and geographies, as well as a randomized trial to assess the combination of IVL with DCB for treating PAD.

We market our IVL System to hospitals whose interventional cardiologists, vascular surgeons and interventional radiologists treat patients with PAD and CAD. We have dedicated meaningful resources to establish direct sales capability in the United States, Germany, Austria and Switzerland, and we have complemented those direct teams with distributors, including in Australia, the Baltics, Canada, Czech Republic, France, Italy, the Netherlands, New Zealand, the Nordic region, Poland, Spain and the United Kingdom. We are actively expanding our international field presence through new distributors, additional sales and clinical personnel, and are adding new U.S. sales territories.

For the treatment of CAD, our C<sup>2</sup> catheter has a CE Mark that indicates its use in calcified, stenotic *de novo* coronary arteries prior to stenting. For the treatment of PAD, our M<sup>5</sup> and S<sup>4</sup> catheters have a CE Mark and have FDA clearances that indicate their use in calcified, stenotic peripheral arteries in patients who are candidates for percutaneous therapy. Our products are not indicated for the treatment of cerebrovascular or carotid arteries; our M<sup>5</sup> and S<sup>4</sup> catheters are not indicated for the treatment of coronary arteries.

While we believe that, from a technological or medical perspective, there are no material disadvantages to the use of our products in comparison to other commercially available alternative products, our products are relatively new, we currently have limited commercialization, sales and marketing experience and our products compete against alternative products that are well-established and are widely accepted by physicians, patients and third-party payors. Many of our competitors are large, well-capitalized companies with significantly greater market share and resources than we have. Our success will depend in part on our ability to increase adoption of our products, expand existing relationships with our customers, obtain regulatory clearances or approvals for our planned or future products, maintain existing reimbursement and obtain reimbursement where it does not currently exist, and develop new products or add new features to our existing products.

### **Why ShockWave?**

Safe - Simple - Effective

- Treatment of both superficial and deep calcium.
- Improved safety through unique mechanism of action.
- Improved efficacy for angioplasty, stents and drug-eluting technologies.
- Seamless integration into interventional practice with exceptional ease-of-use.
- Expanded access to interventional techniques for patients.

### **Our Growth Strategy**

Our mission is to provide safe, effective and easy-to-use treatments to optimize outcomes for calcified cardiovascular disease. We believe the following strategies will advance our mission and will contribute to our future success and growth.

- Address unmet clinical needs in multiple large markets.
- Advance our IVL System as a common treatment for calcified PAD and CAD.
- Grow our specialized sales force across indications and geographies to foster deep relationships with physicians and drive revenue growth.
- Execute on our clinical program to expand indications and build a robust body of clinical evidence.
- Leverage our IVL Technology to develop new products that satisfy significant unmet clinical needs.
- Drive profitability by scaling our business operations to achieve cost and production efficiencies.



### **Recent Developments**

There are a number of recent events which we believe will serve as near-term catalysts for our business and position us for long-term success.

- We received IDE approval for our DISRUPT CAD III global study, which began enrollment in 2019. This study is designed to support U.S. PMA approval for our C<sup>2</sup> catheters.
- In December 2018, we entered into a collaboration with Abiomed, a leading global provider of medical devices that provide circulatory support. Pursuant to this collaboration, we will work with Abiomed to integrate our products into Abiomed's physician training and education programs. In connection with the collaboration, Abiomed purchased shares of our Series D convertible preferred stock.

### **Risks Associated With Our Business**

Our business is subject to numerous risks, as more fully described in the section titled "Risk Factors" immediately following this prospectus summary. You should read these risks before you invest in our common stock. In particular, risks associated with our business include, but are not limited to, the following:

- We have a history of net losses, and we expect to continue to incur losses for the foreseeable future. If we ever achieve profitability, we may not be able to sustain it.
- We currently have limited commercialization, sales or marketing experience. If we are unable to establish effective sales and marketing capabilities or if we are unable to enter into agreements with third parties to commercialize our products, we may not be able to effectively generate product revenue, sustain revenue growth and compete effectively.
- Our success depends in large part on our IVL Technology. If we are unable to successfully market and sell products incorporating our IVL Technology, our business prospects will be significantly harmed and we may be unable to achieve revenue growth.
- We currently manufacture and sell products used in a limited number of procedures, which could negatively affect our operations and financial condition.
- For our company to thrive, we must lead and benefit from a shift in thinking about the role of calcified lesions in our core disease areas.
- The continuing development of our products depends upon our maintaining strong working relationships with physicians.
- Reimbursement may not be available for the procedures that utilize our products, which could diminish our sales or affect our ability to sell our products profitably.
- If we fail to comply with U.S. federal and state fraud and abuse and other healthcare laws and regulations, including those relating to kickbacks and false claims for reimbursement, we could face substantial penalties and our business operations and financial condition could be adversely affected.
- If we are unable to obtain and maintain patent or other intellectual property protection for our products, or if the scope of the patent and other intellectual property protection obtained is not sufficiently broad, our competitors could develop and commercialize products and technology similar or identical to ours, and our ability to successfully commercialize any products we may develop, and our technology, may be adversely affected.
- Regulatory compliance is expensive, complex and uncertain, and a failure to comply could lead to enforcement actions against us and other negative consequences for our business.
- Our operating results may fluctuate significantly, which makes our future operating results difficult to predict and could cause our operating results to fall below expectations or our guidance.

### **Potential Concurrent Private Placement**

Certain of our existing investors have options to purchase up to an aggregate of approximately \$10.5 million of shares in our common stock (or approximately 697,740 shares, assuming an initial public offering price of \$15.00 per share, the midpoint of the estimated price range set forth on the cover page of this prospectus) in a concurrent private placement at a price per share equal to the initial public offering price. There can be no assurance that these stockholders will exercise these options and, even if such options are exercised, that they will be exercised for the full amount of shares. The sale of shares in the concurrent private placement, if any, will not be registered under the Securities Act of 1933, as amended (the “Securities Act”). The closing of this offering is not conditioned upon the closing of the concurrent private placement. Any shares of common stock purchased in the concurrent private placement will not be subject to any underwriting discounts or commissions.

### **Reverse Stock Split**

Our board of directors and stockholders approved a 12.2-for-one reverse stock split of our common stock and convertible preferred stock, which was effected on February 22, 2019. All references to common stock, convertible preferred stock, warrants to purchase common stock, warrants to purchase convertible preferred stock, options to purchase common stock, early exercised options, share data, per share data and related information have been retrospectively adjusted where applicable in this prospectus to reflect the reverse stock split of our capital stock as if it had occurred at the beginning of the earliest period presented.

### **Corporate Information**

We were incorporated in 2009 as a Delaware corporation under the name ShockWave Medical, Inc. Our principal executive offices are located at 5403 Betsy Ross Drive, Santa Clara, California 95054, and our telephone number is (510) 279-4262. Our website address is [www.shockwavemedical.com](http://www.shockwavemedical.com). The information on, or that can be accessed through, our website is not part of this prospectus. We have included our website address as an inactive textual reference only.

We use “Shockwave,” “Shockwave M5,” “Shockwave C2,” “Shockwave S4” and other marks as trademarks in the United States and other countries. This prospectus contains references to our trademarks and service marks and to those belonging to other entities. Solely for convenience, trademarks and trade names referred to in this prospectus, including logos, artwork, and other visual displays, may appear without the ® or ™ symbols, but such references are not intended to indicate in any way that we will not assert, to the fullest extent under applicable law, our right or the rights of the applicable licensor to these trademarks and trade names. We do not intend our use or display of other entities’ trade names, trademarks, or service marks to imply a relationship with, or endorsement or sponsorship of us by, any other entity.

### **Implications of Being an Emerging Growth Company**

We are an “emerging growth company,” as defined in the Jumpstart Our Business Startups Act of 2012. We will remain an emerging growth company until the earliest to occur of: the last day of the fiscal year in which we have more than \$1.07 billion in annual revenue; the date we qualify as a “large accelerated filer,” with at least \$700 million of equity securities held by non-affiliates; the issuance, in any three-year period, by us of more than \$1 billion in non-convertible debt securities; and the last day of the fiscal year ending after the fifth anniversary of our initial public offering. We refer to the Jumpstart Our Business Startups Act of 2012 herein as the “JOBS Act,” and any reference herein to “emerging growth company” has the meaning ascribed to it in the JOBS Act.

An emerging growth company may take advantage of reduced reporting requirements that are otherwise applicable to public companies. These provisions include, but are not limited to:

- being permitted to present only two years of audited financial statements and only two years of related Management's Discussion and Analysis of Financial Condition and Results of Operations in this prospectus;
- not being required to comply with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act of 2002, as amended;
- reduced disclosure obligations regarding executive compensation in our periodic reports, proxy statements and registration statements; and
- exemptions from the requirements of holding a nonbinding advisory vote on executive compensation and stockholder approval of any golden parachute payments not previously approved.

We have elected to take advantage of certain of the reduced disclosure obligations in this prospectus and may elect to take advantage of other reduced reporting requirements in our future filings with the U.S. Securities and Exchange Commission (the "SEC"). As a result, the information that we provide to our stockholders may be different than you might receive from other public reporting companies in which you hold equity interests.

The JOBS Act provides that an emerging growth company can take advantage of an extended transition period for complying with new or revised accounting standards. We have irrevocably elected not to avail ourselves of this exemption and, therefore, we will be subject to the same new or revised accounting standards as other public companies that are not emerging growth companies.

## THE OFFERING

Common stock offered by us	5,000,000 shares.
Underwriters' over-allotment option	750,000 shares.
Common stock to be outstanding immediately after this offering	25,616,085 shares (or 26,366,085 shares, if the underwriters exercise their over-allotment option in full).
Use of proceeds	<p>We estimate that the net proceeds to us from this offering will be approximately \$66.6 million, or approximately \$77.0 million if the underwriters exercise their over-allotment option in full, assuming an initial public offering price of \$15.00 per share (which is the midpoint of the estimated price range set forth on the cover page of this prospectus), after deducting the estimated underwriting discounts and commissions and estimated offering expenses payable by us.</p> <p>We expect to use the net proceeds from this offering for sales and marketing activities to support the ongoing commercialization of our IVL System, including, but not limited to, the expansion of our sales force, additional medical affairs and educational efforts and the expansion of our international sales presence, for research and development and clinical studies and for working capital and general corporate purposes. We may also use a portion of the net proceeds of this offering for acquisitions or strategic transactions, though we have not entered into any agreements or commitments with respect to any specific transactions and have no understandings or agreements with respect to any such transactions at this time. See the section titled "Use of Proceeds" for additional information.</p> <p>The foregoing use of proceeds discussion assumes no exercise of the Stockholder Purchase Option (as defined below). If the Stockholder Purchase Option is exercised in full, then we estimate that the net proceeds from the potential concurrent private placement (the "Potential Concurrent Private Placement") will be an aggregate of approximately \$10.5 million. We intend to use the net proceeds from the Potential Concurrent Private Placement, if any, for working capital and general corporate purposes. There can be no assurance that these stockholders will exercise these options and, even if such options are exercised, that they will be exercised for the full amount of shares. The sale of shares in the Potential Concurrent Private Placement, if any, will not be registered under the Securities Act.</p>

Directed share program	At our request, the underwriters have reserved for sale at the initial public offering price, up to 3% of the shares offered hereby for our directors, officers and certain employees and other persons with whom we have a relationship. See “Underwriting” for more information.
Potential concurrent private placement	Our Series D convertible preferred stockholder, Abiomed Inc., has the option to purchase up to \$10.0 million of shares in our common stock (or 666,666 shares, assuming an initial public offering price of \$15.00 per share, the midpoint of the estimated price range set forth on the cover page of this prospectus) in the Potential Concurrent Private Placement at a price per share equal to the initial public offering price. In addition, pursuant to our Exclusive License Agreement by and between Northgate Technologies, Inc. (together with its affiliates, “Northgate”) and the Company, dated as of June 23, 2011 (the “License Agreement”), Northgate has the right to participate in the Potential Concurrent Private Placement at the initial public offering price in proportion to Northgate’s percentage ownership of the Company as of immediately prior to the Potential Concurrent Private Placement on a fully diluted basis, or approximately \$0.5 million of shares in our common stock (or 31,074 shares, assuming an initial public offering price of \$15.00 per share, the midpoint of the estimated price range set forth on the cover page of this prospectus) (together with Abiomed Inc.’s option, the “Stockholder Purchase Option”). The sale of shares in the Potential Concurrent Private Placement will not be registered in this offering. The closing of this offering is not conditioned upon the closing of the Potential Concurrent Private Placement. The shares of common stock purchased in the Potential Concurrent Private Placement will not be subject to any underwriting discounts or commissions.
Risk factors	You should read the section titled “Risk Factors” in this prospectus for a discussion of factors to consider carefully before deciding to invest in shares of our common stock.
Proposed Nasdaq Global Market symbol	“SWAV.”
<p>The number of shares of common stock to be outstanding immediately after this offering is based upon 20,616,085 shares (including our convertible preferred stock on an as-converted basis and net exercise of certain outstanding warrants) outstanding as of December 31, 2018, and excludes:</p> <ul style="list-style-type: none"><li>• 3,636,224 shares of our common stock issuable upon the exercise of options outstanding as of December 31, 2018, with a weighted-average exercise price of \$3.50 per share;</li></ul>	

- 119,667 shares of our common stock issuable upon the exercise of options granted after December 31, 2018, with an exercise price of \$6.59 per share;
- 54,903 shares of our Series A-1 convertible preferred stock issuable upon the exercise of our Series A-1 convertible preferred stock warrant outstanding as of December 31, 2018, with an exercise price of \$3.09636 per share;
- 34,440 shares of our common stock issuable upon the exercise of our common stock warrants outstanding as of December 31, 2018, with an exercise price of \$4.026 per share;
- 22,216 shares of our common stock issued upon the net exercise of preferred stock warrants;
- 279,648 shares of our common stock issuable upon the exercise of options that we expect to grant under our 2019 Equity Incentive Plan upon the pricing of this offering to our directors, executive officers and certain other employees at an exercise price equal to the initial public offering price of this offering;
- 1,720,782 additional shares of our common stock reserved for future issuance under our 2019 Equity Incentive Plan, which will become effective immediately prior to the completion of this offering, as well as any automatic increases in the number of shares of our common stock reserved for future issuance pursuant to this plan; and
- 300,650 shares of our common stock initially reserved for issuance under our Employee Stock Purchase Plan (the “ESPP”), as well as any automatic increases in the number of shares of our common stock reserved for future issuance pursuant to this plan.

Unless otherwise indicated, this prospectus reflects and assumes the following:

- the automatic conversion of all of our outstanding shares of convertible preferred stock into an aggregate of 18,670,259 shares of our common stock immediately prior to the completion of this offering;
- outstanding shares include 13,421 shares of our common stock issued upon the early exercise of stock options and subject to repurchase;
- the automatic conversion of our outstanding Series A-1 convertible preferred stock warrant into a warrant to purchase 54,903 shares of our common stock upon the completion of this offering, with an exercise price of \$3.09636 per share;
- the net exercise of outstanding warrants to purchase 141,777 shares of our common stock immediately prior to the completion of this offering that would otherwise expire upon completion of this offering, with an exercise price of \$2.196 per share, which will result in the issuance of 121,019 shares of our common stock based on an assumed initial public offering price of \$15.00 per share (which is the midpoint of the estimated price range set forth on the cover of this prospectus);
- no exercise of outstanding options or warrants, other than as described in the fourth bullet above;
- no exercise of the Stockholder Purchase Option;
- no exercise by the underwriters of their over-allotment option;
- the filing and effectiveness of our amended and restated certificate of incorporation and the adoption of our amended and restated bylaws immediately upon the completion of this offering; and
- a 12.2-for-one reverse stock split of our common stock and convertible preferred stock, which was effected on February 22, 2019.

**SUMMARY CONSOLIDATED FINANCIAL DATA**

The following tables summarize our consolidated financial data. We have derived the summary consolidated statements of operations data for the years ended December 31, 2017 and 2018 from our audited consolidated financial statements included elsewhere in this prospectus. We have derived our balance sheet data as of December 31, 2017 and 2018 from our audited consolidated financial statements included elsewhere in this prospectus. Our historical results are not necessarily indicative of the results that may be expected in the future. The following summary consolidated financial data should be read in conjunction with the section titled “Management’s Discussion and Analysis of Financial Condition and Results of Operations” and our consolidated financial statements and related notes included elsewhere in this prospectus.

	<b>Years Ended December 31,</b>	
	<b>2017</b>	<b>2018</b>
	<b>(in thousands, except share and per share data)</b>	
<b>Consolidated Statements of Operations Data:</b>		
Product revenue	\$ 1,719	\$ 12,263
Operating expenses:		
Cost of product revenue	2,836	7,250
Research and development	17,963	22,698
Sales and marketing	6,363	17,536
General and administrative	5,422	5,979
Total operating expenses	32,584	53,463
Loss from operations	(30,865)	(41,200)
Interest and other income, net	276	136
Net loss before taxes	(30,589)	(41,064)
Income tax provision	26	38
Net loss	(30,615)	(41,102)
Net loss per share, basic and diluted <sup>(1)</sup>	\$ (19.71)	\$ (23.39)
Weighted-average shares used in computing net loss per share, basic and diluted <sup>(1)</sup>	1,553,365	1,757,102
Pro forma net loss per share, basic and diluted (unaudited) <sup>(1)</sup>		\$ (2.10)
Weighted-average shares used in computing pro forma net loss per share, basic and diluted (unaudited) <sup>(1)</sup>		19,525,816

(1) See Notes 2 and 12 to our audited consolidated financial statements included elsewhere in this prospectus for an explanation of the calculations of our basic and diluted net loss per share and unaudited pro forma net loss per share and the weighted-average number of shares used in the computation of the per share amounts.

	As of December 31, 2018		
	Actual	Pro Forma(1) (in thousands)	Pro Forma as Adjusted(2) (3)
<b>Consolidated Balance Sheet Data:</b>			
Cash and cash equivalents	\$ 39,643	\$ 39,643	\$ 106,834
Working capital	39,365	39,365	107,449
Total assets	53,421	53,421	119,093
Long-term debt, current and non-current	15,050	15,050	15,050
Convertible preferred stock warrant liability	313	—	—
Convertible preferred stock	152,806	—	—
Accumulated deficit	(126,865)	(126,865)	(126,865)
Total stockholders' (deficit) equity	(122,588)	30,531	97,096

(1) The pro forma consolidated balance sheet data gives effect to: (i) the automatic conversion of all outstanding shares of our convertible preferred stock as of December 31, 2018 into an aggregate of 18,670,259 shares of our common stock immediately prior to the completion of this offering; (ii) the issuance of 121,019 shares of our common stock, based on an assumed initial public offering price of \$15.00 per share (which is the midpoint of the estimated price range set forth on the cover of this prospectus) upon the net exercise of warrants outstanding as of December 31, 2018 for the purchase of 141,277 shares of our common stock that would otherwise expire upon the completion of this offering; (iii) the filing and effectiveness of our amended and restated certificate of incorporation and the retirement of our authorized convertible preferred stock that will convert to common stock as set forth in clause (i); and (iv) the reclassification of the convertible preferred stock warrant liability to additional paid-in capital, a component of total stockholders' (deficit) equity, due to our convertible preferred stock warrant converting to a warrant to purchase our common stock immediately prior to the completion of this offering.

(2) The pro forma as adjusted balance sheet data gives effect to: (i) the pro forma adjustments set forth in footnote (1) above; (ii) the issuance and sale of shares of our common stock in this offering at an assumed initial public offering price of \$15.00 per share (which is the midpoint of the estimated price range set forth on the cover page of this prospectus), after deducting the estimated underwriting discounts and commissions and estimated offering expenses payable by us; and (iii) the reclassification of \$1.5 million of deferred offering costs recorded in other assets on the consolidated balance sheet as of December 31, 2018 to additional paid-in capital, a component of total stockholders' (deficit) equity. The pro forma information discussed above is illustrative only and will be adjusted based on the actual initial public offering price and other terms of our initial public offering determined at pricing.

(3) Each \$1.00 increase (decrease) in the assumed initial public offering price of \$15.00 per share (which is the midpoint of the estimated price range set forth on the cover page of this prospectus), would increase (decrease) each of cash and cash equivalents, working capital, total assets and additional paid-in capital, a component of total stockholders' (deficit) equity, by \$4.7 million, assuming that the number of shares of common stock offered by us, as set forth on the cover page of this prospectus, remains the same, and after deducting the estimated underwriting discounts and commissions and estimated offering expenses payable by us. Similarly, each increase (decrease) of 1,000,000 shares in the number of shares of common stock offered by us would increase (decrease) each of cash and cash equivalents, working capital, total assets and additional paid-in capital, a component of total stockholders' (deficit) equity, by \$14.0 million, assuming the assumed initial public offering price of \$15.00 per share remains the same, and after deducting the estimated underwriting discounts and commissions and estimated offering expenses payable by us.



## RISK FACTORS

*Investing in our common stock involves a high degree of risk. You should carefully consider the risks described below, as well as all of the other information contained in this prospectus, including our financial statements and related notes, before investing in our common stock. While we believe that the risks and uncertainties described below are the material risks currently facing us, additional risks that we do not yet know of or that we currently think are immaterial may also arise and materially affect our business. If any of the following risks materialize, our business, financial condition and results of operations could be materially and adversely affected. In that case, the trading price of our common stock could decline, and you may lose some or all of your investment.*

### **Risks Related to Our Business and Products**

***We have a history of net losses, and we expect to continue to incur losses for the foreseeable future. If we ever achieve profitability, we may not be able to sustain it.***

We have incurred losses since our inception, and expect to continue to incur losses for the foreseeable future. We have reported net losses of \$30.6 million and \$41.1 million for the years ended December 31, 2017 and 2018, respectively. As a result of these losses, as of December 31, 2018, we had an accumulated deficit of approximately \$126.9 million. We expect to continue to incur significant sales and marketing, research and development, regulatory and other expenses as we expand our marketing efforts to increase adoption of our products, expand existing relationships with our customers, obtain regulatory clearances or approvals for our planned or future products, conduct clinical trials on our existing and planned or future products and develop new products or add new features to our existing products. In addition, we expect our general and administrative expenses to increase following this offering due to the additional costs associated with being a public company. The net losses that we incur may fluctuate significantly from period to period. We will need to generate significant additional revenue in order to achieve and sustain profitability. Even if we achieve profitability, we cannot be sure that we will remain profitable for any substantial period of time.

***We have a limited commercialization experience.***

We were incorporated in 2009 and began commercializing our Shockwave M5 IVL catheter (“M5 catheter”) for treating peripheral artery disease (“PAD”) in the United States and Europe in 2018 and our Shockwave C2 IVL catheter (“C2 catheter”) for treating coronary artery disease (“CAD”) in Europe in 2018. Our C2 catheter has not yet been approved or cleared for the treatment of CAD in the United States. Our limited commercialization experience and limited number of approved or cleared products make it difficult to evaluate our current business and predict our future prospects.

These factors also make it difficult for us to forecast our future financial performance and growth, and such forecasts are subject to a number of uncertainties, including our ability to successfully complete our Disrupt PAD III, Disrupt CAD II, Disrupt CAD III, Disrupt CAD IV and Transcatheter Aortic Valve Lithotripsy (“TAVR”) feasibility clinical trials and obtain U.S. Food and Drug Administration (“FDA”) pre-market approval for, and successfully commercialize, our C2 catheter for the treatment of CAD in the United States or future planned products in the United States or in key international markets. If our assumptions regarding the risks and uncertainties we face, which we use to plan our business, are incorrect or change due to circumstances in our business or our markets, or if we do not address these risks successfully, our operating and financial results could differ materially from our expectations and our business could suffer.

***Our success depends in large part on our intravascular lithotripsy technology (our “IVL Technology”). If we are unable to successfully market and sell products incorporating our IVL Technology, our business prospects will be significantly harmed and we may be unable to achieve revenue growth.***

Our future financial success will depend substantially on our ability to effectively and profitably market and sell our products incorporating our IVL Technology. The commercial success of our products and any of our planned or future products will depend on a number of factors, including the following:

- the actual and perceived effectiveness and reliability of our products, especially relative to alternative products;
- the prevalence and severity of any adverse patient events involving our products;
- the results of clinical trials relating to the use of our products;
- our ability to obtain regulatory approval to market our planned or future products for use in treating PAD, CAD and aortic stenosis (“AS”) in the United States;
- the availability, relative cost and perceived advantages and disadvantages of alternative technologies or treatment methods for conditions treated by our products;
- the degree to which treatments using our products are covered and receive adequate reimbursement from third-party payors, including governmental and private insurers;
- the degree to which physicians adopt our products;
- our ability to obtain, maintain, protect and enforce our intellectual property rights in and to our IVL Technology and our products that incorporate our IVL Technology;
- achieving and maintaining compliance with all regulatory requirements applicable to our products;
- the extent to which we are successful in educating physicians about PAD, CAD and AS in general, and the benefits of our products in treating such conditions;
- the strength of our marketing and distribution infrastructure;
- the effectiveness of our and our distributors’ marketing and sales efforts in the United States and abroad, including our efforts to build out our sales team;
- the level of education and awareness among physicians and hospitals concerning our products;
- our reputation among physicians and hospitals;
- our ability to continue to develop, validate and maintain a commercially viable manufacturing process that is compliant with current Good Manufacturing Practices (“cGMP”) and Quality Systems Regulations (“QSR”); and
- whether we are required by the FDA or comparable non-U.S. regulatory authorities to conduct additional clinical trials for future or current indications.

If we fail to successfully market and sell our products, we will not be able to achieve profitability, which will have a material adverse effect on our business, financial condition and results of operations. Our ability to grow our revenue in future periods will depend on our ability to successfully penetrate our target markets and increase sales of our products and any new product or product indications that we introduce, which will, in turn, depend in part on our success in growing our user base and driving increased use of our products. New products or product indications will also need to be approved or cleared by the FDA and comparable non-U.S. regulatory agencies to drive revenue growth. If we cannot achieve revenue growth, it could have a material adverse effect on our business, financial condition and results of operations.

***We currently manufacture and sell products that are used in a limited number of procedures, which could negatively affect our operations and financial condition.***

Currently, our products consist primarily of our IVL System using M5 catheters for the treatment of above-the-knee PAD in the United States and internationally and C2 catheters for the treatment of CAD internationally. Therefore, we are dependent on widespread market adoption of these products and we will continue to be dependent on the success of these products for the foreseeable future. There can be no assurance that our products will gain a substantial degree of market acceptance among specialty physicians, patients or healthcare providers. Our failure to successfully increase sales of these products or any other event impeding our ability to sell these products would result in a material adverse effect on our business, financial condition and results of operations.

***For our company to thrive, we must lead and benefit from a shift in thinking about the role of calcified lesions in our core disease areas.***

A shift in thinking in the treatment of our core disease areas is needed for the successful market acceptance of our products. We will need to educate the medical community about the safety, efficacy, necessity and efficiency of our products. This will require educating them not only about the benefits of our technology, but also about the impact of calcified plaque on treatment choices and treatment outcomes. We believe that focusing on calcified plaque is a paradigm shift in the treatment of these diseases because other interventions have not specifically focused on this source of atherosclerosis. Additionally, we will need to convince the medical community that the additional cost and time of integrating the IVL procedure, designed to prepare the vessel for the subsequent stenting or angioplasty procedure, is worth the increased efficacy of the overall procedure and improvement in patient outcomes. The failure of our clinical, marketing and executive teams to drive this shift in thinking among doctors, patients, practitioners, third-party payors and regulators could adversely affect our ability to grow the business.

***The continuing development of our products depends upon our maintaining strong working relationships with physicians.***

The research, development, marketing and sale of our current products and potential new and improved products or future product indications for which we receive regulatory clearance or approval depend upon our maintaining working relationships with physicians. We rely on these professionals to provide us with considerable knowledge and experience regarding the development, marketing and sale of our products. Physicians assist us in clinical trials and in marketing, and as researchers, product consultants and public speakers. If we cannot maintain our strong working relationships with these professionals and continue to receive their advice and input, the development and marketing of our products could suffer, which could have a material adverse effect on our business, financial condition and results of operations. At the same time, the medical device industry's relationship with physicians is under increasing scrutiny by the U.S. Department of Health and Human Services Office of Inspector General (the "OIG"), the U.S. Department of Justice (the "DOJ"), the state attorney generals and other foreign and domestic government agencies. Our failure to comply with requirements governing the industry's relationships with physicians or an investigation into our compliance by the OIG, the DOJ, state attorney generals and other government agencies, could have a material adverse effect on our business, financial condition and results of operations. Additional information regarding the laws impacting our relationships with physicians and other healthcare professionals can be found below under "Risks Related to Government Regulation and Our Industry."

***We currently have limited sales or marketing capabilities. If we are unable to establish effective sales and marketing capabilities or if we are unable to enter into agreements with third parties to commercialize our products, we may not be able to effectively generate product revenue, sustain revenue growth and compete effectively.***

We currently have limited sales or marketing capabilities. Our sales were \$1.72 million and \$12.3 million for the years ended December 31, 2017 and 2018, respectively. We launched our M5 catheters for the treatment

of PAD in the United States, Europe and select other countries in 2018, we launched our C<sup>2</sup> catheters for the treatment of CAD in Europe in 2018, and we expect to launch our C<sup>2</sup> catheters for the treatment of CAD in the United States in the first half of 2021, subject to FDA approval. Building the requisite sales, marketing or distribution capabilities will be expensive and time-consuming and will require significant attention from our leadership team to manage. Any failure or delay in the development of our sales, marketing or distribution capabilities would adversely impact the commercialization of our products. The competition for talented individuals experienced in selling and marketing medical device products is intense, and we cannot assure you that we can assemble or maintain an effective team. Additionally, we may choose to collaborate, either globally or on a territory-by-territory basis, with third parties on the commercialization of our products. If we are unable to enter into such arrangements on acceptable terms or at all, we may not be able to successfully commercialize our products.

***We may expend our limited resources to pursue a particular product or indication and fail to capitalize on products or indications that may be more profitable or for which there is a greater likelihood of success.***

Because we have limited financial and managerial resources, we focus on specific products, indications and discovery programs. As a result, we may forgo or delay pursuit of other opportunities with others that could have had greater commercial potential. Our resource allocation decisions may cause us to fail to capitalize on viable commercial products or profitable market opportunities. Our spending on current and future research and development programs for specific indications may not yield any commercially viable products. If we do not accurately evaluate the commercial potential or target market for a particular potential product, we may relinquish valuable rights to that potential product through future collaborations, licenses and other similar arrangements in cases in which it would have been more advantageous for us to retain sole development and commercialization rights to such potential product.

***In the future our products may become obsolete, which would negatively affect operations and financial condition.***

The medical device industry is characterized by rapid and significant change. There can be no assurance that other companies will not succeed in developing or marketing devices and products that are more effective than our IVL System or that would render our IVL System obsolete or noncompetitive. Additionally, new surgical procedures, medications and other therapies could be developed that replace or reduce the importance of our products. Accordingly, our success will depend in part on our ability to respond quickly to medical and other changes through the development and introduction of new products. Product development involves a high degree of risk, and there can be no assurance that our new product development efforts will result in any commercially successful products.

***The commercial success of our products will depend upon attaining significant market acceptance of these products among physicians, healthcare payors and the medical community.***

Our success will depend, in part, on the acceptance of our products as safe, useful and, with respect to providers, cost effective. We cannot predict how quickly, if at all, physicians will accept our products or, if accepted, how frequently they will be used. Our products and planned or future products we may develop or market may never gain broad market acceptance among physicians and the medical community for some or all of our targeted indications. Healthcare providers must believe that our products offer benefits over alternative treatment methods. The degree of market acceptance of any of our products will depend on a number of factors, including:

- whether physicians and others in the medical community consider our products to be safe and cost effective treatment methods;
- the potential and perceived advantages of our products over alternative treatment methods;
- the prevalence and severity of any side effects associated with using our products;

- product labeling or product insert requirements by the FDA or other regulatory authorities;
- limitations or warnings contained in the labeling cleared or approved by the FDA or other authorities;
- the cost of treatment in relation to alternative treatments methods;
- the convenience and ease of use of our products relative to alternative treatment methods;
- pricing pressure, including from group purchasing organizations (“GPOs”), seeking to obtain discounts on our products based on the collective buying power of the GPO members;
- a substantial shift in the number of PAD procedures that are performed in office-based labs (“OBLs”) compared to those performed in a hospital as OBLs tend to have higher price sensitivity than hospitals;
- the availability of coverage and adequate reimbursement for procedures using our products from third-party payors, including government authorities;
- the willingness of patients to pay out-of-pocket in the absence of coverage and adequate reimbursement by third-party payors, including government authorities;
- our ability to provide incremental clinical and economic data that show the safety, clinical efficacy and cost effectiveness of, and patient benefits from, our products; and
- the effectiveness of our sales and marketing efforts for our products.

For example, in July 2018, we initiated and subsequently completed a voluntary recall of our Shockwave S4 IVL catheters (“S4 catheter”) after seeing a higher instance of leaks in the balloon, which prevented the balloon from staying inflated at 4 atmospheres (“atm”) for the full course of lithotripsy application. Although there were no patient safety issues reported and no reports of adverse clinical events related to this issue, and the issue has been corrected, customer satisfaction problems early in a product’s launch can have lasting negative impact on our ability to sell such product.

In addition, if we do not educate physicians about PAD and the existence of our products, they may not gain market acceptance, as many physicians do not routinely screen for PAD while screening for CAD. Additionally, even if our products achieve market acceptance, they may not maintain that market acceptance over time if competing products or technologies, which are more cost effective or received more favorably, are introduced. Failure to achieve or maintain market acceptance and/or market share would limit our ability to generate revenue and would have a material adverse effect on our business, financial condition and results of operations.

***The sizes of the markets for our current and future products have not been established with precision, and may be smaller than we estimate.***

Our estimates of the annual total addressable markets for our current products and products under development are based on a number of internal and third-party estimates, including, without limitation, the number of patients with calcified cardiovascular disease and the assumed prices at which we can sell tests for markets that have not been established. While we believe our assumptions and the data underlying our estimates are reasonable, these assumptions and estimates may not be correct and the conditions supporting our assumptions or estimates may change at any time, thereby reducing the predictive accuracy of these underlying factors. In addition, our estimates of the sizes of the PAD and CAD patient population include patients who are asymptomatic or in the early stages of disease; these patients might never progress to more advanced disease stages and, accordingly, might never be likely candidates for treatment with our products. As a result, our estimates of the annual total addressable market for our current or future products may prove to be incorrect. If the actual number of patients who would benefit from our products, the price at which we can sell future products, or the annual total addressable market for our products is smaller than we have estimated, it may impair our sales growth and have an adverse impact on our business.

***We have limited commercial manufacturing experience and may experience development or manufacturing problems or delays in producing our products and planned or future products that could limit the potential growth of our revenue or increase our losses.***

We have limited experience in commercially manufacturing our products and no experience manufacturing these products in the volume that we anticipate will be required if we achieve planned levels of commercial sales. The forecasts of demand we use to determine order quantities and lead times for components purchased from outside suppliers may be incorrect. Our failure to obtain required components or sub-assemblies when needed and at a reasonable cost would adversely affect our business. As a result, we may not be able to develop and implement efficient, low-cost manufacturing capabilities and processes that will enable us to manufacture our existing, planned or future products in significant volumes, while meeting the legal, regulatory, quality, price, durability, engineering, design and production standards required to market our products successfully.

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 in order 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.

Since we produce substantially all of our IVL catheters at one facility, any contamination of the controlled environment, equipment malfunction or failure to strictly follow procedures can significantly reduce our yield. A drop in yield can increase our cost to manufacture our products or, in more severe cases, require us to halt the manufacture of our products until the problem is resolved. Identifying and resolving the cause of a drop in yield can require substantial time and resources.

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, which would have a material adverse effect on our business, financial condition and results of operations.

***We may be unable to compete successfully with larger companies in our highly competitive industry.***

There are numerous approved products for treating vascular diseases in the indications in which we have received clearance or approval and those that we are pursuing or may pursue in the future. Many of these cleared or approved products are well-established and are widely accepted by physicians, patients and third-party payors. Third-party payors may encourage the use of competitors' products. In addition, many companies are developing products, and we cannot predict what the standard of care will be in the future.

The medical device industry is intensely competitive, subject to rapid change and significantly affected by new product introductions and other market activities of industry participants. We compete or plan to compete with manufacturers and distributors of cardiovascular medical devices. Our most notable competitors in the highly competitive cardiovascular field include Boston Scientific Corporation, Cardiovascular Systems, Inc., Medtronic plc and Philips. Many of these competitors are large, well-capitalized companies with significantly greater market share and resources than we have. As a consequence, they are able to spend more on product development, marketing, sales and other product initiatives than we can. We also compete with smaller medical device companies that have single products or a limited range of products. Some of our competitors have:

- significantly greater name recognition;
- broader or deeper relations with healthcare professionals, customers and third-party payors;

- more established distribution networks;
- additional lines of products and the ability to offer rebates or bundle products to offer greater discounts or other incentives to gain a competitive advantage;
- greater experience in conducting research and development, manufacturing, clinical trials, marketing and obtaining regulatory clearance or approval for products; and
- greater financial and human resources for product development, sales and marketing and patent litigation.

We believe that our proprietary IVL Technology, our focus on calcified cardiovascular disease and our organizational culture and strategy, will be important factors in our future success. We compete primarily on the basis that our products treat patients with calcified cardiovascular disease safely and effectively, with improved outcomes and procedural cost savings. Our continued success depends on our ability to:

- develop innovative, proprietary products that can cost-effectively address significant clinical needs;
- continue to innovate and develop scientifically advanced technology;
- obtain and maintain regulatory clearances or approvals;
- demonstrate efficacy in our sponsored and third-party clinical trials and studies;
- apply our technology across product lines and markets;
- attract and retain skilled research and development and sales personnel; and
- cost-effectively manufacture and successfully market and sell products.

In addition, competitors with greater financial resources than ours could acquire other companies to gain enhanced name recognition and market share, as well as new technologies or products that could effectively compete with our existing products, which may cause our revenue to decline and would harm our business.

Our competitors also compete with us in recruiting and retaining qualified scientific, management and commercial personnel, as well as in acquiring technologies complementary to, or necessary for, our products. Because of the complex and technical nature of our products 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 products, which would have a material adverse effect on our business, financial condition and results of operations.

***Our operating results may fluctuate significantly, which makes our future operating results difficult to predict and could cause our operating results to fall below expectations or any guidance we may provide.***

Our quarterly and annual operating results may fluctuate significantly, which makes it difficult for us to predict our future operating results. These fluctuations may occur due to a variety of factors, many of which are outside of our control, including, but not limited to:

- the level of demand for our products and any approved products, which may vary significantly;
- expenditures that we may incur to acquire, develop or commercialize additional products and technologies;
- the timing and cost of obtaining regulatory approvals or clearances for planned or future products or indications;
- the rate at which we grow our sales force and the speed at which newly hired salespeople become effective, and the cost and level of investment therein;

- the degree of competition in our industry and any change in the competitive landscape of our industry, including consolidation among our competitors or future partners;
- coverage and reimbursement policies with respect to our products, if approved, and potential future products that compete with our products;
- the timing and success or failure of preclinical studies or clinical trials for our products or any future products we develop or competing products;
- the timing of customer orders or medical procedures using our products and the number of available selling days in any quarterly period, which can be impacted by holidays, the mix of products sold and the geographic mix of where products are sold;
- seasonality, including the seasonal slowing of demand for our products we have experienced in the fourth quarter and summer months based on the elective nature of procedures performed using our products, and which we expect to become more pronounced in the future as our business grows;
- the timing and cost of, and level of investment in, research, development, regulatory approval and commercialization activities relating to our products, which may change from time to time;
- the cost of manufacturing our products, which may vary depending on the quantity of production and the terms of our agreements with third-party suppliers and manufacturers; and
- future accounting pronouncements or changes in our accounting policies.

The cumulative effects of these factors could result in large fluctuations and unpredictability in our quarterly and annual operating results. As a result, comparing our operating results on a period-to-period basis may not be meaningful. Investors should not rely on our past results as an indication of our future performance.

This variability and unpredictability could also result in our failing to meet the expectations of industry or financial analysts or investors for any period. If our revenue or operating results fall below the expectations of analysts or investors or below any forecasts we may provide to the market, it could have a material adverse effect on our business, financial condition and results or operations.

***Reimbursement may not be available for the procedures that utilize our products, which could diminish our sales or affect our ability to sell our products profitably.***

In both U.S. and non-U.S. markets, our ability to successfully commercialize and achieve market acceptance of our products depends, in significant part, on the availability of adequate financial coverage and reimbursement from third-party payors, including governmental payors (such as the Medicare and Medicaid programs in the United States), managed care organizations and private health insurers. Third-party payors decide which treatments they will cover and establish reimbursement rates for those treatments. Third-party payors in the United States generally do not provide reimbursement for our products. Rather, we expect certain components of our IVL System to continue to be purchased by hospitals and other providers who will then seek reimbursement from third-party payors for the procedures performed using our products. While third-party payors currently cover and provide reimbursement for procedures using our currently cleared or approved products, we can give no assurance that these third-party payors will continue to provide coverage and adequate reimbursement for the procedures using our products, to permit hospitals and doctors to offer procedures using our products to patients requiring treatment, or that current reimbursement levels for procedures using our products will continue. Third-party payors are increasingly examining the cost effectiveness of products, in addition to their safety and efficacy, when making coverage and payment decisions. Furthermore, although we believe there is potential to improve on the current reimbursement profile for our devices in the future, the overall amount of reimbursement available for PAD and CAD procedures could remain at current levels or decrease in the future. Additionally, we cannot be sure that the PAD and CAD procedure reimbursement amounts will not reduce or otherwise negatively affect the demand for our marketed products. Failure by hospitals and other users of our products to obtain coverage and adequate reimbursement for the procedures using our products would cause our business to suffer.



Third-party payors have also instituted initiatives to limit the growth of healthcare costs using, for example, price regulation or controls and competitive pricing programs. Some third-party payors also require demonstrated superiority, on the basis of randomized clinical trials, or pre-approval of coverage, for new or innovative devices or procedures before they will reimburse healthcare providers who use such devices or procedures. Additionally, no uniform policy for coverage and reimbursement exists in the United States, and coverage and reimbursement can differ significantly from payor to payor. Third-party payors often rely upon Medicare coverage policy and payment limitations in setting their own reimbursement rates, but also have their own methods and approval process apart from Medicare determinations. It is uncertain whether our current products or any planned or future products will be viewed as sufficiently cost effective to warrant coverage and adequate reimbursement levels for procedures using such marketed products.

***If our products are not approved for planned or new indications, our commercial opportunity will be limited.***

We currently market and sell our M5 catheters for the treatment of calcified plaque in patients with PAD in the United States and international markets and our C2 catheters for the treatment of calcified plaque in patients with CAD in Europe. However, our strategy is to market and sell our products for the treatment of CAD in the United States, upon approval or clearance from the FDA, and also to pursue additional vascular indications for our products. Conducting clinical studies to obtain data for new or additional indications may require substantial additional funding beyond the net proceeds of this offering. We cannot assure you that we will be able to successfully obtain clearance or approval for any of these additional product indications.

Even if we obtain clearance or approval to market our products for additional indications in the United States or internationally, we cannot assure you that any such indications will be successfully commercialized, widely accepted in the marketplace or more effective than other commercially available alternatives. If we are unable to successfully develop our products for new or additional indications, our commercial opportunity will be limited, which would have a material adverse effect on our business, financial condition and results of operations.

***We have limited data and experience regarding the safety and efficacy of our products. Results of earlier studies may not be predictive of future clinical trial results, and planned studies may not establish an adequate safety or efficacy profile for such products and other planned or future products, which would affect market acceptance of these products.***

Because our IVL Technology is relatively new in the treatment of PAD and CAD, we have performed clinical trials only with limited patient populations. The long-term effects of using our products in a large number of patients have not been studied and the results of short-term clinical use of such products do not necessarily predict long-term clinical benefits or reveal long-term adverse effects. The results of preclinical studies and clinical trials of our products conducted to date and ongoing or future studies and trials of our current, planned or future products may not be predictive of the results of later clinical trials, and interim results of a clinical trial do not necessarily predict final results. Our interpretation of data and results from our clinical trials do not ensure that we will achieve similar results in future clinical trials in other patient populations. In addition, preclinical and clinical data are often susceptible to various interpretations and analyses, and many companies that have believed their products performed satisfactorily in preclinical studies and earlier clinical trials have nonetheless failed to replicate results in later clinical trials and subsequently failed to obtain marketing approval. Products in later stages of clinical trials may fail to show the desired safety and efficacy despite having progressed through nonclinical studies and earlier clinical trials.

***If our clinical trials are unsuccessful or significantly delayed, or if we do not complete our clinical trials, our business may be harmed.***

Clinical development is a long, expensive and uncertain process and is subject to delays and the risk that products may ultimately prove unsafe or ineffective in treating the indications for which they are designed.

Completion of clinical trials may take several years or more. Clinical trials can be delayed for a variety of reasons, including delays in obtaining regulatory approval to commence a trial, in reaching an agreement on acceptable clinical trial terms with prospective sites, in obtaining institutional review board approval at each site, in recruiting patients to participate in a trial or in obtaining sufficient supplies of clinical trial materials.

We cannot provide any assurance that we will successfully, or in a timely manner, enroll our clinical trials, that our clinical trials will meet their primary endpoints or that such trials or their results will be accepted by the FDA or foreign regulatory authorities.

We may experience numerous unforeseen events during, or because of, the clinical trial process that could delay or prevent us from receiving regulatory clearance or approval for new products or modifications of existing products, including new indications for existing products, including:

- enrollment in our clinical trials may be slower than we anticipate, or we may experience high screen failure rates in our clinical trials, resulting in significant delays;
- our clinical trials may produce negative or inconclusive results, and we may decide, or regulators may require us, to conduct additional clinical and/or preclinical testing which may be expensive and time-consuming;
- trial results may not meet the level of statistical significance required by the FDA or other regulatory authorities;
- the FDA or similar foreign regulatory authorities may find the product is not sufficiently safe for investigational use in humans;
- the FDA or similar foreign regulatory authorities may interpret data from preclinical testing and clinical trials in different ways than we do;
- there may be delays or failure in obtaining approval of our clinical trial protocols from the FDA or other regulatory authorities;
- there may be delays in obtaining institutional review board approvals or governmental approvals to conduct clinical trials at prospective sites;
- the FDA or similar foreign regulatory authorities may find our or our suppliers' manufacturing processes or facilities unsatisfactory;
- the FDA or similar foreign regulatory authorities may change their review policies or adopt new regulations that may negatively affect or delay our ability to bring a product to market or receive approvals or clearances to treat new indications;
- we may have trouble in managing multiple clinical sites;
- we may have trouble finding patients to enroll in our trials;
- we may experience delays in agreeing on acceptable terms with third-party research organizations and trial sites that may help us conduct the clinical trials; and
- we, or regulators, may suspend or terminate our clinical trials because the participating patients are being exposed to unacceptable health risks.

Failures or perceived failures in our clinical trials will delay and may prevent our product development and regulatory approval process, damage our business prospects and negatively affect our reputation and competitive position.

***Clinical trials may be delayed, suspended or terminated for many reasons, which will increase our expenses and delay the time it takes to develop new products or seek new indications.***

We may experience delays in our ongoing or future preclinical studies or clinical trials, and we do not know whether future preclinical studies or clinical trials will begin on time, need to be redesigned, enroll an adequate

number of patients on time or be completed on schedule, if at all. The commencement and completion of clinical trials for future products or indications may be delayed, suspended or terminated as a result of many factors, including:

- the FDA or other regulators disagreeing as to the design, protocol or implementation of our clinical trials;
- the delay or refusal of regulators or institutional review boards (“IRBs”) to authorize us to commence a clinical trial at a prospective trial site;
- changes in regulatory requirements, policies and guidelines;
- delays or failure to reach agreement on acceptable terms with prospective clinical research organizations (“CROs”) and clinical trial sites, the terms of which can be subject to extensive negotiation and may vary significantly among different CROs and trial sites;
- delays in patient enrollment and variability in the number and types of patients available for clinical trials;
- the inability to enroll a sufficient number of patients in trials to observe statistically significant treatment effects in the trial;
- having clinical sites deviate from the trial protocol or dropping out of a trial;
- negative or inconclusive results from ongoing preclinical studies or clinical trials, which may require us to conduct additional preclinical studies or clinical trials or to abandon projects that we expect to be promising;
- safety or tolerability concerns that could cause us to suspend or terminate a trial if we find that the participants are being exposed to unacceptable health risks;
- reports from preclinical or clinical testing of other similar therapies that raise safety or efficacy concerns;
- regulators or IRBs requiring that we or our investigators suspend or terminate clinical research for various reasons, including noncompliance with regulatory requirements or safety concerns, among others;
- lower than anticipated retention rates of patients and volunteers in clinical trials;
- our CROs or clinical trial sites failing to comply with regulatory requirements or meet their contractual obligations to us in a timely manner, or at all, deviating from the protocol or dropping out of a trial;
- delays relating to adding new clinical trial sites;
- difficulty in maintaining contact with patients after treatment, resulting in incomplete data;
- the quality of the products falling below acceptable standards;
- the inability to manufacture sufficient quantities of our products to commence or complete clinical trials; and
- exceeding budgeted costs due to difficulty in accurately predicting costs associated with clinical trials.

We could also encounter delays if a clinical trial is suspended or terminated by us, by the IRBs or the Ethics Committees of institutions at which such trials are being conducted, by the Data Safety Monitoring Board for such trial or by the FDA or other regulatory authorities. Such authorities may suspend or terminate a clinical trial due to a number of factors, including failure to conduct the clinical trial in accordance with regulatory requirements, including the FDA’s current Good Clinical Practice (“GCP”), regulations, or our clinical protocols, inspection of the clinical trial operations or trial site by the FDA resulting in the imposition of a clinical hold, unforeseen safety issues or adverse side effects, failure to demonstrate safety and effectiveness, changes in governmental regulations or administrative actions or lack of adequate funding to continue the clinical trial.

In addition, we may encounter delays if the FDA concludes that our financial relationships with investigators result in a perceived or actual conflict of interest that may have affected the interpretation of a study, the integrity of the data generated at the applicable clinical trial site or the utility of the clinical trial itself. Principal investigators for our clinical trials may serve as scientific advisors or consultants to us from time to time and receive cash compensation and/or stock options in connection with such services. If these relationships and any related compensation to or ownership interest by the clinical investigator carrying out the study result in perceived or actual conflicts of interest, or if the FDA concludes that the financial relationship may have affected interpretation of the study, the integrity of the data generated at the applicable clinical trial site may be questioned and the utility of the clinical trial itself may be jeopardized, which could result in the delay or rejection by the FDA. Any such delay or rejection could prevent us from commercializing any of our products currently in development.

If we experience delays in the commencement or completion of any clinical trial of our products, or if any of our clinical trials are terminated, the commercial prospects of our products may be harmed, and our ability to generate revenue from sales may be delayed or materially diminished.

We do not know whether any of our future preclinical studies or clinical trials will begin as planned, will need to be restructured or will be completed on schedule, or at all. Any delays in completing our clinical trials will increase our costs, slow down our product development and approval process and jeopardize our ability to commence sales and generate associated revenue. Any of these occurrences may significantly harm our business, financial condition and prospects. In addition, many of the factors that cause, or lead to, a delay in the commencement or completion of clinical trials may also ultimately lead to the denial, suspension or revocation of expanded regulatory clearance or approval of our products. Significant preclinical study or clinical trial delays also could shorten any periods during which we may have the exclusive right to commercialize our products or allow our competitors to bring products to market before we do and impair our ability to successfully commercialize our products.

***We may be required to suspend or discontinue clinical trials due to side effects or other safety risks that could preclude approval of our products.***

Our clinical trials may be suspended at any time for a number of reasons. We may voluntarily suspend or terminate our clinical trials if at any time we believe that they present an unacceptable risk to participants. In addition, regulatory agencies may order the temporary or permanent discontinuation of our clinical trials at any time if they believe that the clinical trials are not being conducted in accordance with applicable regulatory requirements or that they present an unacceptable safety risk to participants.

***Our ability to market our current products is limited to the treatment of PAD in the United States and internationally and limited to the treatment in CAD in certain countries outside of the United States. If we want to market our products for further uses in the United States, we will need to file for FDA clearances or approvals and may need to conduct trials in addition to our existing trials to support expanded use, which would be expensive and time-consuming and may not be successful. The use, misuse or off-label use of our products may also result in injuries that lead to product liability suits, which could be costly to our business.***

Our current products are cleared in the United States solely for the treatment of PAD and in certain non-U.S. jurisdictions solely for the treatment of PAD and CAD. This prohibits our ability to market or advertise our products for any other indication, which restricts our ability to sell these products and could affect our growth. Additionally, our products are contra-indicated for use in the carotid or cerebrovascular arteries. Our promotional materials and training methods must comply with FDA and other applicable laws and regulations, including the prohibition on the promotion of a medical device for a use that has not been cleared or approved by the FDA.

Use of a device outside of its cleared or approved indication is known as “off-label” use. We cannot prevent a physician from using our products for off-label use, as the FDA does not restrict or regulate a physician’s

choice of treatment within the practice of medicine. However, we are not allowed to actively promote or advertise our products for off-label uses. In addition, we cannot make comparative claims regarding the use of our products against any alternative treatments without conducting head-to-head comparative clinical studies, which would be expensive and time-consuming. If the FDA determines that our promotional, reimbursement or training materials for sales representatives or physicians constitute promotion of an off-label use, the FDA could request that we modify our training, promotional or reimbursement materials or subject us to regulatory or enforcement actions, including the issuance of an untitled letter, a warning letter, injunction, seizure, disgorgement of profits, a civil fine and criminal penalties. Other federal, state or foreign governmental authorities also might take action if they consider our promotion, reimbursement or training materials to constitute promotion of an uncleared or unapproved use, which could result in significant fines or penalties under other statutory authorities, such as laws prohibiting false claims for reimbursement. For example, the government may take the position that off-label promotion resulted in inappropriate reimbursement for an off-label use in violation of the federal civil False Claims Act for which it might impose a civil fine and even pursue criminal action. In those possible events, our reputation could be damaged and adoption of the products would be impaired.

We currently require limited training in the use of our products incorporating our IVL Technology because we market primarily to physicians who are experienced in the interventional techniques required to use our devices. If demand for our products continues to grow, less experienced physicians will likely use our products, potentially leading to more injury and an increased risk of product liability claims. The use or misuse of our products may in the future result in complications, including damage to the treated artery, infection, internal bleeding and limb loss, potentially leading to product liability claims.

Although we train our sales force not to promote our products for off-label uses, and our instructions for use in all markets specify that our products are not intended for use outside of those indications cleared or approved for use, the FDA or another regulatory agency could conclude that we have engaged in off-label promotion.

***We will require substantial additional capital to finance our planned operations, which may not be available to us on acceptable terms or at all. Our failure to obtain additional financing when needed on acceptable terms, or at all, could force us to delay, limit, reduce or eliminate our product development programs, commercialization efforts or other operations.***

Since inception, we have incurred significant net losses and expect to continue to incur net losses for the foreseeable future. Since our inception, our operations have been financed primarily by net proceeds from the sale of our convertible preferred stock, indebtedness and, to a lesser extent, product revenue. As of December 31, 2018, we had \$39.6 million in cash and cash equivalents, and an accumulated deficit of \$126.9 million. Based on our current planned operations, we expect our cash and cash equivalents, together with available borrowings under our current revolving line of credit from our Loan and Security Agreement with Silicon Valley Bank (the “2018 Loan and Security Agreement”) and the proceeds from this offering, will enable us to fund our operating expenses for at least the next 12 months. We have based this estimate on assumptions that may prove to be wrong, and we could use our capital resources sooner than we currently expect.

We have a number of ongoing clinical trials, and expect to continue to make substantial investments in these trials and in additional clinical trials that are designed to provide clinical evidence of the safety and efficacy of our products. We intend to continue to make significant investments in our sales and marketing organization by increasing the number of U.S. sales representatives and expanding our international marketing programs to help facilitate further adoption among existing hospital accounts as well as broaden awareness of our products to new hospitals. We also expect to continue to make investments in research and development, regulatory affairs and clinical studies to develop future generations of our products, support regulatory submissions and demonstrate the clinical efficacy of our products. Moreover, we expect to incur additional expenses associated with operating as a public company, including legal, accounting, insurance, exchange listing and SEC compliance, investor relations and other expenses. Because of these and other factors, we expect to continue to incur substantial net

losses and negative cash flows from operations for the foreseeable future. Our future capital requirements will depend on many factors, including:

- the cost, timing and results of our clinical trials and regulatory reviews;
- the cost and timing of establishing sales, marketing and distribution capabilities;
- the terms and timing of any other collaborative, licensing and other arrangements that we may establish;
- the timing, receipt and amount of sales from our current and potential products;
- the degree of success we experience in commercializing our products;
- the emergence of competing or complementary technologies;
- the cost of preparing, filing, prosecuting, maintaining, defending and enforcing any patent claims and other intellectual property rights; and
- the extent to which we acquire or invest in businesses, products or technologies, although we currently have no commitments or agreements relating to any of these types of transactions.

We will require additional financing to fund working capital and pay our obligations. We may seek to raise any necessary additional capital through a combination of public or private equity offerings and/or debt financings. There can be no assurance that we will be successful in acquiring additional funding at levels sufficient to fund our operations or on terms favorable to us. If adequate funds are not available on acceptable terms when needed, we may be required to significantly reduce operating expenses, which may have a material adverse effect on our business and/or results of operations and financial condition. If we do raise additional capital through public or private equity or convertible debt offerings, the ownership interest of our existing stockholders will be diluted, and the terms of these securities may include liquidation or other preferences that adversely affect our stockholders' rights. If we raise additional capital through debt financing, we may be subject to covenants limiting or restricting our ability to take specific actions, such as incurring additional debt, making capital expenditures or declaring dividends. Additional capital may not be available on reasonable terms, or at all.

***The terms of the 2018 Loan and Security Agreement require us to meet certain operating and financial covenants and place restrictions on our operating and financial flexibility. If we raise additional capital through debt financing, the terms of any new debt could further restrict our ability to operate our business.***

The 2018 Loan and Security Agreement, entered into in February 2018, provides for a \$2.0 million revolving line of credit and a \$15.0 million term loan. The loan is secured by all our assets, excluding intellectual property and certain other assets. Subject to the terms of the 2018 Loan and Security Agreement, amounts borrowed under the revolving line and term loan can be repaid at any time, subject to certain penalty payments, prior to the February 26, 2021 maturity date and December 1, 2021 maturity date, respectively, at which time all amounts borrowed will be due and payable. In connection with the 2018 Loan and Security Agreement, Silicon Valley Bank was concurrently issued a common stock warrant that entitles Silicon Valley Bank to purchase up to 34,440 shares of our common stock with an exercise price of \$4.026 per share, with a term of ten years. The 2018 Loan and Security Agreement contains a number of restrictive covenants, and the terms may restrict our current and future operations, particularly our ability to respond to certain changes in our business or industry, or take future actions. See the section titled "Management's Discussion and Analysis of Financial Condition and Results of Operations—Liquidity and Capital Resources—Debt obligations."

The 2018 Loan and Security Agreement contains customary affirmative and restrictive covenants, including with respect to our ability to enter into fundamental transactions, incur additional indebtedness, grant liens, pay any dividend or make any distributions to our holders, make investments, merge or consolidate with any other person or engage in transactions with our affiliates, but does not include any financial covenants. If we fail to

comply with the covenants or payments specified in the 2018 Loan and Security Agreement, Silicon Valley Bank could declare an event of default, which would give it the right to terminate its commitment to provide additional loans and declare all borrowings outstanding, together with accrued and unpaid interest and fees, to be immediately due and payable. In addition, Silicon Valley Bank would have the right to proceed against the assets we provided as collateral pursuant to the loan. If the debt under the 2018 Loan and Security Agreement were accelerated, we may not have sufficient cash or be able to sell sufficient assets to repay this debt, which would harm our business and financial condition.

***The report of our independent registered public accounting firm includes a “going concern” explanatory paragraph.***

The report of our independent registered public accounting firm on our consolidated financial statements as of and for the year ended December 31, 2018 includes an explanatory paragraph indicating that there is substantial doubt about our ability to continue as a going concern. If we are unable to raise sufficient capital in this offering or otherwise when needed, our business, financial condition and results of operations will be materially and adversely affected, and we will need to significantly modify our operational plans to continue as a going concern. If we are unable to continue as a going concern, we might have to liquidate our assets and the values we receive for our assets in liquidation or dissolution could be significantly lower than the values reflected in our financial statements. The inclusion of a going concern explanatory paragraph by our auditors, our lack of cash resources and our potential inability to continue as a going concern may materially adversely affect our share price and our ability to raise new capital or to enter into critical contractual relations with third parties.

***We are highly dependent on our senior management team and key personnel, and our business could be harmed if we are unable to attract and retain personnel necessary for our success.***

We are highly dependent on our senior management and other key personnel. Our success will depend on our ability to retain senior management and to attract and retain qualified personnel in the future, including sales and marketing professionals, scientists, clinical specialists, engineers and other highly skilled personnel and to integrate current and additional personnel in all departments. The loss of members of our senior management, sales and marketing professionals, scientists, clinical and regulatory specialists and engineers could result in delays in product development and harm our business. If we are not successful in attracting and retaining highly qualified personnel, it would have a material adverse effect on our business, financial condition and results of operations.

Competition for skilled personnel in our market is intense and may limit our ability to hire and retain highly qualified personnel on acceptable terms, or at all. To induce valuable employees to remain at our company, in addition to salary and cash incentives, we have issued stock options that vest over time. The value to employees of stock options that vest over time may be significantly affected by movements in our stock price that are beyond our control, and may at any time be insufficient to counteract more lucrative offers from other companies. Despite our efforts to retain valuable employees, members of our management, scientific and development teams may terminate their employment with us on short notice. Our employment arrangements with our employees provide for at-will employment, which means that any of our employees could leave our employment at any time, with or without notice. We also do not maintain “key man” insurance policies on the lives of these individuals or the lives of any of our other employees.

***We have increased the size of our organization and expect to further increase it in the future, and we may experience difficulties in managing this growth. If we are unable to manage the anticipated growth of our business, our future revenue and operating results may be adversely affected.***

As of December 31, 2018, we had 162 full-time employees worldwide. We have significantly expanded the size of our organization over the past three years, particularly in the number of sales and marketing personnel, and expect to do so in the future. As our sales and marketing strategies develop and as we transition into

operating as a public company, we expect to need additional managerial, operational, sales, marketing, financial and other personnel. Future growth would impose significant added responsibilities on members of management, including:

- identifying, recruiting, integrating, maintaining and motivating additional employees;
- managing our internal development efforts effectively, while complying with our contractual obligations to contractors and other third parties; and
- improving our operational, financial and management controls, reporting systems and procedures.

Our future financial performance and our ability to successfully market and sell our products will depend, in part, on our ability to effectively manage any future growth, and our management may also have to divert a disproportionate amount of attention away from day-to-day activities in order to devote a substantial amount of time to managing these growth activities.

We expect to grow our sales force in anticipation of additional product approvals or clearances and increased entry into new markets. The growth we may experience in the future may provide challenges to our organization, requiring us to also rapidly expand other aspects of our business, including our manufacturing operations. Rapid expansion in personnel may result in less experienced people producing and selling our products, which could result in unanticipated costs and disruptions to our operations. If we are not able to effectively expand our organization by hiring new employees and expanding our groups of consultants and contractors, we may not be able to successfully implement the tasks necessary to further develop and commercialize our products and, accordingly, may not achieve our research, sales and marketing goals, which would have a material adverse effect on our business, financial condition and results of operations.

***If we fail to grow our sales and marketing capabilities and develop widespread brand awareness cost effectively, our growth will be impeded and our business may suffer.***

We are actively expanding our international field presence through new distributors, additional sales and clinical personnel and are adding new U.S. sales territories. We plan to continue to expand and optimize our sales infrastructure in order to grow our customer base and our business. Identifying and recruiting qualified personnel and training them on the use of our products, on applicable federal and state laws and regulations and on our internal policies and procedures, require significant time, expense and attention. It can take significant time before our sales representatives are fully trained and productive. Our business may be harmed if our efforts to expand and train our sales force do not generate a corresponding increase in revenue. In particular, if we are unable to hire, develop and retain talented sales personnel or if new sales personnel are unable to achieve desired productivity levels in a reasonable period of time, we may not be able to realize the expected benefits of this investment or increase our revenue.

Our ability to increase our customer base and achieve broader market acceptance of our products will depend to a significant extent on our ability to expand our marketing operations. We plan to dedicate significant financial and other resources to our marketing programs. Our business would be harmed if our marketing efforts and expenditures do not generate an increase in revenue.

In addition, we believe that developing and maintaining awareness of our brand in a cost-effective manner is critical to achieving broad acceptance of our products and attracting new customers. Brand promotion activities may not generate customer awareness or increase revenue and, even if they do, any increase in revenue may not offset the costs and expenses we incur in building our brand. If we fail to successfully promote, maintain and protect our brand, we may fail to attract or retain the customers necessary to realize a sufficient return on our brand-building efforts, or to achieve the widespread brand awareness that is critical for broad customer adoption of our technology.



***We intend to expand sales of our products internationally in the future, but we may experience difficulties in obtaining regulatory clearance or approval or in successfully marketing our products internationally even if approved. A variety of risks associated with marketing our products internationally could materially adversely affect our business.***

While most of our revenue has been in the United States, our current products are cleared in certain international markets for the treatment of PAD and CAD, and international sales comprised 43% of our revenue for the year ended December 31, 2018. We intend to increase our sales outside the United States, and our C<sup>2</sup> catheters are currently only available outside the United States. Sales of our products outside of the United States are and will be subject to foreign regulatory requirements governing clinical trials and marketing approval. We will incur substantial expenses in connection with our international expansion. Additional risks related to operating in foreign countries include:

- differing regulatory requirements in foreign countries;
- differing reimbursement regimes in foreign countries, including price controls;
- unexpected changes in tariffs, trade barriers, price and exchange controls and other regulatory requirements;
- economic weakness, including inflation, or political instability in particular foreign economies and markets;
- compliance with tax, employment, immigration and labor laws for employees living or traveling abroad;
- foreign taxes, including withholding of payroll taxes;
- foreign currency fluctuations, which could result in increased operating expenses, reduced revenue and other obligations incident to doing business in another country;
- difficulties staffing and managing foreign operations;
- workforce uncertainty in countries where labor unrest is more common than in the United States;
- potential liability under the U.S. Foreign Corrupt Practices Act of 1977, as amended (the “FCPA”), or comparable foreign regulations;
- challenges enforcing our contractual and intellectual property rights, especially in those foreign countries that do not respect and protect intellectual property rights to the same extent as the United States;
- product shortages resulting from any events affecting raw material or finished good supply or distribution or manufacturing capabilities abroad; and
- business interruptions resulting from geopolitical actions, including war and terrorism.

These and other risks associated with our international operations may materially adversely affect our ability to attain or maintain profitable operations, which would have a material adverse effect on our business, financial condition and results of operations.

In addition, there can be no guarantee that we will receive approval to sell our products in every international market we target, nor can there be any guarantee that any sales would result even if such approval is received. Even if the FDA grants marketing approval for a product, comparable regulatory authorities of foreign countries must also approve the manufacturing or marketing of the product in those countries. Approval in the United States, or in any other jurisdiction, does not ensure approval in other jurisdictions. Obtaining foreign approvals could result in significant delays, difficulties and costs for us and require additional trials and additional expenses. Regulatory requirements can vary widely from country to country and could delay the introduction of our products in those countries. Clinical trials conducted in one country may not be accepted by

other countries, and regulatory approval in one country does not mean that regulatory approval will be obtained in any other country. If we fail to comply with these regulatory requirements or to obtain and maintain required approvals, our target market will be reduced and our ability to generate revenue will be diminished. Our inability to successfully enter all our desired international markets and manage business on a global scale could negatively affect our business, financial results and results of operations.

***Our future growth may depend, in part, on our ability to operate in foreign markets, where we would be subject to additional regulatory burdens and other risks and uncertainties.***

Our future growth may depend, in part, on our ability to develop and commercialize our planned and future products in foreign markets. We are not permitted to market or promote any of our planned or future products before we receive regulatory approval from applicable regulatory authorities in foreign markets, and we may never receive such regulatory approvals for any of our planned or future products. To obtain separate regulatory approval in many other countries we must comply with numerous and varying regulatory requirements regarding safety and efficacy and governing, among other things, clinical trials, commercial sales, pricing and distribution of our planned or future products. If we obtain regulatory approval of our products and ultimately commercialize our planned or future products in foreign markets, we would be subject to additional risks and uncertainties, including:

- different regulatory requirements for approval of medical devices in foreign countries;
- reduced protection for intellectual property rights;
- the existence of additional third-party patent rights of potential relevance to our business;
- unexpected changes in tariffs, trade barriers and regulatory requirements;
- economic weakness, including inflation or political instability in particular foreign economies and markets;
- compliance with tax, employment, immigration and labor laws for employees living or traveling abroad;
- foreign currency fluctuations, which could result in increased operating expenses, reduced revenue and other obligations incident to doing business in another country;
- foreign reimbursement, pricing and insurance regimes;
- workforce uncertainty in countries where labor unrest is common;
- production shortages resulting from any events affecting raw material supply or manufacturing capabilities abroad; and
- business interruptions resulting from geopolitical actions, including war and terrorism, or natural disasters, including earthquakes, typhoons, floods and fires.

***We face additional credit and compliance risks related to our international sales using foreign distributors.***

We partner with distributors for our products in select geographies outside of the United States. Specifically, in 2018 we sold to distributors located in Europe, Canada, Australia and New Zealand. For the year ended December 31, 2018, approximately 43% of our sales were outside of the United States. We may not be able to collect all of the funds owed to us by our foreign distributors. Some foreign distributors may experience financial difficulties, including bankruptcy, which may hinder our collection of accounts receivable. Where we extend credit terms to distributors, we periodically review the collectability and creditworthiness when determining the payment terms for such distributors. If our uncollectible accounts exceed our expectations, this could adversely impact our operating results. In addition, failure by our foreign distributors to comply with the FCPA, the United Kingdom Bribery Act 2010 (the "U.K. Bribery Act") or similar laws, insurance requirements or other contract terms could have a negative impact on our business. Failure to manage the risks related to our foreign distributors would have a material adverse effect on our business, financial condition and results of operations.

***Governmental export or import controls could limit our ability to compete in foreign markets and subject us to liability if we violate them.***

Our products may be subject to U.S. export controls. Governmental regulation of the import or export of our products, or our failure to obtain any required import or export authorization for our products, when applicable, could harm our international sales and adversely affect our revenue. Compliance with applicable regulatory requirements regarding the export of our products may create delays in the introduction of our products in international markets or, in some cases, prevent the export of our products to some countries altogether. Furthermore, U.S. export control laws and economic sanctions prohibit the shipment of certain products and services to countries, governments and persons targeted by U.S. sanctions. If we fail to comply with export and import regulations and such economic sanctions, we may be fined or other penalties could be imposed, including a denial of certain export privileges. Moreover, any new export or import restrictions, new legislation or shifting approaches in the enforcement or scope of existing regulations, or in the countries, persons or technologies targeted by such regulations, could result in decreased use of our products by, or in our decreased ability to export our products to existing or potential customers with international operations. Any decreased use of our products or limitation on our ability to export or sell access to our products would likely materially and adversely affect our business, financial condition and results of operations.

***Technological change may adversely affect sales of our products and may cause our products to become obsolete.***

The medical device market is characterized by extensive research and development and rapid technological change. Technological progress or new developments in our industry could adversely affect sales of our products. Our products could be rendered obsolete because of future innovations by our competitors or others in the treatment of vascular diseases, which would have a material adverse effect on our business, financial condition and results of operations.

***Consolidation in the medical device industry could have an adverse effect on our revenue and results of operations.***

Many medical device companies are consolidating to create new companies with greater market power. As the medical device industry consolidates, competition to provide goods and services to industry participants will become more intense. These industry participants may try to use their market power to negotiate price concessions or reductions for our products. If we reduce our prices because of consolidation in the healthcare industry, our revenue would decrease, which could have a material adverse effect on our business, financial condition and results of operations.

***If product liability lawsuits are brought against us, we may incur substantial liabilities and may be required to limit or halt the marketing and sale of our products. The expense and potential unavailability of insurance coverage for liabilities resulting from our products could harm us and our ability to sell our products.***

We face an inherent risk of product liability as a result of the marketing and sale of our products. For example, we may be sued if our products cause or are perceived to cause injury or are found to be otherwise unsuitable during manufacturing, marketing or sale. Any such product liability claim may include allegations of defects in manufacturing, defects in design, a failure to warn of dangers inherent in the product, negligence, strict liability or a breach of warranties. In addition, we may be subject to claims against us even if the apparent injury is due to the actions of others or the pre-existing health of the patient. For example, we rely on physicians in connection with the use of our products on patients. If these physicians are not properly trained or are negligent, the capabilities of our products may be diminished or the patient may suffer critical injury. We may also be subject to claims that are caused by the activities of our suppliers, such as those who provide us with components and sub-assemblies.

If we cannot successfully defend ourselves against product liability claims, we may incur substantial liabilities or be required to limit or halt commercialization of our products. Even successful defense would

require significant financial and management resources. Regardless of the merits or eventual outcome, liability claims may result in:

- decreased demand for our products;
- injury to our reputation;
- initiation of investigations by regulators;
- costs to defend the related litigation;
- a diversion of management's time and our resources;
- substantial monetary awards to trial participants or patients;
- product recalls, withdrawals or labeling, marketing or promotional restrictions;
- loss of revenue;
- exhaustion of any available insurance and our capital resources; and
- the inability to market and sell our products.

We believe we have adequate product liability insurance, but it may not prove to be adequate to cover all liabilities that we may incur. Insurance coverage is increasingly expensive. We may not be able to maintain or obtain insurance at a reasonable cost or in an amount adequate to satisfy any liability that may arise. Our insurance policy contains various exclusions, and we may be subject to a product liability claim for which we have no coverage. The potential inability to obtain sufficient product liability insurance at an acceptable cost to protect against product liability claims could prevent or inhibit the marketing and sale of products we develop. We may have to pay any amounts awarded by a court or negotiated in a settlement that exceed our coverage limitations or that are not covered by our insurance, and we may not have, or be able to obtain, sufficient capital to pay such amounts, which would have a material adverse effect on our business, financial condition and results of operations. In addition, any product liability claims brought against us, with or without merit, could increase our product liability insurance rates or prevent us from securing continuing coverage, harm our reputation in the industry, significantly increase our expenses and reduce product sales.

Some of our customers and prospective customers may also have difficulty in procuring or maintaining liability insurance to cover their operations and use of our products. Medical malpractice carriers are withdrawing coverage in certain states or substantially increasing premiums. If this trend continues or worsens, our customers may discontinue using our products and potential customers may opt against purchasing our products due to the cost or inability to procure insurance coverage.

***Litigation and other legal proceedings may adversely affect our business.***

From time to time we may become involved in legal proceedings relating to patent and other intellectual property matters, product liability claims, employee claims, tort or contract claims, federal regulatory investigations, securities class action and other legal proceedings or investigations, which could have an adverse impact on our reputation, business and financial condition and divert the attention of our management from the operation of our business. Litigation is inherently unpredictable and can result in excessive or unanticipated verdicts and/or injunctive relief that affect how we operate our business. We could incur judgments or enter into settlements of claims for monetary damages or for agreements to change the way we operate our business, or both. There may be an increase in the scope of these matters or there may be additional lawsuits, claims, proceedings or investigations in the future, which could have a material adverse effect on our business, financial condition and results of operations. Adverse publicity about regulatory or legal action against us could damage our reputation and brand image, undermine our customers' confidence and reduce long-term demand for our products, even if the regulatory or legal action is unfounded or not material to our operations.

***If we experience significant disruptions in our information technology systems, our business may be adversely affected.***

We depend on our information technology systems for the efficient functioning of our business, including the manufacture, distribution and maintenance of our products, as well as for accounting, data storage, compliance, purchasing and inventory management. We do not have redundant information technology systems at this time. Our information technology systems may be subject to computer viruses, ransomware or other malware, attacks by computer hackers, failures during the process of upgrading or replacing software, databases or components thereof, power outages, damage or interruption from fires or other natural disasters, hardware failures, telecommunication failures and user errors, among other malfunctions. We could be subject to an unintentional event that involves a third party gaining unauthorized access to our systems, which could disrupt our operations, corrupt our data or result in release of our confidential information. We address these data security concerns in more detail below. Technological interruptions would disrupt our operations, including our ability to timely ship and track product orders, project inventory requirements, manage our supply chain and otherwise adequately service our customers or disrupt our customers' ability use our products for treatments. In the event we experience significant disruptions, we may be unable to repair our systems in an efficient and timely manner. Accordingly, such events may disrupt or reduce the efficiency of our entire operation and have a material adverse effect on our business, financial condition and results of operations. Currently, we carry business interruption coverage to mitigate certain potential losses but this insurance is limited in amount, and we cannot be certain that such potential losses will not exceed our policy limits. We are increasingly dependent on complex information technology to manage our infrastructure. Our information systems require an ongoing commitment of significant resources to maintain, protect and enhance our existing systems. Failure to maintain or protect our information systems and data integrity effectively could have a material adverse effect on our business, financial condition and results of operations.

***If we experience security or data privacy breaches or other unauthorized or improper access to, use of, or destruction of our proprietary or confidential data, employee data or personal data, or if customers, patients and other partners are reluctant to use our devices because of concerns about the privacy or security of their data, we may face additional costs, loss of revenue, significant liabilities, harm to our brand, decreased use of our platform and business disruption.***

In connection with various facets of our business, we collect and use a variety of personal data, such as name, mailing address, email addresses, mobile phone number, location information and clinical trial information. Any failure to prevent or mitigate security breaches or improper access to, use of, or disclosure of our data or consumers' personal data could result in significant liability under state (e.g., state breach notification laws), federal (e.g. the Health Insurance Portability and Accountability Act ("HIPAA") and the Health Information Technology for Economic and Clinical Health Act ("HITECH Act")) and international law (e.g. the European Union's General Data Protection Regulation ("GDPR")). Such an incident may also cause a material loss of revenue from the potential adverse impact to our reputation and brand, affect our ability to retain or attract new users and potentially disrupt our business. We may also rely on third-party service providers to host or otherwise process some of our data and that of users, and any failure by such third party to prevent or mitigate security breaches or improper access to or disclosure of such information could have similarly adverse consequences for us.

Because the techniques used to obtain unauthorized access, disable or degrade service or sabotage systems change frequently and often are not recognized until launched against a target, we and our service providers may be unable to anticipate these techniques or to implement adequate preventative measures. Our servers and platforms may be vulnerable to computer viruses or physical or electronic break-ins that our security measures may not detect. Individuals able to circumvent our security measures may misappropriate our confidential or proprietary information, disrupt our operations, damage our computers or otherwise damage our reputation and business. We may need to expend significant resources and make significant capital investment to protect against security breaches or to mitigate the impact of any such breaches. If we are unable to prevent or mitigate the

impact of such security breaches, our ability to attract and retain new customers, patients and other partners could be harmed, and we could be exposed to litigation and governmental investigations, which could lead to a potential disruption to our business.

***If we fail to identify, acquire and develop other products, we may be unable to grow our business.***

As a significant part of our growth strategy, we intend to develop and commercialize additional products through our research and development program or by licensing or acquiring additional products and technologies from third parties. The success of this strategy depends upon our ability to identify, select and acquire the right to products and technologies on terms that are acceptable to us.

Any product we identify, license or acquire may require additional development efforts prior to commercial sale, including extensive clinical testing and approval or clearance by the FDA and applicable foreign regulatory authorities. All products are prone to the risks of failure inherent in medical device product development, including the possibility that the product will not be shown to be sufficiently safe and effective for approval or clearance by regulatory authorities. In addition, we cannot assure you that any such products that are approved or cleared will be manufactured or produced economically, successfully commercialized or widely accepted in the marketplace.

Proposing, negotiating and implementing an economically viable product or technology acquisition or license is a lengthy and complex process. Other companies, including those with substantially greater financial, marketing and sales resources, may compete with us for the acquisition or license of approved or cleared products. We may not be able to acquire or license the rights to additional approved or cleared products on terms that we find acceptable, or at all.

If we are unable to develop suitable potential products through internal research programs or by obtaining rights from third parties, it could have a material adverse effect on our business, financial condition and results of operations.

***We may acquire other businesses which could require significant management attention, disrupt our business, dilute stockholder value and adversely affect our results of operations.***

As part of our business strategy, we may in the future make acquisitions or investments in complementary companies, products or technologies that we believe fit within our business model and can address the needs of our customers and potential customers. In the future, we may not be able to acquire and integrate other companies, products or technologies in a successful manner. We may not be able to find suitable acquisition candidates, and we may not be able to complete such acquisitions on favorable terms, if at all. In addition, the pursuit of potential acquisitions may divert the attention of management and cause us to incur additional expenses in identifying, investigating and pursuing suitable acquisitions, whether or not they are consummated. If we do complete acquisitions, we may not ultimately strengthen our competitive position or achieve our goals, including increases in revenue, and any acquisitions we complete could be viewed negatively by our customers, investors and industry analysts.

Future acquisitions may reduce our cash available for operations and other uses and could result in amortization expense related to identifiable assets acquired. We may have to pay cash, incur debt or issue equity securities to pay for any such acquisition, each of which could adversely affect our financial condition or the value of our common stock. The sale or issuance of equity to finance any such acquisitions would result in dilution to our stockholders. The incurrence of indebtedness to finance any such acquisition would result in fixed obligations and could also include covenants or other restrictions that could impede our ability to manage our operations. In addition, our future results of operations may be adversely affected by the dilutive effect of an acquisition, performance earn-outs or contingent bonuses associated with an acquisition. Furthermore, acquisitions may require large, one-time charges and can result in increased debt or contingent liabilities, adverse

tax consequences, additional stock-based compensation expenses and the recording and subsequent amortization of amounts related to certain purchased intangible assets, any of which items could negatively affect our future results of operations. We may also incur goodwill impairment charges in the future if we do not realize the expected value of any such acquisitions.

Also, the anticipated benefit of any strategic alliance, joint venture or acquisition may not materialize, or such strategic alliance, joint venture or acquisition may be prohibited. In February 2018, we entered into the 2018 Loan and Security Agreement. The 2018 Loan and Security Agreement restricts our ability to pursue certain mergers, acquisitions, amalgamations or consolidations that we may believe to be in our best interest. Additionally, future acquisitions or dispositions could result in potentially dilutive issuances of our equity securities, the incurrence of debt, contingent liabilities or amortization expenses or write-offs of goodwill, any of which could harm our financial condition. We cannot predict the number, timing or size of future joint ventures or acquisitions, or the effect that any such transactions might have on our operating results.

***Economic conditions may adversely affect our business.***

Adverse worldwide economic conditions may negatively impact our business. A significant change in the liquidity or financial condition of our customers could cause unfavorable trends in their purchases and also in our receivable collections, and additional allowances may be required, which could adversely affect our business, financial condition and results of operations. Adverse worldwide economic conditions may also adversely impact our suppliers' ability to provide us with materials and components, which could have a material adverse effect on our business, financial condition and results of operations.

***Business disruptions could seriously harm our future revenue and financial condition and increase our costs and expenses.***

Our operations could be subject to earthquakes, power shortages, telecommunications failures, water shortages, floods, hurricanes, typhoons, fires, extreme weather conditions, medical epidemics and other natural or man-made disasters or business interruptions, for which we are predominantly self-insured. We rely on third-party manufacturers to produce our products. Our ability to obtain clinical supplies of our products could be disrupted if the operations of these suppliers were affected by a man-made or natural disaster or other business interruption. In addition, our corporate headquarters is located in Santa Clara, California, near major earthquake faults and fire zones, and the ultimate impact on us for being located near major earthquake faults and fire zones and being consolidated in a certain geographical area is unknown. The occurrence of any of these business disruptions could seriously harm our operations and financial condition and increase our costs and expenses.

**Risks Related to Government Regulation and Our Industry**

***If we fail to comply with U.S. federal and state fraud and abuse and other healthcare laws and regulations, including those relating to kickbacks and false claims for reimbursement, we could face substantial penalties and our business operations and financial condition could be adversely affected.***

Healthcare providers and third-party payors play a primary role in the distribution, recommendation, ordering and purchasing of any medical device for which we have or obtain marketing clearance or approval. Through our arrangements with principal investigators, healthcare professionals, third-party payors and customers, we are exposed to broadly applicable anti-fraud and abuse, anti-kickback, false claims and other healthcare laws and regulations that may constrain our business, our arrangements and relationships with customers, and how we market, sell and distribute our marketed medical devices. We have a compliance program, Code of Conduct and associated policies and procedures, but it is not always possible to identify and deter misconduct by our employees and other third parties, and the precautions we take to detect and prevent noncompliance may not be effective in protecting us from governmental investigations for failure to comply with applicable fraud and abuse or other healthcare laws and regulations.

In the United States, we are subject to various state and federal anti-fraud and abuse laws, including, without limitation, the federal healthcare Anti-Kickback Statute (“Anti-Kickback Statute”) and federal civil False Claims Act. There are similar laws in other countries. Our relationships and our distributors’ relationships with physicians, other health care professionals and hospitals are subject to scrutiny under these laws.

Healthcare fraud and abuse laws and related regulations are complex, and even minor irregularities can potentially give rise to claims that a statute or prohibition has been violated. The laws that may affect our ability to operate include:

- the Anti-Kickback Statute, which prohibits, among other things, knowingly and willingly soliciting, offering, receiving or paying remuneration, directly or indirectly, overtly or covertly, in cash or in kind, to induce or reward either the referral of an individual, or the purchase, order or recommendation of, items or services for which payment may be made, in whole or in part, under a federal healthcare program, such as the Medicare and Medicaid programs. The term “remuneration” has been broadly interpreted to include anything of value, and the government can establish a violation of the Anti-Kickback Statute without proving that a person or entity had actual knowledge of the law or a specific intent to violate. In addition, the government may assert that a claim, including items or services resulting from a violation of the Anti-Kickback Statute, constitutes a false or fraudulent claim for purposes of the federal civil False Claims Act. The Anti-Kickback Statute is subject to evolving interpretations and has been applied by government enforcement officials to a number of common business arrangements in the medical device industry. There are a number of statutory exceptions and regulatory safe harbors protecting certain business arrangements from prosecution under the Anti-Kickback Statute; however, those exceptions and safe harbors are drawn narrowly, and there is no exception or safe harbor for many common business activities, such as reimbursement support programs, educational and research grants or charitable donations. Practices that involve remuneration to those who prescribe, purchase or recommend medical devices, including discounts, providing items or services for free or engaging such individuals as consultants, advisors or speakers, may be subject to scrutiny if they do not fit squarely within an exception or safe harbor and would be subject to a facts and circumstances analysis to determine compliance with the Anti-Kickback Statute. Our practices, such as the loan, consignment, or purchase of certain components of our IVL System to customers, may not in all cases meet all of the criteria for statutory exception or regulatory safe harbor protection from anti-kickback liability.
- federal civil and criminal false claims laws and civil monetary penalties laws, including the federal civil False Claims Act, which prohibits, among other things, persons or entities from knowingly presenting, or causing to be presented, a false or fraudulent claim for payment of government funds and knowingly making, using or causing to be made or used, a false record or statement to get a false claim paid or to avoid, decrease or conceal an obligation to pay money to the federal government. A claim including items or services resulting from a violation of the Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the federal civil False Claims Act. Actions under the federal civil False Claims Act may be brought by the government or as a *qui tam* action by a private individual in the name of the government. These individuals, sometimes known as “relators” or, more commonly, as “whistleblowers,” may share in any amounts paid by the entity to the government in fines or settlement. Many pharmaceutical and medical device manufacturers have been investigated and have reached substantial financial settlements with the federal government under the federal civil False Claims Act for a variety of alleged improper activities, including causing false claims to be submitted as a result of the marketing of their products for unapproved and thus non-reimbursable uses and interactions with prescribers and other customers, including those that may have affected their billing or coding practices and submission of claims to the federal government. Federal civil False Claims Act liability is potentially significant in the healthcare industry because the statute provides for treble damages and mandatory monetary penalties for each false or fraudulent claim or statement. Because of the potential for large monetary exposure, healthcare and medical device companies often resolve



allegations without admissions of liability for significant and material amounts to avoid the uncertainty of treble damages and per claim penalties that may be awarded in litigation proceedings.

- HIPAA, which imposes criminal and civil liability for, among other actions, knowingly and willfully executing, or attempting to execute, a scheme to defraud any healthcare benefit program, including private third-party payors, or knowingly and willfully falsifying, concealing or covering up a material fact or making a materially false, fictitious or fraudulent statement or representation, or making or using any false writing or document knowing the same to contain any materially false, fictitious or fraudulent statement or entry in connection with the delivery of or payment for healthcare benefits, items or services;
- HIPAA, as amended by HITECH Act, and their implementing regulations, also impose obligations, including mandatory contractual terms, on covered entities subject to the rule, such as health plans, healthcare clearinghouses and certain healthcare providers, as well as their business associates that perform certain services for them or on their behalf involving the use or disclosure of individually identifiable health information with respect to safeguarding the privacy, security and transmission of individually identifiable health information. We believe we are not a covered entity for purposes of HIPAA, and we believe that we generally do not conduct our business in a manner that would cause us to be a business associate under HIPAA;
- the federal Physician Payment Sunshine Act, also known as Open Payments, which requires manufacturers of drugs, devices, biologics and medical supplies for which payment is available under Medicare, Medicaid or the Children’s Health Insurance Program to report annually, with certain exceptions to the Centers for Medicare & Medicaid Services (“CMS”), information related to payments or other “transfers of value” made to physicians and teaching hospitals, and requires applicable manufacturers and group purchasing organizations to report annually to CMS ownership and investment interests held by physicians and their immediate family members. Beginning in 2022, applicable manufacturers also will be required to report information regarding payments and transfers of value provided to physician assistants, nurse practitioners, clinical nurse specialists, certified nurse anesthetists and certified nurse-midwives; and
- analogous state and foreign law equivalents of each of the above federal laws, such as anti-kickback and false claims laws which may apply to items or services reimbursed by any third-party payor, including commercial insurers; state laws that require medical device companies to comply with the industry’s voluntary compliance guidelines and the applicable compliance guidance promulgated by the federal government or otherwise restrict payments that may be made to healthcare providers and other potential referral sources; state beneficiary inducement laws, which are state laws that require medical device manufacturers to report information related to payments and other transfers of value to physicians and other healthcare providers or marketing expenditures; and state and foreign laws governing the privacy and security of health information in certain circumstances, many of which differ from each other in significant ways and may not have the same effect, thus complicating compliance efforts.

State and federal regulatory and enforcement agencies continue to actively investigate violations of healthcare laws and regulations, and the U.S. Congress continues to strengthen the arsenal of enforcement tools. Most recently, the Bipartisan Budget Act of 2018 (“BBA”) increased the criminal and civil penalties that can be imposed for violating certain federal health care laws, including the Anti-Kickback Statute. Enforcement agencies also continue to pursue novel theories of liability under these laws. In particular, government agencies recently have increased regulatory scrutiny and enforcement activity with respect to manufacturer reimbursement support activities and patient support programs, including bringing criminal charges or civil enforcement actions under the Anti-Kickback Statute, federal civil False Claims Act and HIPAA’s healthcare fraud and privacy provisions.

Because of the breadth of these laws and the narrowness of the statutory exceptions and regulatory safe harbors available under such laws, it is possible that some of our business activities, including certain sales and

marketing practices of our marketed IVL System, including the IVL generator, connector cable and catheter, and financial arrangements with physicians, other healthcare providers, and other customers, could be subject to challenge under one or more such laws. For example, in the United States, in many instances we generally loan for free to customers both the reusable IVL generator and connector cable so long as the customer is purchasing our single-use catheters. Customers also have the option to purchase the IVL generator and connector cable either at the initiation of the relationship or following the consignment period. Additionally, we consign catheters to our customers, free of charge, until a catheter is used at which time the customer is billed for the catheter. The Anti-Kickback Statute includes, among others, space and equipment rental safe harbors. These safe harbors require, among other things, that the aggregate payment between the parties is set in advance and consistent with fair market value. As the IVL generator and connector cable are provided for free, and no payment is made for storage of our catheters at customers' facilities, these arrangements will likely not satisfy these or other safe harbors or statutory exceptions. Therefore, if these arrangements were investigated, they would be subject to a facts and circumstances analysis to determine whether they include prohibited remuneration under the Anti-Kickback Statute. If an arrangement were deemed to violate the Anti-Kickback Statute, it may also subject us to violations under other fraud and abuse laws such as the federal civil False Claims Act and civil monetary penalties laws. Moreover, such arrangements could be found to violate comparable state fraud and abuse laws.

Achieving and sustaining compliance with applicable federal and state anti-fraud and abuse laws may prove costly. If we or our employees are found to have violated any of the above laws we may be subjected to substantial criminal, civil and administrative penalties, including imprisonment, exclusion from participation in federal healthcare programs, such as Medicare and Medicaid, and significant fines, monetary penalties, forfeiture, disgorgement and damages, contractual damages, reputational harm, administrative burdens, diminished profits and future earnings and the curtailment or restructuring of our operations, any of which could adversely affect our ability to operate our business and our financial results. Any action or investigation against us for the violation of these healthcare fraud and abuse laws, even if successfully defended, could result in significant legal expenses and could divert our management's attention from the operation of our business. Companies settling federal civil False Claims Act, Anti-Kickback Statute or civil monetary penalties law cases also may be required to enter into a Corporate Integrity Agreement with the OIG in order to avoid exclusion from participation (i.e., loss of coverage for their products) in federal healthcare programs such as Medicare and Medicaid. Corporate Integrity Agreements typically impose substantial costs on companies to ensure compliance. Defending against any such actions can be costly, time-consuming and may require significant personnel resources, and may have a material adverse effect on our business, financial condition and results of operations.

***We are subject to numerous laws and regulations related to anti-bribery and anti-corruption laws, such as the FCPA and the U.K. Bribery Act, in which violations of these laws could result in substantial penalties and prosecution.***

For our sales and operations outside the United States, we are similarly subject to various heavily-enforced anti-bribery and anti-corruption laws, such as the FCPA, U.K. Bribery Act and similar laws around the world. These laws generally prohibit U.S. companies and their employees and intermediaries from offering, promising, authorizing or making improper payments to foreign government officials for the purpose of obtaining or retaining business or gaining any advantage. We face significant risks if we, which includes our third-party business partners and intermediaries, fail to comply with the FCPA or other anti-corruption and anti-bribery laws.

We leverage various third parties to conduct our business and sell our products abroad, including to government owned universities and hospitals. We, our distributors and our other third-party intermediaries may have direct or indirect interactions with officials and employees of government agencies or state-owned or affiliated entities (such as in the context of obtaining government approvals, registrations or licenses or sales to government owned or controlled healthcare facilities, universities, institutes, clinics, etc.) and may be held liable for the corrupt or other illegal activities of these third-party business partners and intermediaries, our employees, representatives, contractors, partners and agents, even if we do not explicitly authorize such activities. In many

foreign countries, particularly in countries with developing economies, it may be a local custom that businesses engage in practices that are prohibited by the FCPA or other applicable laws and regulations. To that end, while we have adopted and implemented internal control policies and procedures and employee training and compliance programs to deter prohibited practices, such compliance measures ultimately may not be effective in prohibiting our employees, contractors, business partners, intermediaries or agents from violating or circumventing our policies and/or the law.

Responding to any enforcement action or related investigation may result in a materially significant diversion of management's attention and resources and significant defense costs and other professional fees. Any violation of the FCPA or other applicable anti-bribery, anti-corruption or anti-money laundering laws could result in whistleblower complaints, adverse media coverage, investigations, loss of export privileges, severe criminal or civil sanctions and, in the case of the FCPA, suspension or debarment from U.S. government contracts, which could have a material and adverse effect on our business, financial condition and results of operations.

***Regulatory compliance is expensive, complex and uncertain, and a failure to comply could lead to enforcement actions against us and other negative consequences for our business.***

The FDA and similar agencies regulate our products as medical devices. Complying with these regulations is costly, time-consuming, complex and uncertain. For instance, before a new medical device, or a new intended use for, an existing device can be marketed in the United States, a company must first submit and receive either 510(k) clearance or pre-marketing approval from the FDA, unless an exemption applies.

FDA regulations and regulations of similar agencies are wide-ranging and include, among other things, oversight of:

- product design, development, manufacture (including suppliers) and testing;
- laboratory, preclinical and clinical studies;
- product safety and effectiveness;
- product labeling;
- product storage and shipping;
- record keeping;
- pre-market clearance or approval;
- marketing, advertising and promotion;
- product sales and distribution;
- product changes;
- product recalls; and
- post-market surveillance and reporting of deaths or serious injuries and certain malfunctions.

Our current products are subject to extensive regulation by the FDA and non-U.S. regulatory agencies. Further, all of our potential products and improvements of our current products will be subject to extensive regulation and will likely require permission from regulatory agencies and ethics boards to conduct clinical trials and clearance or approval from the FDA and non-U.S. regulatory agencies prior to commercial sale and distribution. Failure to comply with applicable U.S. requirements regarding, for example, promoting, manufacturing or labeling our products, may subject us to a variety of administrative or judicial actions and sanctions, such as Form 483 observations, warning letters, untitled letters, product recalls, product seizures, total or partial suspension of production or distribution, injunctions, fines, civil penalties and criminal prosecution.

The FDA can also refuse to clear or approve pending applications. Any enforcement action by the FDA and other comparable non-U.S. regulatory agencies could have a material adverse effect on our business, financial condition and results of operations.

Our failure to comply with applicable regulatory requirements could result in enforcement action by the FDA or state agencies, which may include any of the following actions:

- untitled letters, warning letters, fines, injunctions, consent decrees and civil penalties;
- unanticipated expenditures to address or defend such actions;
- customer notifications for repair, replacement or refunds;
- recall, detention or seizure of our products;
- operating restrictions or partial suspension or total shutdown of production;
- refusing or delaying our requests for 510(k) clearance or PMA approval of new products or modified products;
- operating restrictions;
- withdrawing 510(k) clearances or PMA approvals that have already been granted;
- refusal to grant export approval for our products; or
- criminal prosecution.

If any of these events were to occur, it would have a material and adverse effect on our business, financial condition and results of operations.

We may not be able to obtain the necessary clearances or approvals or may be unduly delayed in doing so, which could harm our business. Furthermore, even if we are granted regulatory clearances or approvals, they may include significant limitations on the indicated uses for the product, which may limit the market for the product. Although we have obtained 510(k) clearance to market our M<sup>5</sup> and S<sup>4</sup> catheters, our clearance can be revoked if safety or efficacy problems develop.

The FDA also regulates the advertising and promotion of our products to ensure that the claims we make are consistent with our regulatory clearances and approvals, that there are adequate and reasonable data to substantiate the claims and that our promotional labeling and advertising is neither false nor misleading in any respect. If the FDA determines that any of our advertising or promotional claims are misleading, not substantiated or not permissible, we may be subject to enforcement actions, including warning letters, and we may be required to revise our promotional claims and make other corrections or restitutions.

***Our medical device operations are subject to pervasive and continuing FDA regulatory requirements.***

Medical devices regulated by the FDA are subject to “general controls” which include: registration with the FDA; listing commercially distributed products with the FDA; complying with cGMPs under QSR; filing reports with the FDA of and keeping records relative to certain types of adverse events associated with devices under the medical device reporting regulation; assuring that device labeling complies with device labeling requirements; reporting certain device field removals and corrections to the FDA; and obtaining pre-market notification 510(k) clearance for devices prior to marketing. Some devices known as “510(k)-exempt” devices can be marketed without prior marketing-clearance or approval from the FDA. In addition to the “general controls,” some Class II medical devices are also subject to “special controls,” including adherence to a particular guidance document and compliance with the performance standard. Instead of obtaining 510(k) clearance, most Class III devices are subject to PMA. Our C<sup>2</sup> catheters for the treatment of CAD is designated as a Class III product and will follow the PMA process. As a Company, we do not have prior experience in obtaining PMA approval.

The medical device industry is now experiencing greater scrutiny and regulation by federal, state and foreign governmental authorities. Companies in our industry are subject to more frequent and more intensive reviews and investigations, often involving the marketing, business practices and product quality management. Such reviews and investigations may result in civil and criminal proceedings; the imposition of substantial fines and penalties; the receipt of warning letters, untitled letters, demands for recalls or the seizure of our products; the requirement to enter into corporate integrity agreements, stipulated judgments or other administrative remedies; and result in our incurring substantial unanticipated costs and the diversion of key personnel and management's attention from their regular duties, any of which may have a material and adverse effect on our business, financial condition and results of operations, and may result in greater and continuing governmental scrutiny of our business in the future.

Additionally, federal, state and foreign governments and entities have enacted laws and issued regulations and other standards requiring increased visibility and transparency of our interactions with healthcare providers. For example, Open Payments requires us to annually report to CMS payments and other transfers of value to all U.S. physicians and U.S. teaching hospitals, with the reported information made publicly available on a searchable website. Failure to comply with these legal and regulatory requirements could impact our business, and we have had and will continue to spend substantial time and financial resources to develop and implement enhanced structures, policies, systems and processes to comply with these legal and regulatory requirements, which may also impact our business and which could have a material adverse effect on our business, financial condition and results of operations.

***Product clearances and approvals can often be denied or significantly delayed.***

Under FDA regulations, unless exempt, a new medical device may only be commercially distributed after it has received 510(k) clearance, is authorized through the *de novo* classification process or is the subject of an approved PMA. The FDA will clear marketing of a medical device through the 510(k) process if it is demonstrated that the new product is substantially equivalent to another legally marketed product not subject to a PMA. Sometimes, a 510(k) clearance must be supported by preclinical and clinical data.

The PMA process typically is more costly, lengthy and stringent than the 510(k) process. Unlike a 510(k) review, which determines "substantial equivalence," a PMA requires that the applicant demonstrate reasonable assurance that the device is safe and effective by producing valid scientific evidence, including data from preclinical studies and human clinical trials. Therefore, to obtain regulatory clearance or approvals, we typically must, among other requirements, provide the FDA and similar foreign regulatory authorities with preclinical and clinical data that demonstrate to their satisfaction that our products satisfy the criteria for approval. Preclinical testing and clinical trials must comply with the regulations of the FDA and other government authorities in the United States and similar agencies in other countries.

We may be required to obtain PMAs, PMA supplements or additional 510(k) pre-market clearances to market modifications to our existing products. The FDA requires device manufacturers to make and document a determination of whether a modification requires approval or clearance; however, the FDA can review a manufacturer's decision. The FDA may not agree with our decisions not to seek approvals or clearances for particular device modifications. If the FDA requires us to obtain PMAs, PMA supplements or pre-market clearances for any modification to a previously cleared or approved device, we may be required to cease manufacturing and marketing of the modified device and perhaps also to recall such modified device until we obtain FDA clearance or approval. We may also be subject to significant regulatory fines or penalties.

The FDA may not approve our current or future PMA applications or supplements or clear our 510(k) applications on a timely basis or at all. Such delays or refusals could have a material adverse effect on our business, financial condition and results of operations.

The FDA may also change its clearance and approval policies, adopt additional regulations or revise existing regulations, or take other actions which may prevent or delay approval or clearance of our products

under development or impact our ability to modify our currently approved or cleared products on a timely basis. Any of these actions could have a material adverse effect on our business, financial condition and results of operations.

International regulatory approval processes may take more or less time than the FDA clearance or approval process. If we fail to comply with applicable FDA and comparable non-U.S. regulatory requirements, we may not receive regulatory clearances or approvals or may be subject to FDA or comparable non-U.S. enforcement actions. We may be unable to obtain future regulatory clearance or approval in a timely manner, or at all, especially if existing regulations are changed or new regulations are adopted. For example, the FDA clearance or approval process can take longer than anticipated due to requests for additional clinical data and changes in regulatory requirements. A failure or delay in obtaining necessary regulatory clearances or approvals would materially adversely affect our business, financial condition and results of operations.

***Although we have obtained regulatory clearance for our M<sup>5</sup> catheters for the treatment of PAD in the United States, and our M<sup>5</sup> catheters for the treatment of PAD and our C<sup>2</sup> catheter for the treatment of CAD in certain non-U.S. jurisdictions, they will remain subject to extensive regulatory scrutiny.***

Although our M<sup>5</sup> catheters for the treatment of PAD have obtained regulatory clearance in the United States, and our M<sup>5</sup> catheters for the treatment of PAD and C<sup>2</sup> catheters for the treatment of CAD in certain non-U.S. jurisdictions have obtained applicable regulatory approvals, they will be subject to ongoing regulatory requirements for manufacturing, labeling, packaging, storage, advertising, promotion, sampling, record-keeping, conduct of post-marketing studies and submission of safety, effectiveness and other post-market information, including both federal and state requirements in the United States and requirements of comparable non-U.S. regulatory authorities.

Our manufacturing facility is required to comply with extensive requirements imposed by the FDA and comparable foreign regulatory authorities, including ensuring that quality control and manufacturing procedures conform to the QSR or similar regulations set by foreign regulatory authorities. As such, we will be subject to continual review and inspections to assess compliance with the QSR and adherence to commitments made in any 510(k) application. Accordingly, we continue to expend time, money and effort in all areas of regulatory compliance, including manufacturing, production and quality control.

Any regulatory clearances or approvals that we have received for our products will be subject to limitations on the cleared or approved indicated uses for which the product may be marketed and promoted, will be subject to the conditions of approval, or will contain requirements for potentially costly post-marketing testing. We are required to report certain adverse events and production problems, if any, to the FDA and comparable foreign regulatory authorities. Any new legislation addressing product safety issues could result in increased costs to assure compliance. The FDA and other agencies, including the DOJ, closely regulate and monitor the post-clearance or approval marketing and promotion of products to ensure that they are marketed and distributed only for the cleared or approved indications and in accordance with the provisions of the cleared or approved labeling. We have to comply with requirements concerning advertising and promotion for our products.

Promotional communications with respect to devices are subject to a variety of legal and regulatory restrictions and must be consistent with the information in the products' cleared or approved labeling. As such, we may not promote our products for indications or uses for which they do not have clearance or approval. For certain changes to a cleared product, including certain changes to product labeling, the holder of a cleared 510(k) application may be required to submit a new application and obtain clearance. We will train our marketing and sales force against promoting our product candidates for uses outside of the cleared or approved indications for use, known as "off-label uses." However, physicians may use our products for off-label purposes and are allowed to do so when in the physician's independent professional medical judgment he or she deems it appropriate. If the FDA determines that our promotional materials or training constitute promotion of an off-label or other improper use, or that our internal policies and procedures are inadequate to prevent such off-label uses, it could subject us to regulatory or enforcement actions as discussed below.

If a regulatory agency discovers previously unknown problems with a product, such as adverse events of unanticipated severity or frequency, or problems with our facility where the product is manufactured or disagrees with the promotion, marketing or labeling of a product, such regulatory agency may impose restrictions on that product or us, including requiring withdrawal of the product from the market. If we fail to comply with applicable regulatory requirements, a regulatory agency or enforcement authority may, among other things:

- subject our facility to an adverse inspectional finding or Form 483, or other compliance or enforcement notice, communication or correspondence;
- issue warning or untitled letters that would result in adverse publicity or may require corrective advertising;
- impose civil or criminal penalties;
- suspend or withdraw regulatory clearances or approvals;
- refuse to clear or approve pending applications or supplements to approved applications submitted by us;
- impose restrictions on our operations, including closing our sub-assembly suppliers' facilities;
- seize or detain products; or
- require a product recall.

In addition, violations of the Federal Food, Drug and Cosmetic Act ("FD&C Act"), relating to the promotion of approved products may lead to investigations alleging violations of federal and state healthcare fraud and abuse and other laws, as well as state consumer protection laws.

Any government investigation of alleged violations of law could require us to expend significant time and resources in response, and could generate negative publicity. Any failure to comply with ongoing regulatory requirements may significantly and adversely affect our ability to commercialize and generate revenue from our products. If regulatory sanctions are applied or if regulatory clearance or approval is withdrawn, it would have a material adverse effect on our business, financial condition and results of operations.

***Our products may be subject to recalls after receiving FDA or foreign approval or clearance, which could divert managerial and financial resources, harm our reputation and adversely affect our business.***

The FDA and similar foreign governmental authorities have the authority to require the recall of our products because of any failure to comply with applicable laws and regulations, or defects in design or manufacture. A government mandated or voluntary product recall by us could occur because of, for example, component failures, device malfunctions or other adverse events, such as serious injuries or deaths, or quality-related issues, such as manufacturing errors or design or labeling defects. Any future recalls of our products could divert managerial and financial resources, harm our reputation and adversely affect our business.

If we initiate a correction or removal for one of our devices to reduce a risk to health posed by the device, we would be required to submit a publicly available Correction and Removal report to the FDA and, in many cases, similar reports to other regulatory agencies. This report could be classified by the FDA as a device recall which could lead to increased scrutiny by the FDA, other international regulatory agencies and our customers regarding the quality and safety of our devices. Furthermore, the submission of these reports has been and could be used by competitors against us in competitive situations and cause customers to delay purchase decisions or cancel orders and would harm our reputation. In July 2018, we initiated and subsequently completed a voluntary recall of our S4 catheters after seeing a higher instance of leaks in the balloon, which prevented the balloon from staying inflated at 4 atm for the full course of lithotripsy application. While there were no patient safety issues reported and no reports of adverse clinical events related to this issue and the issue has been corrected, we believe it was prudent to suspend utilization of the device and recall the product while we determined the cause of the leak.

In addition, we are subject to medical device reporting regulations that require us to report to the FDA or similar foreign governmental authorities if one of our products may have caused or contributed to a death or serious injury or if we become aware that it has malfunctioned in a way that would likely cause or contribute to a death or serious injury if the malfunction recurred. Failures to properly identify reportable events or to file timely reports, as well as failure to address each of the observations to the FDA's satisfaction, can subject us to sanctions and penalties, including warning letters and recalls. Physicians, hospitals and other healthcare providers may make similar reports to regulatory authorities. Any such reports may trigger an investigation by the FDA or similar foreign regulatory bodies, which could divert managerial and financial resources, harm our reputation and have a material adverse effect on our business, financial condition and results of operations.

***If we or our suppliers fail to comply with the FDA's Quality System Regulation or any applicable state equivalent, our operations could be interrupted and our potential product sales and operating results could suffer.***

Our manufacturing processes and those of our third-party suppliers are required to comply with the FDA's QSR, which covers the design controls, document controls, purchasing controls, identification and traceability, production and process controls, acceptance activities, nonconforming product requirements, corrective and preventive action requirements, labeling and packaging controls, handling, storage, distribution and installation requirements, complaint handling, records requirements, servicing requirements and statistical techniques potentially applicable to the production of our medical devices. We and our suppliers are also subject to the regulations of foreign jurisdictions regarding the manufacturing process where we market products overseas. In addition, we must engage in extensive recordkeeping and reporting and must make available our manufacturing facilities and records for periodic announced or unannounced inspections by governmental agencies, including the FDA, state authorities and comparable agencies in other countries. If we experience an unsuccessful Quality System inspection, our operations could be disrupted and our manufacturing could be interrupted. Failure to take adequate corrective action in response to an adverse Quality System inspection could result in, among other things, a shut-down of our manufacturing operations, significant fines, suspension of marketing clearances and approvals, seizures or recalls of our device, operating restrictions and criminal prosecutions, any of which would cause our business to suffer. Furthermore, our key component suppliers may not currently be or may not continue to be in compliance with applicable regulatory requirements, which may result in manufacturing delays for our product and cause our revenue to decline.

We have registered with the FDA as a medical device manufacturer and have obtained a manufacturing license from the California Department of Health Services ("CDHS"). We anticipate that we and certain of our third-party component suppliers will be subject to FDA and CDHS inspections.

We produce substantially all of our IVL catheters in-house at our facilities in Fremont, California which, together with our research and development, controlled environment room and office space, currently totals 12,000 square feet. We plan to move our production of IVL catheters to our new 35,000 square foot facility in Santa Clara, California in 2019. Our Santa Clara facility has not been inspected by the FDA to date. Our most recent audit by the British Standards Institution ("BSI") was held in 2018. There was one minor non-conformance and no major non-conformances. We can provide no assurance that we will continue to remain in compliance with QSR. If our facilities are found to be in noncompliance or fail to take satisfactory corrective action in response to adverse QSR inspectional findings, the FDA could take legal or regulatory enforcement actions against us and/or our products, including but not limited to the cessation of sales or the recall of distributed products, which could impair our ability to produce our products in a cost-effective and timely manner in order to meet our customers' demands. We may also be required to bear other costs or take other actions that may have a negative impact on our future sales and our ability to generate profits. Taking corrective action may be expensive, time-consuming and a distraction for management, and if we experience a shutdown or delay at our manufacturing facilities, we may be unable to produce our products, which would harm our business.

Current regulations depend heavily on administrative interpretation. If the FDA does not believe that we are in compliance with applicable FDA regulations, the agency could take legal or regulatory enforcement actions



against us and/or our products. We are also subject to periodic inspections by the FDA and other governmental regulatory agencies, as well as certain third-party regulatory groups. Future interpretations made by the FDA or other regulatory bodies made during the course of these inspections may vary from current interpretations and may adversely affect our business and prospects. The FDA's and other comparable non-U.S. regulatory agencies' statutes, regulations or policies may change, and additional government regulation or statutes may be enacted, which could increase post-approval regulatory requirements, or delay, suspend or prevent marketing of any cleared or approved products or necessitate the recall of distributed products. We cannot predict the likelihood, nature or extent of adverse governmental regulation that might arise from future legislative or administrative action, either in the United States or abroad.

The medical device industry has been under heightened FDA scrutiny as the subject of government investigations and enforcement actions. If our operations and activities are found to be in violation of any FDA laws or any other governmental regulations that apply to us, we may be subject to penalties, including civil and criminal penalties, damages, fines and other legal and/or agency enforcement actions. Any penalties, damages, fines or curtailment or restructuring of our operations or activities could adversely affect our ability to operate our business and our financial results. The risk of us being found in violation of FDA laws is increased by the fact that many of these laws are broad and their provisions are open to a variety of interpretations. Any action against us for violation of these laws, even if we successfully defend ourselves against that action and its underlying allegations, could cause us to incur significant legal expenses and divert management's attention from the operation of our business. Where there is a dispute with a federal or state governmental agency that cannot be resolved to the mutual satisfaction of all relevant parties, we may determine that the costs, both real and contingent, are not justified by the commercial returns to us from maintaining the dispute or the product.

Various claims, design features or performance characteristics of our medical devices that we may regard as permitted by the FDA without marketing clearance or approval, may be challenged by the FDA or state or foreign regulators. The FDA or state or foreign regulatory authorities may find that certain claims, design features or performance characteristics, in order to be made or included in the products, may have to be supported by further studies and marketing clearances or approvals, which could be lengthy, costly and possibly unobtainable.

***If any of our products cause or contribute to a death or a serious injury or malfunction in certain ways, we will be required to report under applicable medical device reporting regulations, which can result in voluntary corrective actions or agency enforcement actions.***

Under FDA medical device reporting regulations ("MDR regulations"), medical device manufacturers are required to report to the FDA information that a device has or may have caused or contributed to a death or serious injury or has malfunctioned in a way that would likely cause or contribute to death or serious injury if the malfunction of the device or one of our similar devices were to recur. If we fail to report events required to be reported to the FDA within the required timeframes, or at all, the FDA could take enforcement action and impose sanctions against us. Any such adverse event involving our products also could result in future voluntary corrective actions, such as recalls or customer notifications, or agency action, such as inspection or enforcement action. Any corrective action, whether voluntary or involuntary, as well as defending ourselves in a lawsuit, would require our time and capital, distract management from operating our business and may harm our reputation and have a material adverse effect on our business, financial condition and results of operations.

***Healthcare reform initiatives and other administrative and legislative proposals may adversely affect our business, financial condition, results of operations and cash flows in our key markets.***

There have been and continue to be proposals by the federal government, state governments, regulators and third-party payors to control or manage the increased costs of healthcare and, more generally, to reform the U.S. healthcare system. Certain of these proposals could limit the prices we are able to charge for our products or the coverage and reimbursement available for our products and could limit the acceptance and availability of our

products. The adoption of proposals to control costs could have a material adverse effect on our business, financial condition and results of operations.

For example, in the United States, in March 2010, the Patient Protection and Affordable Care Act, as amended by the Health Care and Education Reconciliation Act of 2010, together, the Affordable Care Act (“ACA”), is a sweeping measure intended to expand healthcare coverage within the United States, primarily through the imposition of health insurance mandates on employers and individuals, the provision of subsidies to eligible individuals enrolled in plans offered on the health insurance exchanges and the expansion of the Medicaid program. Implementation of the ACA will impact existing government healthcare programs and will result in the development of new programs. For example, the ACA, among other things, imposes a deductible excise tax of 2.3% on the sale of most medical devices, including ours, and any failure to pay this amount could result in the imposition of an injunction on the sale of our products, fines and penalties.

There have been judicial and Congressional challenges to certain aspects of the ACA, as well as recent efforts by the Trump administration to repeal or replace certain aspects of the ACA, and we expect such challenges and amendments to continue. For example, since January 2017, President Trump has signed two Executive Orders and other directives designed to delay the implementation of certain provisions of the ACA or otherwise circumvent some of the requirements for health insurance mandated by the ACA. Concurrently, Congress has considered legislation that would repeal or repeal and replace all or part of the ACA. While Congress has not passed comprehensive repeal legislation, two bills affecting the implementation of certain taxes under the ACA have been signed into law. The Tax Cuts and Jobs Act of 2017 (“TCJA”) includes a provision repealing, effective January 1, 2019, the tax-based shared responsibility payment imposed by the ACA on certain individuals who fail to maintain qualifying health coverage for all or part of a year that is commonly referred to as the “individual mandate.” On January 22, 2018, President Trump signed a continuing resolution on appropriations for fiscal year 2018 (the “2018 Continuing Resolution”), that delayed the implementation of certain ACA-mandated fees, including the 2.3% excise tax imposed on manufacturers and importers for certain sales of medical devices through December 31, 2019. Further, the BBA, among other things, amended the ACA, effective January 1, 2019, to close the coverage gap in most Medicare drug plans, commonly referred to as the “donut hole.” In July 2018, CMS published a final rule permitting further collections and payments to and from certain ACA qualified health plans and health insurance issuers under the ACA risk adjustment program in response to the outcome of federal district court litigation regarding the method CMS uses to determine this risk adjustment. On December 14, 2018, a Texas U.S. District Court Judge ruled that the ACA is unconstitutional in its entirety because the “individual mandate” was repealed by Congress as part of the TCJA. While the Texas U.S. District Court Judge, as well as the Trump administration and CMS, have stated that the ruling will have no immediate effect pending appeal of the decision, it is unclear how this decision, subsequent appeals and other efforts to repeal and replace the ACA will impact the ACA and our business.

In addition, other legislative changes have been proposed and adopted since the ACA was enacted. On August 2, 2011, the Budget Control Act of 2011 was signed into law, which, among other things, includes reductions to Medicare payments to providers of 2% per fiscal year, which went into effect on April 1, 2013 and, due to subsequent legislative amendments to the statute, including the BBA, will remain in effect through 2027 unless additional Congressional action is taken. On January 2, 2013, the American Taxpayer Relief Act of 2012 was signed into law, which, among other things, reduced Medicare payments to several providers, including hospitals, and increased the statute of limitations period for the government to recover overpayments to providers from three to five years.

We cannot assure you that the ACA, as currently enacted or as amended in the future, will not harm our business and financial results, and we cannot predict how future federal or state legislative or administrative changes relating to healthcare reform will affect our business.

There likely will continue to be legislative and regulatory proposals at the federal and state levels directed at containing or lowering the cost of healthcare. We cannot predict the initiatives that may be adopted in the future

or their full impact. The continuing efforts of the government, insurance companies, managed care organizations and other payors of healthcare services to contain or reduce costs of healthcare may harm:

- our ability to set a price that we believe is fair for our products;
- our ability to generate revenue and achieve or maintain profitability; and
- the availability of capital.

Further, recently there has been heightened governmental scrutiny over the manner in which manufacturers set prices for their marketed products, which has resulted in several U.S. Congressional inquiries and proposed and enacted federal legislation designed to bring transparency to product pricing and reduce the cost of products and services under government healthcare programs. Congress and the Trump administration have each indicated that it will continue to seek new legislative and/or administrative measures to control product costs. Additionally, individual states in the United States have also increasingly passed legislation and implemented regulations designed to control product pricing, including price or patient reimbursement constraints, discounts, restrictions on certain product access and marketing cost disclosure and transparency measures. Moreover, regional healthcare authorities and individual hospitals are increasingly using bidding procedures to determine what products to purchase and which suppliers will be included in their healthcare programs. Adoption of price controls and other cost-containment measures, and adoption of more restrictive policies in jurisdictions with existing controls and measures may prevent or limit our ability to generate revenue and attain profitability.

Various new healthcare reform proposals are emerging at the federal and state level. Any new federal and state healthcare initiatives that may be adopted could limit the amounts that federal and state governments will pay for healthcare products and services, and could have a material adverse effect on our business, financial condition and results of operations.

***Our financial performance may be adversely affected by medical device tax provisions in the healthcare reform legislation.***

The imposition of the 2.3% medical device excise tax enacted as part of the ACA could adversely affect our financial results. Although the suspension of the excise tax was extended to the end of 2019 by the 2018 Continuing Resolution, we do not know whether the suspension will continue beyond 2019. We may not be able to pass along the cost of the tax to our customers or offset the cost of the tax through higher sales volumes resulting from the expansion of health insurance coverage. Ongoing implementation of this legislation could have a material adverse effect on our business, financial condition and results of operations.

***Material modifications to our products may require new 510(k) clearances or pre-market approvals or may require us to recall or cease marketing our products until clearances or approvals are obtained.***

Modifications that could significantly affect the safety and effectiveness of our approved or cleared products, such as changes to the intended use or technological characteristics of our products, will require new 510(k) clearances or PMAs or require us to recall or cease marketing the modified devices until these clearances or approvals are obtained. Based on FDA published guidelines, the FDA requires device manufacturers to initially make and document a determination of whether or not a modification requires a new approval, supplemental approval or clearance; however, the FDA can review a manufacturer's decision. Any modification to an FDA-cleared device that could significantly affect its safety or efficacy or that would constitute a major change in its intended use would require a new 510(k) clearance or possibly a PMA. For Class III products, changes that affect safety and effectiveness will require the submission and approval of a PMA supplement. We may not be able to obtain additional 510(k) clearances or PMAs for new products or for modifications to, or additional indications for, our products in a timely fashion, or at all. Delays in obtaining required future clearances or approvals would adversely affect our ability to introduce new or enhanced products in a timely manner, which in turn would harm our future growth. We have made modifications to our products in the past

and expect to make additional modifications in the future that we believe do not or will not require additional clearances or approvals. If the FDA disagrees and requires new clearances or approvals for these modifications, we may be required to recall and to stop selling or marketing such products as modified, which could harm our operating results and require us to redesign such products. In these circumstances, we may be subject to significant enforcement actions.

***Our employees, independent contractors, consultants, commercial partners, distributors and vendors may engage in misconduct or other improper activities, including noncompliance with regulatory standards and requirements.***

We are exposed to the risk that our employees, independent contractors, consultants, commercial partners, distributors and vendors may engage in fraudulent or illegal activity. Misconduct by these parties could include intentional, reckless and/or negligent conduct or disclosure of unauthorized activities to us that violates: (i) the laws of the FDA and other similar foreign regulatory bodies, including those laws requiring the reporting of true, complete and accurate information to such regulators; (ii) manufacturing standards; (iii) healthcare fraud and abuse laws in the United States and similar foreign fraudulent misconduct laws; or (iv) laws that require the true, complete and accurate reporting of financial information or data. These laws may impact, among other things, future sales, marketing and education programs. In particular, the promotion, sales and marketing of healthcare items and services, as well as certain business arrangements in the healthcare industry, are subject to extensive laws designed to prevent fraud, kickbacks, self-dealing and other abusive practices. These laws and regulations may restrict or prohibit a wide range of pricing, discounting, marketing and promotion, structuring and commissions, certain customer incentive programs and other business arrangements generally. Activities subject to these laws also involve the improper use of information obtained in the course of patient recruitment for clinical trials.

We have adopted a code of business conduct and ethics, but it is not always possible to identify and deter misconduct by our employees and other third parties, and the precautions we take to detect and prevent these activities may not be effective in controlling unknown or unmanaged risks or losses or in protecting us from governmental investigations or other actions or lawsuits stemming from a failure to be in compliance with such laws or regulations. If any such actions are instituted against us and we are not successful in defending ourselves or asserting our rights, those actions could result in the imposition of significant fines or other sanctions, including the imposition of civil, criminal and administrative penalties, damages, monetary fines, disgorgement, individual imprisonment, additional integrity reporting and oversight obligations, possible exclusion from participation in Medicare, Medicaid and other federal healthcare programs, contractual damages, reputational harm, diminished profits and future earnings and curtailment of operations, any of which could adversely affect our ability to operate our business and our results of operations. Whether or not we are successful in defending against any such actions or investigations, we could incur substantial costs, including legal fees, and divert the attention of management in defending ourselves against any of these claims or investigations, which could have a material adverse effect on our business, financial condition and results of operations.

***Environmental and health safety laws may result in liabilities, expenses and restrictions on our operations. Failure to comply with environmental laws and regulations could subject us to significant liability.***

Federal, state, local and foreign laws regarding environmental protection, hazardous substances and human health and safety may adversely affect our business. Our research and development and manufacturing operations involve the use of hazardous substances and are subject to a variety of federal, state, local and foreign environmental laws and regulations relating to the storage, use, discharge, disposal and remediation of, as well as human exposure to, hazardous substances and the sale, labeling, collection, recycling, treatment and disposal of products containing hazardous substances. These operations are permitted by regulatory authorities, and the resultant waste materials are disposed of in material compliance with environmental laws and regulations. Using hazardous substances in our operations exposes us to the risk of accidental injury, contamination or other liability from the use, storage, importation, handling or disposal of hazardous materials. If our or our suppliers' operations

result in the contamination of the environment or expose individuals to hazardous substances, we could be liable for damages and fines, and any liability could significantly exceed our insurance coverage and have a material adverse effect on our on our business, financial condition and results of operations. Liability under environmental laws and regulations can be joint and several and without regard to fault or negligence. Compliance with environmental laws and regulations may be expensive, and non-compliance could result in substantial liabilities, fines and penalties, personal injury and third-party property damage claims and substantial investigation and remediation costs. Environmental laws and regulations could become more stringent over time, imposing greater compliance costs and increasing risks and penalties associated with violations. We cannot assure you that violations of these laws and regulations will not occur in the future or have not occurred in the past as a result of human error, accidents, equipment failure or other causes. The expense associated with environmental regulation and remediation could harm our business, financial condition and results of operation.

***We face risks related to our collection and use of data, which could result in investigations, inquiries, litigation, fines, legislative and regulatory action and negative press about our privacy and data protection practices.***

Our business processes personal data, including some data related to health. When conducting clinical trials, we face risks associated with collecting trial participants' data, especially health data, in a manner consistent with applicable laws and regulations, such as the Common Rule, GCP guidelines, or FDA human subject protection regulations. We also face risks inherent in handling large volumes of data and in protecting the security of such data. We could be subject to attacks on our systems by outside parties or fraudulent or inappropriate behavior by our service providers or employees. Third parties may also gain access to users' accounts using stolen or inferred credentials, computer malware, viruses, spamming, phishing attacks or other means, and may use such access to obtain users' personal data or prevent use of their accounts. Data breaches could result in a violation of applicable U.S. and international privacy, data protection and other laws, and subject us to individual or consumer class action litigation and governmental investigations and proceedings by federal, state and local regulatory entities in the United States and by international regulatory entities, resulting in exposure to material civil and/or criminal liability. Further, our general liability insurance and corporate risk program may not cover all potential claims to which we are exposed and may not be adequate to indemnify us for all liability that may be imposed.

This risk is enhanced in certain jurisdictions and, as we expand our operations domestically and internationally, we may be subject to additional laws in other jurisdictions. Any failure, or perceived failure, by us to comply with privacy and data protection laws, rules and regulations could result in proceedings or actions against us by governmental entities or others. These proceedings or actions may subject us to significant penalties and negative publicity, require us to change our business practices, increase our costs and severely disrupt our business. For example, in the United States, California recently adopted the California Consumer Privacy Act of 2018, which will come into effect beginning in January 2020. The GDPR became effective in May 2018. The GDPR applies extraterritorially and imposes several stringent requirements for controllers and processors of personal data, including, for example, higher standards for obtaining consent from individuals to process their personal data, more robust disclosures to individuals and a strengthened individual data rights regime, shortened timelines for data breach notifications, limitations on retention of information, increased requirements pertaining to special categories of personal data and pseudonymised (i.e., key-coded) data and additional obligations when we contract third-party processors in connection with the processing of the personal data. The GDPR provides that European Union ("EU") member states may make their own laws and regulations limiting the (i) processing of personal data, including special categories of data (e.g., racial or ethnic origin, political opinions, religious or philosophical beliefs) and (ii) profiling and automated individual decision-making of individuals, which could limit our ability to use and share personal data or other data and could cause our costs to increase, harming our business and financial condition. Non-compliance with GDPR is subject to significant penalties, including fines of up to €20 million or 4% of total worldwide revenue. The interpretations of the GDPR by local data protection authorities in EU member states, along with the complexity of the new data protection regime itself, will leave the interpretation and enforcement of the law unclear in the near term, with

potential inconsistencies across the EU member states. The implementation and enforcement of the GDPR may subject us to enforcement risk and requirements to change certain of our data collection, processing and other policies and practices. We could incur significant costs investigating and defending such claims and, if we are found liable, significant damages. If any of these events were to occur, our business and financial results could be adversely affected. Other jurisdictions outside the EU are similarly introducing or enhancing laws and regulations relating to privacy and data security, which enhances risks relating to compliance with such laws.

Additionally, we are subject to laws and regulations regarding cross-border transfers of personal data, including laws relating to transfer of personal data outside of the European Economic Area (“EEA”). We rely on transfer mechanisms permitted under these laws, including EU Standard Contract Clauses. Such mechanisms have received heightened regulatory and judicial scrutiny in recent years. If we cannot rely on existing mechanisms for transferring personal data from the EEA, the United Kingdom or other jurisdictions, we could be prevented from transferring personal data of users or employees in those regions. This could adversely affect the manner in which we provide our services and thus materially affect our operations and financial results.

***Legislative or regulatory reforms may make it more difficult and costly for us to obtain regulatory clearance or approval of our planned or future products and to manufacture, market and distribute our products after clearance or approval is obtained.***

From time to time, legislation is drafted and introduced in Congress that could significantly change the statutory provisions governing the regulatory approval, manufacture and marketing of regulated products or the reimbursement thereof. In addition, FDA regulations and guidance are often revised or reinterpreted by the FDA in ways that may significantly affect our business and our products. Any new regulations or revisions or reinterpretations of existing regulations may impose additional costs or lengthen review times of planned or future products. It is impossible to predict whether legislative changes will be enacted or FDA regulations, guidance or interpretations changed, and what the impact of such changes, if any, may be.

Moreover, the policies of the Trump Administration and their impact on the regulation of our products in the United States remain uncertain. The outcome of the 2016 election and the 2018 Congressional mid-term elections resulting in a split in majority control between the House of Representatives and the Senate could result in significant legislative and regulatory reforms impacting the FDA’s regulation of our products. Any change in the laws or regulations that govern the clearance and approval processes relating to our current, planned and future products could make it more difficult and costly to obtain clearance or approval for new products or to produce, market and distribute existing products. Significant delays in receiving clearance or approval or the failure to receive clearance or approval for our new products would have an adverse effect on our ability to expand our business.

In the EU, on May 25, 2017 the new Medical Devices Regulation (“2017/745” or “MDR”) was adopted. Following its entry into application on May 26, 2020, the MDR will introduce substantial changes to the obligations with which medical device manufacturers must comply in the EU. High risk medical devices will be subject to additional scrutiny during the conformity assessment procedure.

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

***If we are unable to obtain and maintain patent or other intellectual property protection for our products, or if the scope of the patent and other intellectual property protection obtained is not sufficiently broad, our competitors could develop and commercialize products and technology similar or identical to ours, and our ability to successfully commercialize any products we may develop, and our technology, may be adversely affected.***

As with other medical device companies, our success depends in large part on our ability to maintain and solidify a proprietary position for our products, which will depend upon our success in obtaining effective patent

claims that cover, and other intellectual property with respect to, such products, their manufacturing processes and their intended methods of use and enforcing those patent claims once granted as well as our other intellectual property. In some cases, we may not be able to obtain issued claims covering our technologies which are sufficient to prevent third parties, such as our competitors, from utilizing our technology. Any failure to obtain or maintain patent and other intellectual property protection with respect to our IVL products and technologies or other aspects of our business could have a material adverse effect on our business, financial condition and results of operations.

Changes in either the patent laws or their interpretation in the United States and other countries may diminish our ability to protect our inventions, obtain, maintain and enforce our intellectual property rights and, more generally, could affect the value of our intellectual property or narrow the scope of our issued patents. Additionally, we cannot predict whether the patent applications we are currently pursuing will issue as patents in any particular jurisdiction or whether the claims of any issued patents will provide sufficient protection from competitors or other third parties.

The patent prosecution process is expensive, time-consuming and complex, and we may not be able to file, prosecute, maintain, enforce or license all necessary or desirable patent applications at a reasonable cost or in a timely manner. It is also possible that we will fail to identify patentable aspects of our research and development output in time to obtain patent protection. Although we enter into non-disclosure and confidentiality agreements with parties who have access to confidential or patentable aspects of our research and development output, such as our employees, corporate collaborators, outside scientific collaborators, suppliers, consultants, advisors and other third parties, any of these parties may breach the agreements and disclose such output before a patent application is filed, thereby jeopardizing our ability to seek patent protection. In addition, our ability to obtain and maintain valid and enforceable patents depends on whether the differences between our inventions and the prior art allow our inventions to be patentable over the prior art. Furthermore, the publication of discoveries in scientific literature often lags behind the actual discoveries, and patent applications in the United States and other jurisdictions are typically not published until 18 months after filing, or in some cases not at all. Therefore, we cannot be certain that we were the first to make the inventions claimed in any of our patents or pending patent applications, or that we were the first to file for patent protection of such inventions. Moreover, in some circumstances, we may not have the right to control the preparation, filing and prosecution of patent applications, or to maintain the patents, covering technology that we license from or license to third parties and are therefore reliant on our licensors or licensees. Therefore, these and any of our patents and applications may not be prosecuted and enforced in a manner consistent with the best interests of our business. Defects of form in the preparation or filing of our patents or patent applications may exist, or may arise in the future, for example, with respect to proper priority claims, inventorship and the like, although we are unaware of any such defects that we believe are of material importance. If we or any current or future licensors or licensees fail to establish, maintain, protect or enforce such patents and other intellectual property rights, such rights may be reduced or eliminated. If any current or future licensors or licensees are not fully cooperative or disagree with us as to the prosecution, maintenance or enforcement of any patent rights, such patent rights could be compromised. If there are material defects in the form, preparation or prosecution of our patents or patent applications, such patents or applications may be invalid and unenforceable. Any of these outcomes could impair our ability to prevent competition from third parties, which may have an adverse impact on our business.

The strength of patent rights generally, and particularly the patent position of medical device companies, involves complex legal and scientific questions and can be uncertain, and has been the subject of much litigation in recent years. This uncertainty includes changes to the patent laws through either legislative action to change statutory patent law or court action that may reinterpret existing law or rules in ways affecting the scope or validity of issued patents. Our current or future patent applications may fail to result in issued patents in the United States or foreign countries with claims that cover our products. Even if patents do successfully issue from our patent applications, third parties may challenge the validity, enforceability or scope of such patents, which may result in such patents being narrowed, invalidated or held unenforceable. Any successful challenge to our patents could deprive us of exclusive rights necessary for the successful commercialization of our products.

Furthermore, even if they are unchallenged, our patents may not adequately protect our products, provide exclusivity for our products or prevent others from designing around our claims. If the scope of any patent protection we obtain is not sufficiently broad, or if we lose any of our patent protection, our ability to prevent our competitors from commercializing similar or identical technology and products would be adversely affected. If the breadth or strength of protection provided by the patents we hold or pursue with respect to our products is challenged, it could dissuade companies from collaborating with us to develop, or threaten our ability to commercialize, our products.

Patents have a limited lifespan. In the United States, the natural expiration of a utility patent is generally 20 years after its effective filing date and the natural expiration of a design patent is generally 14 years after its issue date, unless the filing date occurred on or after May 13, 2015, in which case the natural expiration of a design patent is generally 15 years after its issue date. Various extensions may be available; however, the life of a patent, and the protection it affords, is limited. Without patent protection for our products and services, we may be open to competition. Further, if we encounter delays in our development efforts, the period of time during which we could market our products and services under patent protection would be reduced and, given the amount of time required for the development, testing and regulatory review of planned or future products, patents protecting such products might expire before or shortly after such products are commercialized. As a result, our intellectual property may not provide us with sufficient rights to exclude others from commercializing products similar or identical to ours.

Moreover, the coverage claimed in a patent application can be significantly reduced before the patent is issued, and its scope can be reinterpreted after issuance. Even if patent applications we license or own, currently or in the future, issue as patents, they may not issue in a form that will provide us with any meaningful protection, prevent competitors or other third parties from competing with us, or otherwise provide us with any competitive advantage. Any patents that we own may be challenged, narrowed, circumvented or invalidated by third parties. Consequently, we do not know whether our IVL products and technologies will be protectable or remain protected by valid and enforceable patents. Our competitors or other third parties may be able to circumvent our patents by developing similar or alternative technologies or products in a non-infringing manner which could materially adversely affect our business, financial condition and results of operations.

Some of our patents and patent applications may in the future be co-owned with third parties. If we are unable to obtain an exclusive license to any such third party co-owners' interest in such patents or patent applications, such co-owners may be able to license their rights to other third parties, including our competitors, and our competitors could market competing products and technology. In addition, we may need the cooperation of any such co-owners of our patents in order to enforce such patents against third parties, and such cooperation may not be provided to us. Any of the foregoing could have a material adverse effect on our business, financial condition and results of operations.

***Patents covering our products could be found invalid or unenforceable if challenged in court or before administrative bodies in the United States or abroad.***

The issuance of a patent is not conclusive as to its inventorship, scope, validity or enforceability, and our patents may be challenged in the courts or patent offices in the United States and abroad. We may be subject to a third-party preissuance submission of prior art to the U.S. Patent and Trademark Office (the "USPTO"), or become involved in opposition, derivation, revocation, reexamination, post-grant and *inter partes* review, or interference proceedings or other similar proceedings challenging our patent rights. An adverse determination in any such submission, proceeding or litigation could reduce the scope of, or invalidate or render unenforceable, our patent rights, allow third parties to commercialize our technology or products and compete directly with us, without payment to us, or result in our inability to manufacture or commercialize products without infringing third-party patent rights. Moreover, we may have to participate in interference proceedings declared by the USPTO to determine priority of invention or in post-grant challenge proceedings, such as oppositions in a foreign patent office, that challenge our priority of invention or other features of patentability with respect to our patents



and patent applications. Such challenges may result in loss of patent rights, in loss of exclusivity or in patent claims being narrowed, invalidated or held unenforceable, which could limit our ability to stop others from using or commercializing similar or identical technology and products, or limit the duration of the patent protection of our technology or products. Such proceedings also may result in substantial cost and require significant time from our scientists and management, even if the eventual outcome is favorable to us. For example, petitions for *inter partes* review of U.S. Pat. Nos. 9,642,673, 8,956,371 and 8,728,091 (the “IPR Patents”), which are three of our issued U.S. patents that relate to our current IVL Technology, were filed in December 2018 at the USPTO’s Patent Trial and Appeal Board (the “PTAB”) by Cardiovascular Systems, Inc., one of our competitors. Our preliminary responses to these petitions are due by April 2019, and the PTAB is expected to decide whether or not to institute the *inter partes* reviews by July 2019. If the PTAB decides to institute an *inter partes* review with respect to one or more of the IPR Patents, it could result in the loss or narrowing in scope of such patents, which could limit our ability to stop others from using or commercializing products and technology similar or identical to ours. Any of the foregoing could have a material adverse effect on our business, financial condition and results of operations.

In addition, if we initiate legal proceedings against a third party to enforce a patent covering our products, the defendant could counterclaim that such patent is invalid or unenforceable. In patent litigation in the United States, defendant counterclaims alleging invalidity or unenforceability are commonplace. Grounds for a validity challenge could be an alleged failure to meet any of several statutory requirements, including lack of novelty, obviousness or non-enablement. Grounds for an unenforceability assertion could be an allegation that someone connected with prosecution of the patent withheld relevant information from the USPTO or made a misleading statement during prosecution. Third parties may also raise claims challenging the validity or enforceability of our patents before administrative bodies in the United States or abroad, even outside the context of litigation, including through re-examination, post-grant review, *inter partes* review, interference proceedings, derivation proceedings and equivalent proceedings in foreign jurisdictions (e.g., opposition proceedings). Such proceedings could result in the revocation of, cancellation of or amendment to our patents in such a way that they no longer cover our products. The outcome following legal assertions of invalidity and unenforceability is unpredictable. With respect to the validity question, for example, we cannot be certain that there is no invalidating prior art, of which we and the patent examiner were unaware during prosecution. If a third party were to prevail on a legal assertion of invalidity or unenforceability, we would lose at least part, and perhaps all, of the patent protection on our products. Such a loss of patent protection would have a material adverse effect on our business, financial condition and results of operations.

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

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

Periodic maintenance fees, renewal fees, annuity fees and various other government fees on patents and applications will be due to be paid to the USPTO and various government patent agencies outside of the United States over the lifetime of our patents and applications. The USPTO and various non-U.S. government agencies require compliance with several procedural, documentary, fee payment and other similar provisions during the patent application process. In some cases, an inadvertent lapse can be cured by payment of a late fee or by other means in accordance with the applicable rules. There are situations, however, in which non-compliance can result in the abandonment or lapse of the patent or patent application, resulting in a partial or complete loss of patent rights in the relevant jurisdiction. In such an event, potential competitors might be able to enter the market with similar or identical products or technology, which could have a material adverse effect on our business, financial condition and results of operations.

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

Third parties may attempt to commercialize competitive products or services in foreign countries where we do not have any patents or patent applications and/or where legal recourse may be limited. This may have a significant commercial impact on our foreign business operations.

Filing, prosecuting and defending patents on our products in all countries throughout the world would be prohibitively expensive, and the laws of foreign countries may not protect our rights to the same extent as the laws of the United States. Consequently, we may not be able to prevent third parties from practicing our inventions in all countries outside the United States, or from selling or importing products made using our inventions in and into the United States or other jurisdictions. Competitors may use our technologies in jurisdictions where we have not obtained patent protection to develop their own products and, further, may export otherwise infringing products to territories where we have patent protection but enforcement is not as strong as that in the United States. These products may compete with our products, and our patents or other intellectual property rights may not be effective or sufficient to prevent them from competing.

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

Many countries have compulsory licensing laws under which a patent owner may be compelled to grant licenses to third parties. In addition, many countries limit the enforceability of patents against government agencies or government contractors. In these countries, the patent owner may have limited remedies, which could materially diminish the value of such patent. If we are forced to grant a license to third parties with respect to any patents relevant to our business, our competitive position may be impaired, and our business, financial condition and results of operations may be adversely affected.

***Changes in U.S. patent law could diminish the value of patents in general, thereby impairing our ability to protect our products.***

Changes in either the patent laws or interpretation of the patent laws in the United States could increase the uncertainties and costs surrounding the prosecution of patent applications and the enforcement or defense of issued patents. Assuming that other requirements for patentability are met, prior to March 2013, in the United States, the first to invent the claimed invention was entitled to the patent, while outside the United States, the first to file a patent application was entitled to the patent. After March 2013, under the Leahy-Smith America Invents Act (the "America Invents Act"), enacted in September 2011, the United States transitioned to a first inventor to file system in which, assuming that other requirements for patentability are met, the first inventor to file a patent application will be entitled to the patent on an invention regardless of whether a third party was the first to invent the claimed invention. A third party that files a patent application in the USPTO after March 2013, but before us could therefore be awarded a patent covering an invention of ours even if we had made the invention before it was made by such third party. This will require us to be cognizant of the time from invention to filing of a patent application. Since patent applications in the United States and most other countries are confidential for a period of time after filing or until issuance, we cannot be certain that we were the first to file any patent application related to our products or invent any of the inventions claimed in our patents or patent applications.

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

***Our reliance on third parties requires us to share our trade secrets, which increases the possibility that a competitor will discover them or that our trade secrets will be misappropriated or disclosed. If we are unable to protect the confidentiality of our trade secrets, our business and competitive position would be harmed.***

In addition to seeking patent protection for our products, we also rely upon unpatented trade secrets, know-how and continuing technological innovation to develop and maintain a competitive position. We seek to protect such proprietary information, in part, through confidentiality agreements with our employees, collaborators, contractors, advisors, consultants and other third parties and invention assignment agreements with our employees. We also have agreements with some of our consultants that require them to assign to us any inventions created as a result of their working with us. The confidentiality agreements are designed to protect our proprietary information and, in the case of agreements or clauses containing invention assignment, to grant us ownership of technologies that are developed through a relationship with employees or third parties.

We cannot guarantee that we have entered into such agreements with each party that has or may have had access to our trade secrets or proprietary information. Additionally, despite these efforts, any of these parties may breach the agreements and disclose our proprietary information, including our trade secrets, and we may not be able to obtain adequate remedies for such breaches. Enforcing a claim that a party illegally disclosed or misappropriated a trade secret is difficult, expensive and time-consuming, and the outcome is unpredictable. In addition, some courts inside and outside the United States are less willing or unwilling to protect trade secrets. If any of our trade secrets were to be lawfully obtained or independently developed by a competitor or other third party, we would have no right to prevent them from using that technology or information to compete with us. If any of our trade secrets were to be disclosed to, or independently developed by, a competitor or other third party, our competitive position would be materially and adversely harmed. Furthermore, we expect these trade secrets, know-how and proprietary information to over time be disseminated within the industry through independent development, the publication of journal articles describing the methodology and the movement of personnel from academic to industry scientific positions.

We also seek to preserve the integrity and confidentiality of our data and trade secrets by maintaining physical security of our premises and physical and electronic security of our information technology systems. While we have confidence in these individuals, organizations and systems, agreements or security measures may be breached, and we may not have adequate remedies for any breach. In addition, our trade secrets may otherwise become known, or be independently discovered by, competitors. To the extent that our employees, consultants, contractors or collaborators use intellectual property owned by others in their work for us, disputes may arise as to the rights in related or resulting know-how and inventions, which could have a material adverse effect on our business, financial condition and results of operations.

***We may be subject to claims challenging the ownership or inventorship of our patents and other intellectual property and, if unsuccessful in any of these proceedings, we may be required to obtain licenses from third parties, which may not be available on commercially reasonable terms, or at all, or to cease the development, manufacture and commercialization of one or more of our products.***

We may be subject to claims that current or former employees, collaborators or other third parties have an interest in our patents, trade secrets or other intellectual property as an inventor or co-inventor. For example, we may have inventorship disputes arise from conflicting obligations of employees, consultants or others who are involved in developing our products. Litigation may be necessary to defend against these and other claims challenging inventorship of our patents, trade secrets or other intellectual property. If we fail in defending any such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights, such as exclusive ownership of, or right to use, intellectual property that is important to our products. If we were to lose exclusive ownership of such intellectual property, other owners may be able to license their rights to other third parties, including our competitors. We also may be required to obtain and maintain licenses from third parties, including parties involved in any such disputes. Such licenses may not be available on commercially reasonable terms, or at all, or may be non-exclusive. If we are unable to obtain and maintain such licenses, we may need to cease the development, manufacture and commercialization of one or more of our products. The loss of exclusivity or the narrowing of our patent claims could limit our ability to stop others from using or commercializing similar or identical technology and products. Even if we are successful in defending against such claims, litigation could result in substantial costs and be a distraction to management and other employees. Any of the foregoing could have a material adverse effect on our business, financial condition and results of operations.

***Third-party claims of intellectual property infringement, misappropriation or other violation against us or our collaborators may prevent or delay the sale and marketing of our products.***

The medical device industry is highly competitive and dynamic. Due to the focused research and development that is taking place by several companies, including us and our competitors, in this field, the intellectual property landscape is in flux, and it may remain uncertain in the future. As such, we could become subject to significant intellectual property-related litigation and proceedings relating to our or third-party intellectual property and proprietary rights.

Our commercial success depends in part on our and any potential future collaborators' ability to develop, manufacture, market and sell any products that we may develop and use our proprietary technologies without infringing, misappropriating and otherwise violating the patents and other intellectual property rights of third parties. It is uncertain whether the issuance of any third-party patent would require us or any potential collaborators to alter our development or commercial strategies, obtain licenses or cease certain activities. The medical device industry is characterized by extensive litigation regarding patents and other intellectual property rights, as well as administrative proceedings for challenging patents, including interference, *inter partes* or post-grant review, derivation and reexamination proceedings before the USPTO or oppositions and other comparable proceedings in foreign jurisdictions.

Third parties, including our competitors, may currently have patents or obtain patents in the future and claim that the manufacture, use or sale of our products infringes upon these patents. We have not conducted an extensive search of patents issued or assigned to other parties, including our competitors, and no assurance can be given that patents containing claims covering our products, parts of our products, technology or methods do not exist, have not been filed or could not be filed or issued. In addition, because patent applications can take many years to issue and because publication schedules for pending applications vary by jurisdiction, there may be applications now pending of which we are unaware and which may result in issued patents which our current or future products infringe. Also, because the claims of published patent applications can change between publication and patent grant, there may be published patent applications that may ultimately issue with claims that we infringe. As the number of competitors in our market grows and the number of patents issued in this area

increases, the possibility of patent infringement claims against us escalates. Moreover, we may face claims from non-practicing entities (“NPEs”), which have no relevant product revenue and against whom our own patent portfolio may have no deterrent effect. Third parties, including NPEs, have claimed, and may in the future claim, that our products infringe or violate their patents or other intellectual property rights.

In the event that any third party claims that we infringe their patents or that we are otherwise employing their proprietary technology without authorization and initiates litigation against us, even if we believe such claims are without merit, there is no assurance that a court would find in our favor on questions of infringement, validity, enforceability or priority. A court of competent jurisdiction could hold that these third-party patents are valid, enforceable and infringed by our products. In order to successfully challenge the validity of any such U.S. patent in federal court, we would need to overcome a presumption of validity. As this burden is a high one requiring us to present clear and convincing evidence as to the invalidity of any such U.S. patent claim, there is no assurance that a court of competent jurisdiction would invalidate the claims of any such U.S. patent. If we are found to infringe third-party patents, and we are unsuccessful in demonstrating that such patents are invalid or unenforceable, such third parties may be able to block our ability to commercialize the applicable products or technology unless we obtain a license under the applicable patents, or until such patents expire or are finally determined to be held invalid or unenforceable. Such a license may not be available on commercially reasonable terms, or at all. Even if we are able to obtain a license, the license would likely obligate us to pay significant license fees and/or royalties, and the rights granted to us might be non-exclusive, which could result in our competitors gaining access to the same technology. If we are unable to obtain a necessary license to a third-party patent on commercially reasonable terms, or at all, we may be unable to commercialize our products, or such commercialization efforts may be significantly delayed, which could in turn significantly harm our business.

Defense of infringement claims, regardless of their merit or outcome, would involve substantial litigation expense and would be a substantial diversion of management and other employee resources from our business, and may impact our reputation. In the event of a successful claim of infringement against us, we may be enjoined from further developing or commercializing the infringing products and/or have to pay substantial damages for use of the asserted intellectual property, including treble damages and attorneys’ fees were we found to willfully infringe such intellectual property. We also might have to redesign our infringing products or technologies, which may be impossible or require substantial time and monetary expenditure.

Engaging in litigation to defend against third-party infringement claims is very expensive, particularly for a company of our size, and time-consuming. In addition, there could be public announcements of the results of hearings, motions or other interim proceedings or developments, and if securities analysts or investors perceive these results to be negative, it could have a substantial adverse effect on our common stock price. Such litigation or proceedings could substantially increase our operating losses and reduce the resources available for development activities or any future sales, marketing or distribution activities. We may not have sufficient financial or other resources to conduct such litigation or proceedings adequately. Some of our competitors may be able to sustain the costs of litigation or administrative proceedings more effectively than we can because of greater financial resources and more mature and developed intellectual property portfolios. Uncertainties resulting from the initiation and continuation of patent litigation or other proceedings against us could impair our ability to compete in the marketplace. The occurrence of any of the foregoing could have a material adverse effect on our business, financial condition or results of operations.

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

Competitors may infringe our patents, or we may be required to defend against claims of infringement. In addition, our patents also may become involved in inventorship, priority or validity disputes. To counter or defend against such claims can be expensive and time-consuming. In an infringement proceeding, a court may decide that a patent owned by us is invalid or unenforceable, or may refuse to stop the other party from using the technology at issue on the grounds that our patents do not cover such technology. An adverse result in any

litigation proceeding could put one or more of our patents at risk of being invalidated or interpreted narrowly. Furthermore, because of the substantial amount of discovery required in connection with intellectual property litigation, there is a risk that some of our confidential information could be compromised by disclosure during litigation.

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

***We may not be successful in obtaining necessary rights to any products we may develop through acquisitions and in-licenses.***

Many medical device companies and academic institutions are competing with us and filing patent applications potentially relevant to our business. We may find it necessary or prudent to obtain licenses from such third-party intellectual property holders. In addition, with respect to any patents we may in the future co-own with third parties, we may require licenses to such co-owners' interest to such patents. However, we may be unable to secure such licenses or otherwise acquire or in-license any intellectual property rights from third parties that we identify as necessary for planned or future products. The licensing or acquisition of third-party intellectual property rights is a competitive area, and more established companies may pursue strategies to license or acquire third-party intellectual property rights that we may consider attractive or necessary. These established companies may have a competitive advantage over us due to their size, capital resources and greater clinical development and commercialization capabilities. In addition, companies that perceive us to be a competitor may be unwilling to assign or license rights to us. We also may be unable to license or acquire third-party intellectual property rights on terms that would allow us to make an appropriate return on our investment or at all. If we are unable to successfully obtain rights to required third-party intellectual property rights or maintain the existing intellectual property rights we have, we may have to abandon development of the relevant products, which could have a material adverse effect on our business, financial condition and results of operations.

***We may be subject to claims that our employees, consultants or advisors have wrongfully used or disclosed alleged trade secrets of their current or former employers or claims asserting ownership of what we regard as our own intellectual property.***

Our employees, consultants and scientific advisors may be currently or previously employed or engaged at universities or other medical device or healthcare companies, including our competitors and potential competitors. Although we try to ensure that our employees, consultants and advisors do not use the proprietary information or know-how of others in their work for us, we may in the future become subject to claims that we or these individuals have, inadvertently or otherwise, used or disclosed intellectual property, including trade secrets or other proprietary information, of their current or former employer. Litigation may be necessary to defend against these claims. If we fail in defending any such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights or personnel, which could have a material adverse effect on our business, financial condition and results of operations. Even if we are successful in defending against such claims, litigation could result in substantial costs and be a distraction to management.

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

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

Our trademarks or trade names may be challenged, infringed, circumvented, declared generic or determined to be violating or infringing on other marks. We may not be able to protect our rights to these trademarks and trade names, which we need to build name recognition among potential partners and customers in our markets of interest. At times, competitors or other third parties may adopt trade names or trademarks similar to ours, thereby impeding our ability to build brand identity and possibly leading to market confusion. In addition, there could be potential trade name or trademark infringement or dilution claims brought by owners of other trademarks. Over the long term, if we are unable to establish name recognition based on our trademarks and trade names, then we may not be able to compete effectively and our business may be adversely affected. Our efforts to enforce or protect our proprietary rights related to trademarks, trade secrets, domain names or other intellectual property may be ineffective, could result in substantial costs and diversion of resources and could adversely affect our business, financial condition and results of operations.

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

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

***Intellectual property rights do not necessarily address all potential threats.***

The degree of future protection afforded by our intellectual property rights is uncertain because intellectual property rights have limitations and may not adequately protect our business or permit us to maintain our competitive advantage. For example:

- others may be able to make products that are similar to our products or utilize similar technology but that are not covered by the claims of our patents or that incorporate certain technology in our products that is in the public domain;
- we, or our future licensors or collaborators, might not have been the first to make the inventions covered by the applicable issued patent or pending patent application that we own now or may own or license in the future;
- we, or our future licensors or collaborators, might not have been the first to file patent applications covering certain of our or their inventions;
- others may independently develop similar or alternative technologies or duplicate any of our technologies without infringing our intellectual property rights;
- it is possible that our current or future pending patent applications will not lead to issued patents;
- issued patents that we hold rights to may be held invalid or unenforceable, including as a result of legal challenges by our competitors or other third parties;
- our competitors or other third parties might conduct research and development activities in countries where we do not have patent rights and then use the information learned from such activities to develop competitive products for sale in our major commercial markets;
- we may not develop additional proprietary technologies that are patentable;
- the patents of others may harm our business; and
- we may choose not to file a patent in order to maintain certain trade secrets or know-how, and a third party may subsequently file a patent covering such intellectual property.

Any of the foregoing could have a material adverse effect on our business, financial condition and results of operations.

**Risks Related to Our Reliance on Third Parties**

***From time to time, we engage outside parties to perform services related to certain of our clinical studies and trials. If these third parties do not successfully carry out their contractual duties or meet expected deadlines, we may not be able to obtain regulatory approval for or commercialize our products.***

From time to time, we engage consultants to help design, monitor and analyze the results of certain of our clinical studies and trials. The consultants we engage interact with clinical investigators to enroll patients in our clinical trials. We depend on these consultants and clinical investigators to conduct clinical studies and trials and monitor and analyze data from these studies and trials under the investigational plan and protocol for the study or trial and in compliance with applicable regulations and standards, such as GCP guidelines, the Common Rule, and FDA human subject protection regulations. We may face delays in our regulatory approval process if these parties do not perform their obligations in a timely, compliant or competent manner. If these third parties do not successfully carry out their duties or meet expected deadlines, or if the quality, completeness or accuracy of the data they obtain is compromised due to the failure to adhere to our clinical trial protocols or for other reasons, our clinical studies or trials may be extended, delayed or terminated or may otherwise prove to be unsuccessful, and we may have to conduct additional studies, which would significantly increase our costs, in order to obtain the regulatory clearances or approvals that we need to commercialize our products



***We may need to depend on third parties to manufacture our products. If these manufacturers fail to meet our requirements and strict regulatory standards, we may be unable to develop, commercialize or market our products.***

We may in the future need to depend upon third parties to manufacture our products. Reliance on a third-party manufacturer entails risks to which we would not be subject if we manufactured products ourselves, including:

- reliance on the third party for regulatory compliance and quality assurance;
- the possible breach of the manufacturing agreement by the third party because of factors beyond our control; and
- the possibility of termination or nonrenewal of the agreement by the third party because of our breach of the manufacturing agreement or based on its own business priorities.

Any of these factors could cause delay or suspension of clinical trials, regulatory submissions, required approvals, commercialization or marketing of our products or cause us to incur higher costs. Furthermore, if our contract manufacturers fail to deliver the required commercial quantities of finished products on a timely basis and at commercially reasonable prices and we are unable to find one or more replacement manufacturers capable of production at a substantially equivalent cost, in substantially equivalent volumes and quality, and on a timely basis, we would likely be unable to meet demand for our products and we would lose potential revenue. Any difficulties in locating and hiring third-party manufacturers, or in the ability of third-party manufacturers to supply quantities of our products at the times and in the quantities we need, could have a material adverse effect on our business. It may take a significant amount of time to establish an alternative source of supply for our products and to have any such new source approved by the FDA.

***We depend upon third-party suppliers, including single source suppliers, making us vulnerable to supply problems and price fluctuations.***

We rely on third-party suppliers to provide us with certain components of our products. We rely on single source suppliers for certain components of our products. In some cases, we do not have long-term supply agreements with, or guaranteed commitments from, our suppliers, including single source suppliers. We depend on our suppliers to provide us and our customers with materials in a timely manner that meet our and their quality, quantity and cost requirements. These suppliers may encounter problems during manufacturing for a variety of reasons, any of which could delay or impede their ability to meet our demand. These suppliers may cease producing the components we purchase from them or otherwise decide to cease doing business with us.

Any supply interruption from our suppliers or failure to obtain additional suppliers for any of the components used in our products would limit our ability to manufacture our products and could have a material adverse effect on our business, financial condition and results of operations.

***We and our component suppliers may not meet regulatory quality standards applicable to our manufacturing processes, which could have an adverse effect on our business, financial condition and results of operations.***

As a medical device manufacturer, we must register with the FDA and non-U.S. regulatory agencies, and we are subject to periodic inspection by the FDA and foreign regulatory agencies, for compliance with certain good manufacturing practices, including design controls, product validation and verification, in process testing, quality control and documentation procedures. Compliance with applicable regulatory requirements is subject to continual review and is rigorously monitored through periodic inspections by the FDA and foreign regulatory agencies. Our component suppliers are also required to meet certain standards applicable to their manufacturing processes.

We cannot assure you that we or our component suppliers comply or can continue to comply with all regulatory requirements. The failure by us or one of our component suppliers to achieve or maintain compliance

with these requirements or quality standards may disrupt our ability to supply products sufficient to meet demand until compliance is achieved or, with a component supplier, until a new supplier has been identified and evaluated. Our, or any of our component supplier's, failure to comply with applicable regulations could cause sanctions to be imposed on us, including warning letters, fines, injunctions, civil penalties, failure of regulatory authorities to grant marketing approval of our products, delays, suspension or withdrawal of approvals or clearances, license revocation, seizures or recalls of products, operating restrictions and criminal prosecutions, which could harm our business. We cannot assure you that if we need to engage new suppliers to satisfy our business requirements, we can locate new suppliers in compliance with regulatory requirements at a reasonable cost and in an acceptable timeframe. Our failure to do so could have a material adverse effect on our business, financial condition and results of operations.

In the EU, we must maintain certain International Organization for Standardization ("ISO") certifications to sell our products and must undergo periodic inspections by notified bodies, including the BSI, to obtain and maintain these certifications. If we fail these inspections or fail to meet these regulatory standards, it could have a material adverse effect on our business, financial condition and results of operations.

***We may seek strategic alliances or enter into licensing arrangements in the future and may not be successful in doing so, and even if we are, we may not realize the benefits or costs of such relationships.***

We may form or seek strategic alliances, create joint ventures or collaborations or enter into additional licensing arrangements with third parties that we believe will complement or augment our sales and marketing efforts with respect to our products and any planned or future products that we may develop. For example, in December 2018, we entered into a collaboration with Abiomed Inc., pursuant to which we will work with Abiomed to integrate our products into Abiomed's physician training and education programs. We may not be successful in our efforts to establish such collaborations for our products. Any of these relationships may require us to incur non-recurring and other charges, increase our near and long-term expenditures, issue securities that dilute our existing stockholders or disrupt our management and business. In addition, we face significant competition in seeking appropriate strategic partners and the negotiation process is time-consuming and complex. Moreover, we may not be successful in our efforts to establish a strategic partnership or other alternative arrangements for our products. If we license products or businesses, we may not be able to realize the benefit of such transactions if we are unable to successfully integrate them with our existing operations and company culture. We cannot be certain that, following a strategic transaction or license, we will achieve the revenue or specific net income that justifies such transaction. Any delays in entering into new strategic partnership agreements related to our products could delay the commercialization of our products in certain geographies for certain indications, which would harm our business prospects, financial condition and results of operations.

In addition, any potential future collaborations may be terminable by our strategic partners, and we may not be able to adequately protect our rights under these agreements. Furthermore, strategic partners may negotiate for certain rights to control decisions regarding the development and commercialization of our products, if approved, and may not conduct those activities in the same manner as we do. Any termination of collaborations we enter into in the future, or any delay in entering into collaborations related to our products, could delay the development and commercialization of our products and reduce their competitiveness if they reach the market, which could have a material adverse effect on our business, financial condition and results of operations.

#### **Risks Related to This Offering and Ownership of Our Common Stock**

***An active, liquid and orderly market for our common stock may not develop, and you may not be able to resell your common stock at or above the public offering price. The market price of our common stock may be highly volatile, and you may not be able to resell your shares at or above the initial public offering price.***

Prior to this offering, there has not been a public market for our common stock. We cannot assure you that an active trading market for our common stock will develop following this offering. You may not be able to sell

your shares quickly or at the market price if trading in our common stock is not active. The initial public offering price for the shares will be determined by negotiations between us and representatives of the underwriters and may not be indicative of prices that will prevail in the trading market.

The trading price of our common stock is likely to be highly volatile and could be subject to wide fluctuations in price in response to various factors, many of which are beyond our control, including:

- our failure to increase the sales of our products;
- the failure by our customers to obtain coverage and adequate reimbursements or reimbursement levels that would be sufficient to support product sales to our customers;
- unanticipated serious safety concerns related to the use of our products;
- introduction of new products or services offered by us or our competitors;
- announcements of significant acquisitions, strategic partnerships, joint ventures or capital commitments by us or our competitors;
- announcements of technological or medical innovations for the treatment of vascular disease;
- our ability to effectively manage our growth;
- the size and growth of our target markets;
- actual or anticipated quarterly variations in our or our competitors' results of operations;
- failure to meet estimates or recommendations by securities analysts who cover our stock;
- failure to meet our own financial estimates;
- accusations that we have violated a law or regulation;
- recalls of our products;
- disputes or other developments relating to proprietary rights, including patents, litigation matters and our ability to obtain, maintain, protect and enforce patent protection and other intellectual property rights for our technologies and products;
- significant litigation, including stockholder litigation or litigation related to intellectual property;
- our cash position;
- any delay in any regulatory filings for our planned or future products and any adverse development or perceived adverse development with respect to the applicable regulatory authority's review of such products;
- adverse regulatory decisions, including failure to receive regulatory approval or clearance of our planned and future products or maintain regulatory approval or clearance for our existing products;
- changes in laws or regulations applicable to our products;
- adverse developments concerning our suppliers or distributors;
- our inability to obtain adequate supplies and components for our products or inability to do so at acceptable prices;
- our inability to establish and maintain collaborations if needed;
- changes in the market valuations of similar companies;
- overall performance of the equity markets;
- sales of large blocks of our common stock, including sales by our executive officers, directors and significant stockholders;

- trading volume of our common stock;
- additions or departures of key scientific or management personnel;
- changes in accounting principles;
- ineffectiveness of our internal controls;
- actual or anticipated changes in healthcare policy and reimbursement levels;
- general market conditions and other factors, including factors unrelated to our operating performance or the operating performance of our competitors; and
- other events or factors, many of which are beyond our control.

In addition, the stock market in general and the market for medical device companies in particular have experienced extreme price and volume fluctuations that have often been unrelated or disproportionate to the operating performance of those companies. These broad market and industry factors may seriously harm the market price of our common stock, regardless of our operating performance. In the past, following periods of volatility in the market, securities class action litigation has often been instituted against companies. Such litigation, if instituted against us, could result in substantial costs and diversion of management's attention and resources, which could materially adversely affect our business, financial condition and results of operations.

***We do not intend to pay dividends on our common stock, so any returns will be limited to increases, if any, in our stock's value. Your ability to achieve a return on your investment will depend on appreciation, if any, in the price of our common stock.***

We currently anticipate that we will retain future earnings for the development, operation and expansion of our business and do not anticipate declaring or paying any cash dividends for the foreseeable future. Any future determination to declare dividends will be made at the discretion of our board of directors and will depend on, among other factors, our financial condition, operating results, capital requirements, general business conditions and other factors that our board of directors may deem relevant. Any return to stockholders will therefore be limited to the appreciation in the value of their stock, if any.

***Our ability to utilize our net operating loss carryforwards and certain other tax attributes may be limited.***

As of December 31, 2018, we had net operating loss ("NOL") carryforwards of approximately \$119.5 million for federal income tax purposes, and \$56.7 million for state income tax purposes. These federal (generated prior to 2018) and state NOL carryforwards begin expiring in 2029. Utilization of these NOLs depends on many factors, including our future income, which cannot be assured. Some of these NOLs could expire unused and be unavailable to offset our future income tax liabilities. In addition, under Section 382 of the Internal Revenue Code of 1986, as amended (the "Code"), and corresponding provisions of state law, if a corporation undergoes an "ownership change," which is generally defined as a greater than 50% change, by value, in its equity ownership by 5% stockholders over a three-year period, the corporation's ability to use its pre-change NOLs and other pre-change tax attributes to offset its post-change income may be limited. We have not determined if we have experienced Section 382 ownership changes in the past and if a portion of our NOLs is subject to an annual limitation under Section 382. In addition, we may experience ownership changes in the future as a result of subsequent changes in our stock ownership, including this offering, some of which may be outside of our control. If we determine that an ownership change has occurred and our ability to use our historical NOLs is materially limited, it could harm our future operating results by effectively increasing our future tax obligations. In addition, under the TCJA, federal NOLs incurred in 2018 and in future years may be carried forward indefinitely but generally may not be carried back and the deductibility of such NOLs is limited to 80% of taxable income.

***Changes in tax laws or regulations that are applied adversely to us or our customers may have a material adverse effect on our business, cash flow, financial condition or results of operations.***

The TCJA enacted many significant changes to the U.S. tax laws, the consequences of which have not yet been fully determined. Changes in corporate tax rates, the realization of net deferred tax assets relating to our U.S. operations, the taxation of foreign earnings and the deductibility of expenses contained in the TCJA or other tax reform legislation could have a material impact on the value of our deferred tax assets, could result in significant one-time charges in the current or future taxable years and could increase our future U.S. tax expense. The foregoing items, as well as any future changes in tax laws, could have a material adverse effect on our business, cash flow, financial condition or results of operations. In addition, it is uncertain if and to what extent various states will conform to the newly enacted federal tax legislation.

***After this offering, our principal stockholders and management will own a significant percentage of our stock and will be able to exercise significant influence over matters subject to stockholder approval.***

As of December 31, 2018, our executive officers, directors and 5% stockholders beneficially owned approximately 67% of the outstanding shares of capital stock, and, upon the closing of this offering, that same group will hold approximately 54% of our outstanding shares of common stock (assuming no exercise of the underwriters' over-allotment option). In addition, as of December 31, 2018, our officers and directors held options to purchase an aggregate of 1,863,190 shares of our common stock at a weighted-average exercise price of \$3.35 per share; and (ii) 41,115 warrants to purchase shares of our common stock, which would give our officers and directors ownership of approximately 28% of our outstanding common stock following this offering if such awards are fully vested and are exercised in full (assuming no exercise of the underwriters' over-allotment option). Therefore, even after this offering, these stockholders will have the ability to influence us through this ownership position.

***A significant portion of our outstanding shares of common stock is restricted from immediate resale but may be sold into the market in the near future. This could cause the market price of our common stock to drop significantly, even if our business is doing well.***

Sales of a substantial number of shares of our common stock in the public market could occur at any time, subject to the 180-day lock-up periods under the lock-up agreements and market standoff provisions described in the sections of this prospectus titled "Shares Eligible for Future Sale" and "Underwriting." These sales, or the perception in the market that the holders of a large number of shares of common stock intend to sell shares, could reduce the market price of our common stock. As of December 31, 2018, our directors, executive officers and holders of 5% or more of our outstanding stock beneficially owned approximately 67% of our outstanding stock in the aggregate. If one or more of them were to sell a substantial portion of the shares they hold, it could cause our stock price to decline. Furthermore, the lock-up agreements mentioned above may be waived by the underwriters at any time which could lead to these shares being sold in the market prior to the expiration of this 180-day lock-up period.

In addition, as of December 31, 2018, there were 3,636,224 shares of our common stock subject to outstanding options that will become eligible for sale in the public market upon exercise of such options to the extent permitted by any applicable vesting requirements, the lock-up agreements, market standoff provisions and Rules 144 and 701 under the Securities Act of 1933, as amended (the "Securities Act"). Moreover, after this offering, holders of an aggregate of 18,670,259 shares of our common stock will have rights, subject to some conditions, to require us to file registration statements covering their shares or to include their shares in registration statements that we may file for ourselves or other stockholders.

We also intend to register all 2,301,080 shares of our common stock that will be initially reserved for issuance under our 2019 Equity Incentive Plan and our ESPP. Once we register these shares, they can be freely sold in the public market upon issuance and once vested and exercised, as applicable, subject to the 180-day lock-up periods under the lock-up agreements described in the section of this prospectus titled "Underwriting."

Sales of our common stock as restrictions end or pursuant to registration rights may make it more difficult for us to sell equity securities in the future at a time and at a price that we deem appropriate. These sales also could cause the price of our common stock to fall and make it more difficult for you to sell shares of our common stock.

***We are an emerging growth company, and we cannot be certain if the reduced reporting requirements applicable to emerging growth companies will make our common stock less attractive to investors.***

We are an emerging growth company, as defined in the Jumpstart Our Business Startups Act of 2012 (the “JOBS Act”). For as long as we continue to be an emerging growth company, we may take advantage of exemptions from various reporting requirements that are applicable to other public companies that are not emerging growth companies, including not being required to comply with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act, reduced disclosure obligations regarding executive compensation in this prospectus and our periodic reports and proxy statements and exemptions from the requirements of holding nonbinding advisory votes on executive compensation and stockholder approval of any golden parachute payments not previously approved. We could be an emerging growth company for up to five years following the year in which we complete this offering, although circumstances could cause us to lose that status earlier. We will remain an emerging growth company until the earlier of (i) the last day of the fiscal year (a) following the fifth anniversary of the completion of this offering, (b) in which we have total annual gross revenue of at least \$1.07 billion or (c) in which we are deemed to be a large accelerated filer, which requires the market value of our common stock that is held by non-affiliates to exceed \$700.0 million as of the prior June 30th, and (ii) the date on which we have issued more than \$1.0 billion in non-convertible debt during the prior three-year period.

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

As a public company, we will incur significant legal, accounting and other expenses that we did not incur as a private company. We will be subject to the reporting requirements of the Securities Exchange Act of 1934, as amended (the “Exchange Act”), which will require, among other things, that we file with the SEC, annual, quarterly and current reports with respect to our business and financial condition. In addition, the Sarbanes-Oxley Act of 2002, as amended (the “Sarbanes-Oxley Act”), as well as rules subsequently adopted by the SEC and the Nasdaq Global Market to implement provisions of the Sarbanes-Oxley Act, impose significant requirements on public companies, including requiring that we evaluate and determine the effectiveness of our internal control over financial reporting, beginning with our annual report for the year ending December 31, 2020, which must be attested to by our independent registered public accounting firm to the extent we are no longer an “emerging growth company,” as defined by the JOBS Act, or a smaller reporting company under the Securities Act. Further, in July 2010, the Dodd-Frank Wall Street Reform and Consumer Protection Act (the “Dodd-Frank Act”), was enacted. There are significant corporate governance and executive compensation related provisions in the Dodd-Frank Act that require the SEC to adopt additional rules and regulations in these areas such as “say on pay” and proxy access. Emerging growth companies are permitted to implement many of these requirements over a longer period and up to five years from the pricing of this offering. We intend to take advantage of this legislation but cannot guarantee that we will not be required to implement these requirements sooner than anticipated or planned and thereby incur unexpected expenses. Stockholder activism, the current political environment and the current high level of government intervention and regulatory reform may lead to substantial new regulations and disclosure obligations, which may lead to additional compliance costs and impact the manner in which we operate our business in ways we cannot currently anticipate.

We expect the rules and regulations applicable to public companies to substantially increase our legal and financial compliance costs and to make some activities more time-consuming and costly. If these requirements divert the attention of our management and personnel from other business concerns, they could have a material adverse effect on our business, financial condition and results of operations. The increased costs will decrease our net income or increase our net loss, and may require us to reduce costs in other areas of our business or

increase the prices of our products or services. For example, we expect these rules and regulations to make it more difficult and more expensive for us to obtain director and officer liability insurance, and we may be required to incur substantial costs to maintain the same or similar coverage. We cannot predict or estimate the amount or timing of additional costs we may incur to respond to these requirements. The impact of these requirements could also make it more difficult for us to attract and retain qualified persons to serve on our board of directors, our board committees or as executive officers.

If we have material weaknesses in our internal control over financial reporting, we may not detect errors on a timely basis and our financial statements may be materially misstated. We are in the process of designing and implementing our internal control over financial reporting in which the process will be time-consuming, costly and complicated. Until such time as we are no longer an “emerging growth company,” our auditors will not be required to attest as to our internal control over financial reporting. If we identify material weaknesses in our internal control over financial reporting, if we are unable to comply with the requirements of Section 404 of the Sarbanes-Oxley Act in a timely manner, if we are unable to assert that our internal control over financial reporting is effective or, once required, if our independent registered public accounting firm is unable to attest that our internal control over financial reporting is effective, investors may lose confidence in the accuracy and completeness of our financial reports and the market price of our common stock could decrease. We could also become subject to stockholder or other third-party litigation, as well as investigations by the stock exchange on which our securities are listed, the SEC or other regulatory authorities, which could require additional financial and management resources and could result in fines, trading suspensions or other remedies.

***If you purchase our common stock in this offering, you will incur immediate and substantial dilution in the book value of your shares. You will likely experience further dilution if we issue shares in future financing transactions or upon exercise of options or warrants.***

The initial public offering price is substantially higher than the net tangible book value per share of our common stock. Investors purchasing common stock in this offering will pay a price per share that substantially exceeds the book value of our tangible assets after subtracting our liabilities. As a result, investors purchasing common stock in this offering will incur immediate dilution of \$11.21 per share, based on an assumed initial public offering price of \$15.00 per share (which is the midpoint of the estimated price range set forth on the cover page of this prospectus). Further, investors purchasing common stock in this offering will contribute approximately 32.8% of the total amount invested by stockholders since our inception, but will own only approximately 19.5% of the shares of common stock outstanding after giving effect to this offering.

This dilution is due to our investors who purchased shares prior to this offering having paid substantially less when they purchased their shares than the price offered to the public in this offering. To the extent outstanding options or warrants are exercised, there will be further dilution to new investors. As a result of the dilution to investors purchasing shares in this offering, investors may receive significantly less than the purchase price paid in this offering, if anything, in the event of our liquidation. For a further description of the dilution that you will experience immediately after this offering, see section titled “Dilution.”

If we raise additional funds by issuing additional common stock, or securities convertible into or exchangeable or exercisable for common stock, our stockholders will experience additional dilution, and new investors could have rights superior to existing stockholders.

Pursuant to our 2019 Equity Incentive Plan, our management is authorized to grant stock options to our employees, directors and consultants. In addition, we also have warrants outstanding to purchase shares of our common stock. You will incur dilution upon exercise of any outstanding stock options or warrants.

***We have broad discretion to use the net proceeds from this offering and our investment of these proceeds may not yield a favorable return.***

Our management will have broad discretion in the application of the net proceeds from this offering, including for any of the purposes described in the section titled “Use of Proceeds,” and you will not have the

opportunity as part of your investment decision to assess whether the net proceeds are being used appropriately. Because of the number and variability of factors that will determine our use of the net proceeds from this offering, their ultimate use may vary substantially from their currently intended use. Our management might not apply our net proceeds in ways that ultimately increase the value of your investment. We expect to use the net proceeds from this offering to expand our direct sales force and marketing of our products, to support clinical studies for new products and product enhancements, including expanded indications, and to support other research and development activities, working capital and general corporate purposes. We may also use a portion of the net proceeds of this offering for acquisitions or strategic transactions. We have not entered into any agreements or commitments with respect to any specific transactions and have no understandings or agreements with respect to any such transactions at this time. The failure by our management to apply these funds effectively could harm our business. Pending their use, we may invest the net proceeds from this offering in short-term, investment-grade or interest-bearing securities. These investments may not yield a favorable return to our stockholders. If we do not invest or apply the net proceeds from this offering in ways that enhance stockholder value, we may fail to achieve expected financial results, which could cause our stock price to decline.

***We are at risk of securities class action litigation.***

In the past, securities class action litigation has often been brought against a company following a decline in the market price of its securities. This risk is especially relevant for us because medical device companies have experienced significant stock price volatility in recent years. If we face such litigation, it could result in substantial costs and a diversion of management's attention and resources, which could harm our business.

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

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

***Our amended and restated certificate of incorporation, our amended and restated bylaws and Delaware law contain provisions that could discourage another company from acquiring us and may prevent attempts by our stockholders to replace or remove our current management.***

Provisions of Delaware law (where we are incorporated), our amended and restated certificate of incorporation and amended and restated bylaws may discourage, delay or prevent a merger or acquisition that stockholders may consider favorable, including transactions in which you might otherwise receive a premium for your shares. In addition, 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 or remove our board of directors. These provisions include:

- authorizing the issuance of "blank check" preferred stock without any need for action by stockholders;
- requiring supermajority stockholder voting to effect certain amendments to our amended and restated certificate of incorporation and amended and restated bylaws;
- eliminating the ability of stockholders to call and bring business before special meetings of stockholders;
- prohibiting stockholder action by written consent;



- establishing advance notice requirements for nominations for election to the board of directors or for proposing matters that can be acted on by stockholders at stockholder meetings;
- dividing our board of directors into three classes so that only one third of our directors will be up for election in any given year; and
- providing that our directors may be removed by our stockholders only for cause.

In addition, we are subject to Section 203 of the Delaware General Corporation Law, which may have an anti-takeover effect with respect to transactions not approved in advance by our board of directors, including discouraging takeover attempts that could have resulted in a premium over the market price for shares of our common stock.

These provisions apply even if a takeover offer may be considered beneficial by some stockholders and could delay or prevent an acquisition that our board of directors determines is not in our and our stockholders' best interests and could also affect the price that some investors are willing to pay for our common stock. See the section titled "Description of Capital Stock."

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

Our amended and restated certificate of incorporation provides that the Court of Chancery of the State of Delaware is the exclusive forum for: any derivative action or proceeding brought on our behalf; any action asserting a breach of fiduciary duty; any action asserting a claim against us arising pursuant to the Delaware General Corporation Law, our amended and restated certificate of incorporation or our amended and restated bylaws; or any action asserting a claim against us that is governed by the internal affairs doctrine. The choice of forum provision may limit a stockholder's ability to bring a claim in a judicial forum that it finds favorable for disputes with us or our directors, officers or other employees, which may discourage such lawsuits against us and our directors, officers and other employees. If a court were to find the choice of forum provision contained in our amended and restated certificate of incorporation to be inapplicable or unenforceable in an action, we may incur additional costs associated with resolving such action in other jurisdictions, which could harm our business and financial condition. This exclusive forum provision will not apply to suits brought to enforce a duty or liability created by the Exchange Act or any other claim for which the federal courts have exclusive jurisdiction.

## SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS

We have made statements under the captions “Prospectus Summary,” “Risk Factors,” “Management’s Discussion and Analysis of Financial Condition and Results of Operations,” “Business” and in other sections of this prospectus that are forward-looking statements. In some cases, you can identify these statements by forward-looking words such as “may,” “might,” “will,” “should,” “expects,” “plans,” “anticipates,” “believes,” “estimates,” “predicts,” “potential” or “continue,” the negative of these terms and other comparable terminology. These forward-looking statements, which are subject to risks, uncertainties and assumptions about us, may include projections of our future financial performance, our anticipated growth strategies and anticipated trends in our business. Forward-looking statements contained in this prospectus include, but are not limited to statements about:

- our ability to design, develop, manufacture and market innovative products to treat patients with challenging medical conditions, particularly in PAD, CAD and AS;
- our expected future growth, including growth in international sales;
- the size and growth potential of the markets for our products, and our ability to serve those markets;
- the rate and degree of market acceptance of our products;
- coverage and reimbursement for procedures performed using our products;
- the performance of third parties in connection with the development of our products, including third-party suppliers;
- regulatory developments in the United States and foreign countries;
- our ability to obtain and maintain regulatory approval or clearance of our products on expected timelines;
- our plans to research, develop and commercialize our products and any other approved or cleared product;
- our ability to scale our organizational culture of cooperative product development and commercial execution;
- the development, regulatory approval, efficacy and commercialization of competing products;
- the loss of key scientific or management personnel;
- our expectations regarding the period during which we qualify as an emerging growth company under the JOBS Act;
- our ability to develop and maintain our corporate infrastructure, including our internal controls;
- our use of the proceeds from this offering;
- our financial performance and capital requirements; and
- our expectations regarding our ability to obtain and maintain intellectual property protection for our products, as well as our ability to operate our business without infringing the intellectual property rights of others.

These statements are only predictions based on our current expectations and projections about future events. There are important factors that could cause our actual results, level of activity, performance or achievements to differ materially from the results, level of activity, performance or achievements expressed or implied by the forward-looking statements, including those factors discussed in the section titled “Risk Factors.” You should specifically consider the numerous risks outlined under “Risk Factors.”

[Table of Contents](#)

[Index to Financial Statements](#)

Although we believe the expectations reflected in the forward-looking statements are reasonable, we cannot guarantee future results, level of activity, performance or achievements. We undertake no obligation to update any of these forward-looking statements after the date of this prospectus to conform our prior statements to actual results or revised expectations.

## **MARKET, INDUSTRY AND OTHER DATA**

Unless otherwise indicated, information contained in this prospectus concerning our industry and the market in which we operate, including our general expectations and market position, market opportunity and market size, is based on information from various third-party industry and research sources, on assumptions that we have made based on that data and other similar sources, and on our knowledge of the markets for our current and planned or future products. This information involves a number of assumptions and limitations, and you are cautioned not to give undue weight to such estimates.

Certain market and industry data used in this document, where noted, is attributable to Millennium Research Group, Inc. (“MRG”). MRG asserts copyright protection over the use of such information and reserves all rights with respect to its use. This information has been reprinted with MRG’s permission and the reproduction, distribution, transmission or publication of such information is prohibited without its consent.

In addition, industry publications, studies and surveys generally state that they have been obtained from sources believed to be reliable, although we do not guarantee the accuracy or completeness of such information. The industry in which we operate is subject to a high degree of uncertainty and risk due to a variety of factors, including those described in the section titled “Risk Factors” and elsewhere in this prospectus. These and other factors could cause our actual results to differ materially from those expressed in the estimates made by the independent parties and by us.

## USE OF PROCEEDS

We estimate that the net proceeds to us from this offering will be approximately \$66.6 million, or approximately \$77.0 million if the underwriters exercise their over-allotment option in full, assuming an initial public offering price of \$15.00 per share (which is the midpoint of the estimated price range set forth on the cover page of this prospectus), after deducting the estimated underwriting discounts and commissions and estimated offering expenses payable by us.

Each \$1.00 increase (decrease) in the assumed initial public offering price of \$15.00 per share would increase (decrease) our net proceeds from this offering by \$4.7 million, assuming that the number of shares offered by us, as set forth on the cover page of this prospectus, remains the same, and after deducting the estimated underwriting discounts and commissions payable by us. Similarly, each increase (decrease) of 1,000,000 shares in the number of shares offered by us would increase (decrease) our net proceeds from this offering by \$14.0 million, assuming an initial public offering price of \$15.00 per share, and after deducting the estimated underwriting discounts and commissions payable by us.

We intend to use the net proceeds of this offering, together with our existing cash and cash equivalents, as follows:

- approximately \$32.6 million for sales and marketing activities to support the ongoing commercialization of our IVL System, including, but not limited to, the expansion of our sales force, additional medical affairs and educational efforts and the expansion of our international sales presence;
- approximately \$15.5 million for research and development and clinical studies; and
- the remainder for working capital and general corporate purposes.

Our ongoing clinical programs are intended to allow us to expand commercialization of our products into new geographies and indications. Our Disrupt PAD III clinical study, Disrupt PAD III observational study, Disrupt CAD II clinical study, Disrupt CAD III clinical study and TAVL Chronic Feasibility clinical study are currently enrolling, with enrollment expected to be completed in the second half of 2019 for the Disrupt PAD III clinical study and Disrupt PAD III observational study, the first half of 2019 for the Disrupt CAD II clinical study, the second half of 2020 for the Disrupt CAD III clinical study and the first half of 2019 for the TAVL Chronic Feasibility clinical study. Our Disrupt CAD IV clinical study is currently in the early planning phase with Japan's Pharmaceuticals and Medical Devices Agency. See "Business—Our Products" and "Business—Clinical Studies—Ongoing and Planned Clinical Studies" for further information on the status of our clinical studies and current and planned products.

We believe that our existing cash and cash equivalents, together with available borrowing under our current revolving line of credit from the 2018 Loan and Security Agreement and the net proceeds from this offering, will be sufficient to fund our planned operations for at least the next 12 months. However, following this offering, we will require additional capital in order to achieve our goals. For additional information regarding our potential additional capital requirements, see "Risk Factors—We will require substantial additional capital to finance our planned operations, which may not be available to us on acceptable terms or at all. Our failure to obtain additional financing when needed on acceptable terms, or at all, could force us to delay, limit, reduce or eliminate our product development programs, commercialization efforts or other operations."

The foregoing use of proceeds discussion assumes no exercise of the Stockholder Purchase Option. If the Stockholder Purchase Option is exercised in full, then we estimate that the net proceeds from the Potential Concurrent Private Placement will be an aggregate of approximately \$10.5 million. We intend to use the net proceeds from the Potential Concurrent Private Placement, if any, for working capital and general corporate purposes. There can be no assurance that these stockholders will exercise this option and, even if such option is exercised, that it will be exercised for the full amount of shares. The sale of shares in the Potential Concurrent Private Placement, if any, will not be registered under the Securities Act.

[Table of Contents](#)

[Index to Financial Statements](#)

We cannot specify with certainty the particular uses of the net proceeds that we will receive from this offering and the Potential Concurrent Private Placement, if any. Accordingly, we will have broad discretion in using these proceeds. Pending the use of proceeds from this offering and the Potential Concurrent Private Placement, if any, as described above, we plan to invest the net proceeds that we receive in this offering and the Potential Concurrent Private Placement, if any, in short-term and long-term interest-bearing obligations, including government and investment-grade debt securities and money market funds.

## **DIVIDEND POLICY**

We have never paid any dividends on our common shares or any of our other securities. We currently anticipate that we will retain all available funds for use in the operation and expansion of our business, and do not anticipate paying any cash dividends in the foreseeable future. Any future determination to pay cash dividends will be at the discretion of our board of directors and will be dependent upon our financial condition, results of operations, capital requirements, restrictions under any future indebtedness and other factors the board of directors deems relevant. In addition, the terms of our 2018 Loan and Security Agreement with Silicon Valley Bank restrict our ability to pay dividends to limited circumstances.

**CAPITALIZATION**

The following table sets forth our cash and cash equivalents and capitalization as of December 31, 2018:

- on an actual basis;
- on a pro forma basis, giving effect to: (i) the automatic conversion of all outstanding shares of our convertible preferred stock as of December 31, 2018 into an aggregate of 18,670,259 shares of our common stock immediately prior to the completion of this offering, as if such conversion had occurred on December 31, 2018; (ii) the issuance of 121,019 shares of our common stock, based on an assumed initial public offering price of \$15.00 per share (which is the midpoint of the estimated price range set forth on the cover of this prospectus) upon the net exercise of warrants outstanding as of December 31, 2018 for the purchase of 141,277 shares of our common stock that would otherwise expire upon the completion of this offering; (iii) the filing and effectiveness of our amended and restated certificate of incorporation and the retirement of our authorized convertible preferred stock that will convert to common stock as set forth in clause (i); and (iv) the reclassification of the convertible preferred stock warrant liability to additional paid-in capital, a component of total stockholders' (deficit) equity, due to our convertible preferred stock warrant converting to a warrant to purchase our common stock immediately prior to the completion of this offering; and
- on a pro forma as adjusted basis to give further effect to (i) the sale by us of 5,000,000 shares of our common stock in this offering, at an assumed initial public offering price of \$15.00 per share (which is the midpoint of the estimated price range set forth on the cover page of this prospectus), after deducting the estimated underwriting discounts and commissions and estimated offering expenses payable by us; and (ii) the reclassification of \$1.5 million of deferred offering costs recorded in other assets on the consolidated balance sheet as of December 31, 2018 to additional paid-in capital, a component of total stockholders' (deficit) equity.

This table should be read in conjunction with the section titled "Management's Discussion and Analysis of Financial Condition and Results of Operations" and the consolidated financial statements and the related notes appearing elsewhere in this prospectus.

	<b>December 31, 2018</b>		
	<b>(in thousands, except share and per share data)</b>		
	<b>Actual</b>	<b>Pro Forma</b>	<b>Pro Forma as Adjusted</b>
Cash and cash equivalents	\$ 39,643	\$ 39,643	\$ 106,834
Long-term debt, current and non-current	\$ 15,050	\$ 15,050	\$ 15,050
Convertible preferred stock warrant liability	313	—	—
Convertible preferred stock, \$0.001 par value per share; 229,098,987 shares authorized, 18,670,259 shares issued and outstanding, actual; no shares authorized, issued or outstanding, pro forma and pro forma as adjusted	152,806	—	—
Stockholders' (deficit) equity:			
Preferred stock, \$0.001 par value per share; no shares authorized, issued or outstanding, actual; 5,000,000 shares authorized, no shares issued and outstanding, pro forma and pro forma as adjusted	—	—	—
Common stock, \$0.001 par value per share, 325,000,000 shares authorized, 1,824,807 shares issued and outstanding, actual, 281,274,838 shares authorized, 20,616,085 issued and outstanding, pro forma; 281,274,838 shares authorized, 25,616,085 shares issued and outstanding, pro forma as adjusted	2	21	26
Additional paid-in capital	4,275	157,375	223,935
Accumulated deficit	(126,865)	(126,865)	(126,865)
Total stockholders' (deficit) equity	\$ (122,588)	\$ 30,531	\$ 97,096
Total capitalization	\$ 45,581	\$ 45,581	\$ 112,146



Each \$1.00 increase (decrease) in the initial public offering price per share would increase (decrease) our cash and cash equivalents, additional paid-in capital, a component of total stockholders' (deficit) equity, and total capitalization by \$4.7 million (assuming no exercise of the underwriters' over-allotment option). Similarly, each increase (decrease) of 1,000,000 shares in the number of shares offered by us would increase (decrease) our cash and cash equivalents, additional paid-in capital, a component of total stockholders' (deficit) equity, and total capitalization by \$14.0 million (assuming no exercise of the underwriters' over-allotment option).

If the underwriters' over-allotment option were exercised in full, pro forma as adjusted cash and cash equivalents, additional paid-in capital and stockholders' (deficit) equity as of December 31, 2018, would be \$117.3 million, \$234.4 million, and \$107.6 million, respectively.

If the Stockholder Purchase Option were exercised in full, pro forma as adjusted cash and cash equivalents, additional paid-in capital, and stockholders' (deficit) equity as of December 31, 2018, would be \$117.3 million, \$234.4 million, and \$107.6 million, respectively.

The number of shares of our common stock issued and outstanding actual, pro forma and pro forma as adjusted in the table above is based on 20,616,085 shares (including our convertible preferred stock on an as-converted basis and net exercise of certain outstanding warrants) outstanding as of December 31, 2018, and excludes:

- 3,636,224 shares of our common stock issuable upon the exercise of options outstanding as of December 31, 2018, with a weighted-average exercise price of \$3.50 per share;
- 119,667 shares of our common stock issuable upon the exercise of options granted after December 31, 2018, with an exercise price of \$6.59 per share;
- 54,903 shares of our Series A-1 convertible preferred stock issuable upon the exercise of our Series A-1 convertible preferred stock warrant outstanding as of December 31, 2018, with an exercise price of \$3.09636 per share;
- 34,440 shares of our common stock issuable upon the exercise of our common stock warrants outstanding as of December 31, 2018, with an exercise price of \$4.026 per share;
- 22,216 shares of our common stock issued upon the net exercise of preferred stock warrants;
- 279,648 shares of our common stock issuable upon the exercise of options that we expect to grant under our 2019 Equity Incentive Plan upon the pricing of this offering to our directors, executive officers and certain other employees at an exercise price equal to the initial public offering price of this offering;
- 1,720,782 additional shares of our common stock reserved for future issuance under our 2019 Equity Incentive Plan, which will become effective immediately prior to the completion of this offering, as well as any automatic increases in the number of shares of our common stock reserved for future issuance pursuant to this plan; and
- 300,650 shares of our common stock initially reserved for issuance under our ESPP, as well as any automatic increases in the number of shares of our common stock reserved for future issuance pursuant to this plan.

## DILUTION

If you invest in our common stock you will experience immediate and substantial dilution in the pro forma net tangible book value of your shares of common stock. Dilution in pro forma net tangible book value represents the difference between the public offering price per share of our common stock and the pro forma as adjusted net tangible book value per share of our common stock.

As of December 31, 2018, we had a historical net tangible book deficit of \$(122.6) million, or \$(67.18) per share of common stock, based on 1,824,807 shares of our common stock outstanding. Our historical net tangible book value per share represents the amount of our tangible assets, less liabilities and convertible preferred stock, divided by the total number of shares of our common stock outstanding at December 31, 2018.

Our pro forma net tangible book value as of December 31, 2018, was \$30.5 million, or \$1.48 per share of common stock. Pro forma net tangible book value per share represents tangible assets, less liabilities and convertible preferred stock, divided by the aggregate number of shares of common stock outstanding, after giving effect to: (i) the automatic conversion of all outstanding shares of our convertible preferred stock as of December 31, 2018 into an aggregate of 18,670,259 shares of our common stock immediately prior to the completion of this offering, (ii) the issuance of 121,019 shares of our common stock, based upon an assumed initial public offering price of \$15.00 per share (which is the midpoint of the estimated price range set forth on the cover page of this prospectus), upon the net exercise of warrants outstanding as of December 31, 2018 for the purchase of 141,777 shares of our common stock that would otherwise expire upon completion of this offering; (iii) the reclassification of the convertible preferred stock warrant liability to additional paid-in capital, a component of total stockholders' (deficit) equity, due to our convertible preferred stock warrant converting to a warrant to purchase our common stock immediately prior to the completion of this offering; and (iv) the filing and effectiveness of our amended and restated certificate of incorporation, which will be in effect immediately upon the completion of this offering.

After giving further effect to (i) the sale and issuance by us of the 5,000,000 shares of our common stock in this offering at the assumed initial public offering price of \$15.00 per share (which is the midpoint of the estimated price range set forth on the cover page of this prospectus) and the receipt and application of the net proceeds; and (ii) the reclassification of \$1.5 million of deferred offering costs recorded in other assets on the consolidated balance sheet as of December 31, 2018 to additional paid-in capital, a component of total stockholders' (deficit) equity, our pro forma as adjusted net tangible book value as of December 31, 2018 would be \$97.1 million, or \$3.79 per share. This represents an immediate increase in pro forma net tangible book value to our existing stockholders of \$2.31 per share and an immediate dilution to new investors of \$11.21 per share. Dilution per share to new investors represents the difference between the price per share to be paid by new investors for the shares of common stock sold in this offering and the pro forma as adjusted net tangible book value per share immediately after this offering. The following table illustrates this per share dilution:

Assumed initial public offering price per share	\$15.00
Historical net tangible book deficit per share as of December 31, 2018	\$(67.18)
Pro forma increase in historical net tangible book value per share as of December 31, 2018	68.66
Pro forma net tangible book value per share as of December 31, 2018	1.48
Increase in pro forma net tangible book value per share attributable to new investors participating in this offering	2.31
Pro forma as adjusted net tangible book value per share	\$ 3.79
Dilution per share to new investors participating in this offering	<u>\$11.21</u>

Each \$1.00 increase (decrease) in the assumed initial public offering price of \$15.00 per share (which is the midpoint of the estimated price range set forth on the cover page of this prospectus) would increase (decrease)

pro forma as adjusted net tangible book value by \$4.7 million, and would increase (decrease) dilution per share to new investors in this offering by \$0.82, assuming that the number of shares offered by us, as set forth on the cover page of this prospectus, remains the same and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us. Similarly, each increase or decrease of 1,000,000 shares in the number of shares offered by us would increase (decrease) our pro forma as adjusted net tangible book value by \$14.0 million and increase (decrease) the dilution to new investors by \$0.38 per share, assuming the assumed initial public offering price remains the same, and after deducting the estimated underwriting discounts and commissions and estimated offering expenses payable by us.

If the underwriters' over-allotment option is exercised in full, the pro forma as adjusted net tangible book value per share of our common stock would be \$4.08 per share, and the dilution in pro forma net tangible book value per share to new investors in this offering would be \$10.92 per share.

The following table sets forth, on a pro forma as adjusted basis, as of December 31, 2018, the number of shares of common stock purchased from us, the total consideration paid, or to be paid, and the average price per share paid, or to be paid, by existing stockholders and by the new investors, at an assumed initial public offering price of \$15.00 per share, the midpoint of the estimated initial public offering range set forth on the cover page of this prospectus, before deducting the estimated underwriting discounts and commissions and offering expenses payable by us:

	<u>Shares Purchased</u>		<u>Total Consideration</u>		<u>Average Price Per Share</u>
	<u>Number</u>	<u>Percent</u>	<u>Amount</u>	<u>Percent</u>	
Existing stockholders	20,616,085	80.5%	\$153,495,036	67.2%	\$ 7.45
New investors	5,000,000	19.5	75,000,000	32.8	\$15.00
Total	<u>25,616,085</u>	<u>100%</u>	<u>\$228,495,036</u>	<u>100%</u>	

Each \$1.00 increase (decrease) in the assumed initial public offering price of \$15.00 per share (which is the midpoint of the estimated initial public offering price range set forth on the cover page of this prospectus), would increase (decrease) the total consideration paid by new investors and total consideration paid by all stockholders by \$4.7 million, assuming that the number of shares offered by us, as set forth on the cover page of this prospectus, remains the same and after deducting the estimated underwriting discounts and commissions and estimated offering expenses payable by us.

The above table assumes no exercise of the underwriters' over-allotment option. If the underwriters' over-allotment option were exercised in full, our existing stockholders would own 78.2% and our new investors would own 21.8% of the total number of shares of our common stock outstanding upon completion of this offering. Additionally, the cash consideration paid to us by existing stockholders would be \$153.5 million, or approximately 64.0% of the total cash consideration, and the cash consideration paid to us by new investors purchasing shares in this offering would be \$86.3 million, or approximately 36.0% of the total cash consideration.

The foregoing tables and calculations assume no exercise of outstanding options or warrants, and further assumes no exercise of the Stockholder Purchase Option. If all of our outstanding options and warrants and the Stockholder Purchase Option were exercised in full, (i) existing stockholders would own 83.4% and our new investors in this offering would own 16.6% of the total number of shares of our common stock outstanding upon the completion of this offering and (ii) the cash consideration paid to us by existing stockholders would be \$177.0 million, or approximately 70.2% of the total cash consideration, and the cash consideration paid to us by new investors purchasing shares in this offering would be \$75.0 million, or approximately 29.8% of the total cash consideration. The average price per share paid to us by existing stockholders would be \$7.07 and the average price per share paid to us by new investors purchasing shares in this offering would be \$15.00.

The foregoing tables and calculations (other than the historical net tangible book value calculation) are based on 20,616,085 shares (including our convertible preferred stock on an as-converted basis and net exercise of certain outstanding warrants) outstanding as of December 31, 2018, and excludes:

- 3,636,224 shares of our common stock issuable upon the exercise of options outstanding as of December 31, 2018, with a weighted-average exercise price of \$3.50 per share;
- 119,667 shares of our common stock issuable upon the exercise of options granted after December 31, 2018, with an exercise price of \$6.59 per share;
- 54,903 shares of our Series A-1 convertible preferred stock issuable upon the exercise of our Series A-1 convertible preferred stock warrant outstanding as of December 31, 2018, with an exercise price of \$3.09636 per share;
- 34,440 shares of our common stock issuable upon the exercise of our common stock warrants outstanding as of December 31, 2018, with an exercise price of \$4.026 per share;
- 22,216 shares of our common stock issued upon the exercise of preferred stock warrants;
- 279,648 shares of our common stock issuable upon the exercise of options that we expect to grant under our 2019 Equity Incentive Plan upon the pricing of this offering to our directors, executive officers and certain other employees at an exercise price equal to the initial public offering price of this offering;
- 1,720,782 additional shares of our common stock reserved for future issuance under our 2019 Equity Incentive Plan, which will become effective immediately prior to the completion of this offering, as well as any automatic increases in the number of shares of our common stock reserved for future issuance pursuant to this plan; and
- 300,650 shares of our common stock initially reserved for issuance under our ESPP, as well as any automatic increases in the number of shares of our common stock reserved for future issuance pursuant to this plan.

To the extent that any outstanding options or warrants are exercised, new investors will experience further dilution.

**SELECTED CONSOLIDATED FINANCIAL DATA**

The following tables summarize our consolidated financial data. We have derived the summary consolidated statements of operations data for the years ended December 31, 2017 and 2018 from our audited consolidated financial statements included elsewhere in this prospectus. We have derived our balance sheet data as of December 31, 2017 and 2018 from our audited consolidated financial statements included elsewhere in this prospectus. Our historical results are not necessarily indicative of the results that may be expected in the future. The following summary consolidated financial data should be read in conjunction with the section titled “Management’s Discussion and Analysis of Financial Condition and Results of Operations” and our consolidated financial statements and related notes included elsewhere in this prospectus.

	Years Ended December 31,	
	2017	2018
	(in thousands, except share and per share data)	
<b>Consolidated Statements of Operations Data:</b>		
Product revenue	\$ 1,719	\$ 12,263
Operating expenses:		
Cost of product revenue	2,836	7,250
Research and development	17,963	22,698
Sales and marketing	6,363	17,536
General and administrative	5,422	5,979
Total operating expenses	32,584	53,463
Loss from operations	(30,865)	(41,200)
Interest and other income, net	276	136
Net loss before taxes	(30,589)	(41,064)
Income tax provision	26	38
Net loss	(30,615)	(41,102)
Net loss per share, basic and diluted(1)	\$ (19.71)	\$ (23.39)
Weighted-average shares used in computing net loss per share, basic and diluted(1)	1,553,365	1,757,102
Pro forma net loss per share, basic and diluted (unaudited)(1)		\$ (2.10)
Weighted-average shares used in computing pro forma net loss per share, basic and diluted (unaudited)(1)		19,525,816

(1) See Notes 2 and 12 to our audited consolidated financial statements included elsewhere in this prospectus for an explanation of the calculations of our basic and diluted net loss per share and unaudited pro forma net loss per share and the weighted-average number of shares used in the computation of the per share amounts and unaudited pro forma information.

	As of December 31,	
	2017	2018
	(in thousands)	
<b>Consolidated Balance Sheet Data:</b>		
Cash, cash equivalents and short-term investments	\$ 53,729	\$ 39,643
Working capital	53,318	39,365
Total assets	59,304	53,421
Long-term debt, current and non-current	—	15,050
Convertible preferred stock warrant liability	577	313
Convertible preferred stock	137,469	152,806
Accumulated deficit	(85,763)	(126,865)
Total stockholders' (deficit) equity	(83,292)	(122,588)

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

*You should read the following discussion and analysis of our financial condition and results of operations together with our consolidated financial statements and the related notes appearing elsewhere in this prospectus. Some of the information contained in this discussion and analysis or set forth elsewhere in this prospectus, including information with respect to our plans and strategy for our business, includes forward-looking statements that involve risks, uncertainties and assumptions. You should read the "Special Notes Regarding Forward-Looking Statements" and "Risk Factors" sections of this prospectus for a discussion of important factors that could cause actual results to differ materially from the results described in or implied by the forward-looking statements contained in the following discussion and analysis.*

### Company Overview

We are a medical device company focused on developing and commercializing products intended to transform the way calcified cardiovascular disease is treated. We aim to establish a new standard of care for medical device treatment of atherosclerotic cardiovascular disease through our differentiated and proprietary local delivery of sonic pressure waves for the treatment of calcified plaque, which we refer to as IVL. Our IVL System, which leverages our IVL Technology, is a minimally invasive, easy-to-use and safe way to significantly improve patient outcomes. Our M5 catheter was CE-Marked in April 2018 and cleared by the FDA in July 2018 for use in our IVL System for the treatment of PAD. Our C<sup>2</sup> catheter, which we are currently marketing in Europe, was CE-Marked in June 2018 for use in our IVL System for the treatment of CAD. We have ongoing clinical programs across several products and indications which, if successful, will allow us to expand commercialization of our products into new geographies and indications. Importantly, we are undertaking ongoing clinical trials of our C<sup>2</sup> catheter intended to support a PMA within the United States and a Shonin submission in Japan for the treatment of CAD. We anticipate having final data from these ongoing clinical trials intended to support a U.S. launch of our C<sup>2</sup> catheter in the first half of 2021.

The first two indications we are targeting with our IVL System are PAD, the narrowing or blockage of vessels that carry blood from the heart to the extremities, and CAD, the narrowing or blockage of the arteries that supply blood to the heart. In the future, we see significant opportunity in the potential treatment of AS, a condition where the heart's aortic valve becomes increasingly calcified with age, causing it to narrow and obstruct blood flow from the heart.

We have adapted the use of lithotripsy to the cardiovascular field with the aim of creating what we believe can become the safest, most effective means of addressing the growing challenge of cardiovascular calcification. Lithotripsy has been used to successfully treat kidney stones (deposits of hardened calcium) for over 30 years. By integrating lithotripsy into a device that resembles a standard balloon catheter, physicians can prepare, deliver and treat calcified lesions using a familiar form factor, without disruption to their standard procedural workflow. Our differentiated IVL System works by delivering shockwaves through the entire depth of the artery wall, modifying calcium in the medial layer of the artery, not just at the superficial most intimal layer. The shockwaves crack this calcium and enable the stenotic artery to expand at low pressures, thereby minimizing complications inherent to traditional balloon dilations, such as dissections or tears. Preparing the vessel with IVL facilitates optimal outcomes with other therapies, including stents and drug-eluting technologies. Using IVL also avoids complications associated with atherectomy devices such as dissection, perforation and embolism. When followed by an anti-proliferative therapy such as a DCB or DES, the micro-fractures may enable better drug penetration into the arterial wall and improve drug uptake, thereby improving the effectiveness of the combination treatment.

Our IVL System includes a generator, connector cable and a family of IVL catheters designed to treat PAD and CAD.

## [Table of Contents](#)

## [Index to Financial Statements](#)

We have completed five clinical studies with a total of 179 patients, across 22 centers in multiple countries, for peripheral and coronary artery and cardiac valve diseases. We are currently conducting or planning five other studies, involving nearly 2,000 patients in up to 190 centers in the United States and internationally.

We market our products to hospitals whose interventional cardiologists, vascular surgeons and interventional radiologists treat patients with PAD and CAD. We have dedicated meaningful resources to establish a direct sales capability in the United States, Germany, Austria and Switzerland, which we have complemented with distributors, including in Australia, the Baltics, Canada, Czech Republic, France, Italy, the Netherlands, New Zealand, the Nordic region, Poland, Spain and the United Kingdom. We are actively expanding our international field presence through new distributors, additional sales and clinical personnel and are adding new U.S. sales territories.

We produce substantially all of our IVL catheters in-house at our facilities in Fremont, California which, together with our research and development, controlled environment room and office space, currently totals 12,000 square feet. We stock inventory of raw materials, components and finished goods at our facilities in Fremont and with our direct sales representatives, who travel to our hospital customers' locations as part of their sales efforts. Our electronics (*i.e.*, our generators and connector cables) are produced by original equipment manufacturing ("OEM") partners using our design specifications. We plan to move our production of IVL catheters to our new 35,000 square foot facility in Santa Clara, California in 2019. We rely on a single or limited number of suppliers for certain raw materials and components, and we generally have no long-term supply arrangements with our suppliers, as we order on a purchase order basis. In the United States, we generally ship our IVL products from Fremont to our hospital customers in the United States on a consignment basis, but also may sell our IVL products directly to our hospital customers through our direct sales representatives, who deliver such products to hospital customers in the field. Internationally, we ship our IVL products from Fremont to either our third-party logistic provider located in the Netherlands who then ships directly to hospital customers and distributors pursuant to purchase orders or from Fremont directly to hospital customers and distributors pursuant to purchase orders. We also ship to some customers in Germany, Austria and Switzerland on a consignment basis from our third-party logistic provider located in the Netherlands.

For products sold through direct sales representatives, control is transferred upon delivery to customers. For products sold to distributors internationally, and certain customers that purchase stocking orders in the United States, control is transferred upon shipment or delivery to the customer's named location, based on the contractual shipping terms. For consignment inventory, control is transferred at the time the catheters are consumed in a procedure. Currently, our product sales consist predominantly of sales of our M5 catheters and our C2 catheters, as we generally loan our generator kits, which include a generator and a connector cable, to our customers without charge to facilitate the use of our IVL catheters.

In 2018, we generated product revenue of \$12.3 million, which represents a 613% increase over 2017, and a \$41.2 million loss from operations as compared to a loss from operations of \$30.9 million in 2017. In 2018, 43% of our product revenue was generated from customers located outside of the United States. Our sales outside of the United States are denominated principally in Euros. As a result, we have foreign exchange exposure. We have not entered into any material foreign currency hedging contracts, although we may do so in the future.

Since inception, we have incurred significant net losses and expect to continue to incur net losses for the foreseeable future. Since our inception, our operations have been financed primarily by net proceeds from the sale of our convertible preferred stock, indebtedness, and, to a lesser extent, product revenue. As of December 31, 2018, we had \$39.6 million in cash and cash equivalents, and an accumulated deficit of \$126.9 million.

We have a number of on-going clinical trials, and expect to continue to make substantial investments in these trials and in additional clinical trials that are designed to provide clinical evidence of the safety and efficacy of our products. We intend to continue to make significant investments in our sales and marketing organization



by increasing the number of U.S. sales representatives and expanding our international marketing programs to help facilitate further adoption among existing hospital accounts as well as broaden awareness of our products to new hospital accounts. We also expect to continue to make investments in research and development, regulatory affairs and clinical studies to develop future generations of products based on our IVL Technology, support regulatory submissions and demonstrate the clinical efficacy of our products. Moreover, we expect to incur additional expenses associated with operating as a public company, including legal, accounting, insurance, exchange listing and SEC compliance, investor relations and other expenses. Because of these and other factors, we expect to continue to incur substantial net losses and negative cash flows from operations for the foreseeable future. In addition, we will require additional financing to fund working capital and pay our obligations. We may seek to raise any necessary additional capital through a combination of public or private equity offerings and/or debt financings.

### Factors Affecting Our Business

There are a number of factors that have impacted, and we believe will continue to impact, our results of operations and growth. These factors include:

- **Market acceptance.** The growth of our business depends on our ability to gain broader acceptance of our current products by continuing to make physicians and other hospital staff aware of the benefits of our products to generate increased demand and frequency of use, and thus increase sales to our hospital customers. Our ability to grow our business will also depend on our ability to expand our customer base in existing or new target end markets. Although we are attempting to increase the number of patients treated with procedures that use our products through our established relationships and focused sales efforts, we cannot provide assurance that our efforts will increase the use of our products.
- **Regulatory approvals/clearances and timing and efficiency of new product introductions.** We must successfully obtain timely approvals or clearances and introduce new products that gain acceptance with physicians, ensuring adequate supply while avoiding excess inventory of older products and resulting inventory write-downs or write-offs. For our sales to grow, we will also need to receive FDA approval for the use of our C<sup>2</sup> catheters in our IVL System for the treatment of CAD in the United States, and will need to obtain regulatory clearance or approval of our other pipeline products in the United States and in international markets. In addition, as we introduce new products, we expect to build our inventory of components and finished goods in advance of sales, which may cause quarterly fluctuations in our results of operations.
- **Sales force size and effectiveness.** The rate at which we grow our sales force and the speed at which newly hired salespeople become effective can impact our revenue growth or our costs incurred in anticipation of such growth. We intend to continue to make significant investments in our sales and marketing organization by increasing the number of U.S. sales representatives and expanding our international marketing programs to help facilitate further adoption among existing hospital accounts as well as broaden awareness of our products to new hospital accounts.
- **Competition.** Our industry is intensely competitive and, in particular, we compete with a number of large, well-capitalized companies. We must continue to successfully compete in light of our competitors' existing and future products and related pricing and their resources to successfully market to the physicians who use our products.
- **Reimbursement.** The level of reimbursement from third-party payors for procedures performed using our products could have a substantial impact on the prices we are able to charge for our products and how widely our products are accepted. The level at which reimbursement is set for procedures using our products, and any increase in reimbursement for procedures using our products, will depend substantially on our ability to generate clinical evidence, to gain advocacy in the respective physician societies and to work with the Centers for Medicare & Medicaid Services and payors.

- **Clinical results.** Publications of clinical results by us, our competitors and other third parties can have a significant influence on whether, and the degree to which, our products are used by physicians and the procedures and treatments those physicians choose to administer for a given condition.
- **Product and Geographic Mix; Timing.** Our financial results, including our gross margins, may fluctuate from period to period based on the timing of customer orders or medical procedures, the number of available selling days in a particular period, which can be impacted by a number of factors, such as holidays or days of severe inclement weather in a particular geography, the mix of products sold and the geographic mix of where products are sold. In particular, our distributors for international sales receive a distribution margin on sales of our IVL catheters, which affects our gross margin.
- **Seasonality.** We expect to experience a seasonal slowing of demand for our products in our fourth quarters due to year-end clinical treatment patterns, such as the postponement of elective surgeries around the winter holidays. In addition, we have experienced some seasonality during summer months, which we believe is attributable to the postponement of elective surgeries for summer vacation plans of physicians and patients. We expect these seasonal factors to become more pronounced in the future as our business grows.

In addition, we have experienced and expect to continue to experience meaningful variability in our quarterly revenue and gross profit/loss as a result of a number of factors, including, but not limited to: inventory write-offs and write-downs; costs, benefits and timing of new product introductions; the availability and cost of components and raw materials; and fluctuations in foreign currency exchange rates. Additionally, we experience quarters in which operating expenses, in particular research and development expenses, fluctuate depending on the stage and timing of product development.

While these factors may present significant opportunities for us, they also pose significant risks and challenges that we must address. See the section titled "Risk Factors" for more information.

## Components of Our Results of Operations

### **Product revenue**

Product revenue is primarily from the sale of our IVL catheters.

We sell our products to hospitals, primarily through direct sales representatives, as well as through distributors in selected international markets. For products sold through direct sales representatives, control is transferred upon delivery to customers. For products sold to distributors internationally and certain customers that purchase stocking orders in the United States, control is transferred upon shipment or delivery to the customer's named location, based on the contractual shipping terms. Additionally, a significant portion of our revenue is generated through a consignment model under which inventory is maintained at hospitals. For consignment inventory, control is transferred at the time the catheters are consumed in a procedure.

### **Cost of product revenue**

Cost of product revenue consists primarily of costs of components for use in our products, the materials and labor that are used to produce our products, the manufacturing overhead that directly supports production and depreciation relating to the equipment used in our IVL System that we loan to our hospital customers without charge to facilitate the use of our IVL catheters in their procedures. We depreciate equipment over a three-year period. We expect cost of product revenue to increase in absolute terms as our revenue grows.

Our gross margin has been and will continue to be affected by a variety of factors, primarily production volumes, the cost of direct materials, product mix, geographic mix, discounting practices, manufacturing costs, product yields, headcount and cost-reduction strategies. We expect our gross margin percentage to increase over

the long term to the extent we are successful in increasing our sales volume and are therefore able to leverage our fixed costs. We intend to use our design, engineering and manufacturing capabilities to further advance and improve the efficiency of our manufacturing processes, which, if successful, we believe will reduce costs and enable us to increase our gross margin percentage. While we expect gross margin percentage to increase over the long term, it will likely fluctuate from quarter to quarter as we continue to introduce new products and adopt new manufacturing processes and technologies.

***Research and development expenses***

Research and development (“R&D”) expenses consist of applicable personnel, consulting, materials and clinical trial expenses. R&D expenses include:

- certain personnel-related expenses, including salaries, benefits, bonus, travel and stock-based compensation;
- cost of clinical studies to support new products and product enhancements, including expenses for clinical research organizations (“CROs”) and site payments;
- materials and supplies used for internal R&D and clinical activities;
- allocated overhead including facilities and information technology expenses; and
- cost of outside consultants who assist with technology development, regulatory affairs, clinical affairs and quality assurance.

R&D costs are expensed as incurred. In the future, we expect R&D expenses to increase in absolute dollars as we continue to develop new products, enhance existing products and technologies and perform activities related to obtaining additional regulatory approval.

***Sales and marketing expenses***

Sales and marketing expenses consist of personnel-related expenses, including salaries, benefits, sales commissions, travel and stock-based compensation. Other sales and marketing expenses include marketing and promotional activities, including trade shows and market research, and cost of outside consultants. We expect to continue to grow our sales force and increase marketing efforts as we continue commercializing products based on our IVL Technology. As a result, we expect sales and marketing expenses to increase in absolute dollars in future periods.

***General and administrative expenses***

General and administrative expenses consist of personnel-related expenses, including salaries, benefits, bonus, travel and stock-based compensation. Other general and administrative expenses include professional services fees, including legal, audit and tax fees, insurance costs, cost of outside consultants and employee recruiting and training costs. Moreover, we expect to incur additional expenses associated with operating as a public company, including legal, accounting, insurance, exchange listing and SEC compliance and investor relations. As a result, we expect general and administrative expenses to increase in absolute dollars in future periods.

***Interest expense***

Interest expense consists of interest on our debt and amortization of associated debt discount. In February 2018, we entered into a Loan and Security Agreement with Silicon Valley Bank for a term loan and a revolving line of credit as described in Note 7 to our consolidated financial statements appearing elsewhere in this prospectus (the “2018 Loan and Security Agreement”). In June 2018 and December 2018, we drew an aggregate

of \$15.0 million in borrowings under the term loan facility. As a result, we expect interest expense to increase in absolute dollars in future periods. As of December 31, 2018, we had \$2.0 million available on the revolving line of credit.

#### *Change in fair value of warrant liability*

We have accounted for our freestanding warrants to purchase shares of our convertible preferred stock as liabilities at fair value primarily because the shares underlying the warrants contain contingent redemption features outside our control. The warrants are subject to re-measurement at each balance sheet date with gains and losses reported through our consolidated statements of operations and comprehensive loss.

#### *Other income, net*

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

#### *Income tax provision*

Income tax provision consists primarily of income taxes in certain foreign jurisdictions in which we conduct business. We have a full valuation allowance for deferred tax assets, including net operating loss carryforwards and tax credits related primarily to R&D.

### Results of Operations

#### *Comparison of the Years Ended December 31, 2017 and 2018*

The following table shows our results of operations for the years ended December 31, 2017 and 2018:

	Year Ended December 31,		Change \$	Change %
	2017	2018		
	(in thousands)			
Revenue:				
Product revenue	\$ 1,719	\$ 12,263	\$ 10,544	613%
Operating expenses:				
Cost of product revenue	2,836	7,250	4,414	156%
Research and development	17,963	22,698	4,735	26%
Sales and marketing	6,363	17,536	11,173	176%
General and administrative	5,422	5,979	557	10%
Total operating expenses	32,584	53,463	20,879	64%
Loss from operations	(30,865)	(41,200)	(10,335)	33%
Interest expense	(58)	(401)	(343)	591%
Change in fair value of warrant liability	(32)	(52)	(20)	63%
Other income, net	366	589	223	61%
Net loss before taxes	(30,589)	(41,064)	(10,475)	34%
Income tax provision	26	38	12	46%
Net loss	<u>\$(30,615)</u>	<u>\$(41,102)</u>	<u>\$(10,487)</u>	<u>34%</u>

#### *Product revenue*

Product revenue increased by \$10.5 million, or 613%, from \$1.7 million in 2017 to \$12.3 million in 2018. The increase was primarily due to an increase in the number of customers and an increase in purchase volume of our products per customer both within the United States and internationally.

Product revenue consisted primarily of the sale of our IVL catheters. Product revenue, classified by the major geographic areas in which our products are shipped, was \$1.0 million within the United States and \$0.7 million for all other countries in 2017 and \$7.0 million within the United States and \$5.3 million for all other countries in 2018.

#### ***Cost of product revenue and gross margin percentage***

Cost of product revenue increased by \$4.4 million, or 156%, from \$2.8 million in 2017 to \$7.3 million in 2018. The increase was primarily due to growth in sales volume. Gross margin percentage was negative 65% for the year ended December 31, 2017. Gross margin percentage improved to 41% for the year ended December 31, 2018. This change in gross margin percentage was primarily due to increased sales volume of our catheters.

#### ***Research and development expenses***

The following table summarizes our R&D expenses incurred during the periods presented:

	<b>Year Ended December 31,</b>	
	<b>2017</b>	<b>2018</b>
	(in thousands)	
Compensation and related personnel costs	\$ 10,263	\$ 10,580
Clinical-related costs	3,358	5,626
Materials and supplies	1,805	2,541
Facilities and other allocated costs	1,153	1,560
Outside consultants	788	1,360
Other research and development costs	596	1,031
<b>Total research and development expenses</b>	<b>\$ 17,963</b>	<b>\$ 22,698</b>

R&D expenses increased by \$4.7 million, or 26%, from \$18.0 million in 2017 to \$22.7 million in 2018. The increase was primarily due to a \$2.3 million increase in clinical-related costs and a \$0.6 million increase in costs associated with outside consultants to support clinical trials. There was also a \$0.7 million increase in materials and supplies for R&D and a \$0.4 million increase in facilities and other allocated costs due to higher rent and building expenditures.

#### ***Sales and marketing expenses***

Sales and marketing expenses increased by \$11.2 million, or 176%, from \$6.4 million in 2017 to \$17.5 million in 2018. The increase was primarily due to a \$9.5 million increase in compensation and related personnel costs, which includes a \$3.1 million increase in commission expense, as a result of increased headcount and increased business development related activities to expand the domestic and international customer base. Marketing and promotional expenses increased by \$0.8 million to support the commercialization of our products.

#### ***General and administrative expenses***

General and administrative expenses increased by \$0.6 million, or 10%, from \$5.4 million in 2017 to \$6.0 million in 2018. The increase was primarily due to a \$0.8 million increase in professional services and general corporate expenses incurred in connection with our preparation to become a public company, partially offset by a \$0.3 million decrease in recruiting and training expenses.

#### ***Interest expense***

Interest expense increased by \$0.3 million, or 591%, from \$0.1 million in 2017 to \$0.4 million in 2018. The increase in interest expense was attributable to us entering into the 2018 Loan and Security Agreement and

drawing down on the first tranche of the term loan in June 2018 of \$10.0 million and the second tranche of the term loan in December 2018 of \$5.0 million.

***Change in fair value of warrant liability***

The change in fair value of warrant liability was \$32,000 in 2017 and \$0.1 million in 2018, reflecting an increase in the convertible preferred stock warrant liability of \$0.2 million from changes to the Black-Scholes option pricing model assumptions used to value the warrant liability, partially offset by a decrease in the convertible preferred stock warrant liability of \$0.1 million related to the expiration of 46,102 of our Series A-1 convertible preferred stock warrants in 2018.

***Other income, net***

Other income, net increased by \$0.2 million, or 61%, from \$0.4 million in 2017 to \$0.6 million in 2018. The increase was primarily due to a \$0.3 million increase in interest income on our cash and cash equivalents and short-term investments due to increases in interest rates on balances held in interest-earning instruments, partially offset by a \$0.1 million increase in other expenses.

***Income tax provision***

Income tax provision increased by \$12,000, or 46%, from \$26,000 in 2017 to \$38,000 in 2018. This increase was primarily due to an increase in foreign income tax expense.

**Liquidity and Capital Resources**

***Sources of liquidity***

Since our inception through December 31, 2018, our operations have been financed primarily by net proceeds from the sale of our convertible preferred stock, indebtedness and, to a lesser extent, product revenue. As of December 31, 2018, we had \$39.6 million in cash and cash equivalents and an accumulated deficit of \$126.9 million.

In December 2018, we received \$15.0 million in gross proceeds from the sale of our Series D convertible preferred stock.

***Debt obligations***

***2018 Loan and Security Agreement***

In February 2018, we entered into the 2018 Loan and Security Agreement. The terms of the 2018 Loan and Security Agreement include a term loan of \$15.0 million and a revolving line of credit of \$2.0 million. The term loan is available in two tranches, of which the first tranche of \$10.0 million was drawn down in June 2018 and the second tranche of \$5.0 million was drawn down in December 2018.

The term loan matures in December 2021, with interest-only monthly payments until September 2019. The interest-only period will extend through December 2019 if certain financing milestones are met. The term loan accrues interest at a floating per annum rate equal to the greater of the Wall Street Journal prime rate minus 1.75% and 2.75% (3.75% as of December 31, 2018). There is a final payment equal to 6.75% of the original aggregate principal amount, or \$1.0 million, of the term loan advances. The line of credit accrues interest at the Wall Street Journal prime rate.

The revolving line of credit matures in February 2021 and accrues interest at the Wall Street Journal prime rate. As of December 31, 2018, we have \$2.0 million available on our revolving line of credit. In connection with the execution of the 2018 Loan and Security Agreement, we issued Silicon Valley Bank a warrant to purchase 34,440 shares of our common stock, with a term of ten years.

The term loan is secured by all our assets, excluding intellectual property and certain other assets. The loan contains customary affirmative and restrictive covenants, including with respect to our ability to enter into fundamental transactions, incur additional indebtedness, grant liens, pay any dividend or make any distributions to our holders, make investments and merge or consolidate with any other person or engage in transactions with our affiliates, but does not include any financial covenants.

### ***Funding requirements***

Based on our planned operations, we do not expect that our current cash and cash equivalents, together with available borrowings under our revolving line of credit from our 2018 Loan and Security Agreement, will be sufficient to fund our operations for at least 12 months after the date our most recent consolidated financial statements were issued without raising additional capital through equity or debt financing. These conditions raise substantial doubt about our ability to continue as a going concern for a period of one year from the date of the issuance of our most recent consolidated financial statements. Our ability to continue as a going concern is dependent upon our ability to successfully secure sources of financing and ultimately achieve profitable operations. However, based on our planned operations, we expect our cash and cash equivalents, together with available borrowings under our revolving line of credit and the proceeds from this offering, will be sufficient to fund our operating expenses for at least the next 12 months.

We have a number of ongoing clinical trials, and expect to continue to make substantial investments in these trials and in additional clinical trials that are designed to provide clinical evidence of the safety and efficacy of our products. We intend to continue to make significant investments in our sales and marketing organization by increasing the number of U.S. sales representatives and expanding our international marketing programs to help facilitate further adoption among existing hospital accounts as well as broaden awareness of our products to new hospitals. We also expect to continue to make investments in research and development, regulatory affairs and clinical studies to develop future generations of products based on our IVL Technology, support regulatory submissions and demonstrate the clinical efficacy of our products. Moreover, we expect to incur additional expenses associated with operating as a public company, including legal, accounting, insurance, exchange listing and SEC compliance, investor relations and other expenses. Because of these and other factors, we expect to continue to incur substantial net losses and negative cash flows from operations for the foreseeable future.

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

- the cost, timing and results of our clinical trials and regulatory reviews;
- the cost and timing of establishing sales, marketing and distribution capabilities;
- the terms and timing of any other collaborative, licensing and other arrangements that we may establish;
- the timing, receipt and amount of sales from our current and potential products;
- the degree of success we experience in commercializing our products;
- the emergence of competing or complementary technologies;
- the cost of preparing, filing, prosecuting, maintaining, defending and enforcing any patent claims and other intellectual property rights; and
- the extent to which we acquire or invest in businesses, products or technologies, although we currently have no commitments or agreements relating to any of these types of transactions.

We will require additional financing to fund working capital and pay our obligations. We may seek to raise any necessary additional capital through a combination of public or private equity offerings and/or debt financings. There can be no assurance that we will be successful in acquiring additional funding at levels sufficient to fund our operations or on terms favorable to us, if at all. If adequate funds are not available on

acceptable terms when needed, we may be required to significantly reduce operating activities, which may have a material adverse effect on our business and/or results of operations and financial condition. If we do raise additional capital through public or private equity or convertible debt offerings, the ownership interest of our existing stockholders will be diluted, and the terms of these securities may include liquidation or other preferences that adversely affect our existing stockholders' rights. If we raise additional capital through debt financing, we may be subject to covenants limiting or restricting our ability to take specific actions, such as incurring additional debt, making capital expenditures or declaring dividends. Additional capital may not be available on reasonable terms, or at all.

### Cash Flows

The following table summarizes our cash flows for the periods indicated:

	Year Ended December 31,	
	2017	2018
	(in thousands)	
Net cash used in operating activities	\$ (30,347)	\$ (41,465)
Net cash used in investing activities	(2,232)	(174)
Net cash provided by financing activities	33,687	29,809
Net increase (decrease) in cash, cash equivalents and restricted cash	<u>\$ 1,108</u>	<u>\$ (11,830)</u>

#### *Operating activities*

In 2018, cash used in operating activities was \$41.5 million, attributable to a net loss of \$41.1 million and a net change in our net operating assets and liabilities of \$2.6 million, partially offset by non-cash charges of \$2.3 million. Non-cash charges primarily consisted of \$1.3 million in stock-based compensation, \$0.7 million in depreciation and amortization and \$0.2 million in amortization of debt issuance costs. The change in our net operating assets and liabilities was primarily due to a \$2.6 million increase in inventory and \$2.2 million increase in accounts receivable due to an increase in sales, and a \$0.9 million increase in other assets from deferred offering costs. These changes were partially offset by a \$3.1 million increase in accrued and other current liabilities and accounts payable resulting primarily from increases in our operating activities and accrued professional services fees.

In 2017, cash used in operating activities was \$30.3 million, attributable to a net loss of \$30.6 million and a net change in our net operating assets and liabilities of \$1.3 million, partially offset by non-cash charges of \$1.5 million. Non-cash charges primarily consisted of \$1.0 million in stock-based compensation and \$0.5 million in depreciation. The change in our net operating assets and liabilities was primarily due to a \$1.9 million increase in inventory for anticipated growth in our business, a \$0.6 million increase in accounts receivable due to increase in sales, and a \$0.4 million increase in prepaid expenses and other current assets. These changes were partially offset by a \$1.6 million increase in accrued and other current liabilities and accounts payable resulting primarily from increases in our operating activities.

#### *Investing activities*

In 2018, cash used in investing activities was \$0.2 million, attributable to the purchase of property and equipment of \$2.0 million, partially offset by the maturity of available-for-sale investments of \$1.8 million.

In 2017, cash used in investing activities was \$2.2 million, attributable to purchases of investments of \$17.7 million and purchase of property and equipment of \$0.4 million, partially offset by maturity of available-for-sale investments of \$15.9 million.



### Financing activities

In 2018, cash provided by financing activities was \$29.8 million, attributable to proceeds of \$15.0 million from borrowings on the 2018 Loan and Security Agreement, net proceeds of \$14.9 million from the issuance of our Series D convertible preferred stock and proceeds from stock option exercises and warrant exercises of \$0.5 million, partially offset by deferred offering cost payments of \$0.6 million.

In 2017, cash provided by financing activities was \$33.7 million, attributable to net proceeds of \$34.9 million from the issuance of our Series C convertible preferred stock and proceeds from stock option exercises and warrant exercises of \$0.3 million, partially offset by the principal payment of our term loan of \$1.6 million.

### Contractual Obligations and Commitments

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

	Payments Due by Period				
	Total	Less than 1 Year	1-3 Years	3- 5 Years	More than 5 Years
	(in thousands)				
Operating lease obligations	\$3,207	\$940	\$1,685	\$ 582	\$ —
Debt, principal and interest <sup>(1)</sup>	17,138	2,243	14,895	—	—
<b>Total</b>	<b>\$20,345</b>	<b>\$ 3,183</b>	<b>\$16,580</b>	<b>\$ 582</b>	<b>\$ —</b>

(1) In June 2018 and December 2018, we borrowed \$10.0 and \$5.0 million, respectively, pursuant to a term loan under the 2018 Loan and Security Agreement. The term loan matures in December 2021. Principal payments associated with the term loan are included in the above table. Interest expense incurred on the term loan is included in the above table based on obligations outstanding and rates effective as of December 31, 2018, including a final one-time payment of \$1.0 million in December 2021.

In addition, we enter into agreements in the normal course of business with contract research organizations for clinical trials and with vendors for preclinical studies and other services and products for operating purposes which are cancelable at any time by us, generally upon 30 days prior written notice. These payments are not included in this table of contractual obligations.

### Off-Balance Sheet Arrangements

During the periods presented, we did not have, nor do we currently have, any off-balance sheet arrangements as defined in the rules and regulations of the SEC.

### Critical Accounting Policies and Estimates

Management's discussion and analysis of our financial condition and results of operations is based on our consolidated financial statements, which have been prepared in accordance with U.S. generally accepted accounting principles ("GAAP"). The preparation of these consolidated financial statements requires us to make estimates and assumptions for the reported amounts of assets, liabilities, revenue, expenses and related disclosures. Our estimates are based on our historical experience and on various other factors that we believe are reasonable under the circumstances, the results of which form the basis for making judgments about the carrying value of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates under different assumptions or conditions and any such differences may be material.

While our significant accounting policies are more fully described in the Note 2 to our consolidated financial statements appearing elsewhere in this prospectus, we believe the following discussion addresses our most critical accounting policies, which are those that are most important to our financial condition and results of operations and require our most difficult, subjective and complex judgments.

***Revenue recognition***

We adopted Accounting Standards Codification (“ASC”) 606, *Revenue from Contracts with Customers*, effective January 1, 2018 using the modified retrospective method. The adoption of ASC 606 did not have a material effect on our revenue recognition.

We sell our products to hospitals, primarily through direct sales representatives, as well as through distributors in selected international markets. For products sold through direct sales representatives, control is transferred upon delivery to customers. For products sold to distributors internationally and certain customers that purchase stocking orders in the United States, control is transferred upon shipment or delivery to the customer’s named location, based on the contractual shipping terms. Additionally, a significant portion of our revenue is generated through a consignment model under which inventory is maintained at hospitals. For consignment inventory, control is transferred at the time the catheters are consumed in a procedure.

Under agreements with our customers, we generally provide for the use of an IVL generator and connector cable at no charge to facilitate the use of our IVL catheters. These agreements do not contain contractually enforceable minimum commitments and are generally cancellable by either party with 30 days’ notice.

***Convertible preferred stock warrant liability***

We have accounted for our freestanding warrants to purchase shares of our convertible preferred stock as liabilities at fair value upon issuance primarily because the shares underlying the warrants contain contingent redemption features outside our control. The warrants are subject to re-measurement at each balance sheet date and any change in fair value is recognized as the change in fair value of warrant liability. We will continue to adjust the carrying value of the warrants until such time as these instruments are exercised, expire or convert into warrants to purchase shares of our common stock. At that time, the liabilities will be reclassified to additional paid-in capital, a component of stockholders’ equity (deficit). The consummation of this offering will result in this reclassification.

***Accrued research and development costs***

We accrue liabilities for estimated costs of R&D activities conducted by our third-party service providers, which include the conduct of preclinical and clinical studies. We record the estimated costs of R&D activities based upon the estimated amount of services provided but not yet invoiced, and include these costs in accrued liabilities on the consolidated balance sheet and within R&D expense on the consolidated statements of operations and comprehensive loss.

We accrue for these costs based on factors, such as estimates of the work completed and budget provided and in accordance with agreements established with our third-party service providers. We make significant judgments and estimates in determining the accrued liabilities balance in each reporting period. As actual costs become known, we adjust our accrued liabilities. We have not experienced any material differences between accrued costs and actual costs incurred since our inception.

***Stock-based compensation***

We account for share-based payments at fair value. The fair value of stock options is measured using the Black-Scholes option-pricing model. For share-based awards that vest subject to the satisfaction of a service requirement, the fair value measurement date for stock-based compensation awards is the date of grant and the expense is recognized on a straight-line basis, over the vesting period. We account for forfeitures as they occur.

The fair value of each stock option grant was determined using the methods and assumptions discussed below (see “—Fair value of common stock”). Each of these inputs is subjective and generally requires significant judgment and estimation by management.

- *Expected Term*—The expected term represents the period that stock-based awards are expected to be outstanding. Our historical share option exercise information is limited due to a lack of sufficient data points and does not provide a reasonable basis upon which to estimate an expected term. The expected term for option grants is therefore determined using the simplified method. The simplified method deems the expected term to be the midpoint between the vesting date and the contractual life of the stock-based awards.
- *Expected Volatility*—The expected volatility was derived from the historical stock volatilities of comparable peer public companies within our industry that are considered to be comparable to our business over a period equivalent to the expected term of the stock-based awards, since there has been no trading history of our common stock.
- *Risk-Free Interest Rate*—The risk-free interest rate is based on the U.S. Treasury yield curve in effect at the date of grant for zero-coupon U.S. Treasury notes with maturities approximately equal to the stock-based awards’ expected term.
- *Expected Dividend Yield*—The expected dividend yield is zero as we have not paid nor do we anticipate paying any dividends on our common stock in the foreseeable future.

During the years ended December 31, 2017 and 2018, stock-based compensation was \$1.0 million and \$1.3 million, respectively. As of December 31, 2018, we had \$3.8 million of total unrecognized stock-based compensation, which we expect to recognize over a weighted-average period of 2.72 years. Based upon the assumed initial public offering price of \$15.00 per share (which is the midpoint of the estimated price range set forth on the cover of this prospectus), the aggregate intrinsic value of options outstanding as of December 31, 2018 was \$41.8 million, of which \$19.6 million related to vested options and \$22.2 million related to unvested options.

#### ***Fair value of common stock***

Historically, for all periods prior to this initial public offering, the fair values of the shares of our common stock underlying our share-based awards were estimated on each grant date by our board of directors. In order to determine the fair value of our common stock underlying option grants, our board of directors considered, among other things, valuations of our common stock prepared by an independent third-party valuation firm in accordance with the guidance provided by the American Institute of Certified Public Accountants Practice Guide, *Valuation of Privately-Held-Company Equity Securities Issued as Compensation*.

For our valuations performed prior to December 31, 2017, the fair value of our common stock was estimated using the option pricing model (“OPM”) with a backsolve method based on precedent transactions. The backsolve method for inferring the equity value implied by a recent financing transaction involves making assumptions for the expected time to liquidity, volatility and risk-free rate and then solving for the value of equity such that value for the most recent financing equals the amount paid. This method was selected as management concluded that the contemporaneous financing transaction was an arm’s-length transaction. Furthermore, as of each of the valuation dates prior to December 31, 2017, we were at an early stage of development and future liquidity events were difficult to forecast. The stock options granted from January 2018 through July 2018 were issued with an exercise price based on the then most recent valuation determined by our board of directors as of September 2017. This valuation was prepared using the OPM valuation with a backsolve based on the Series C convertible preferred stock financing in September 2017. The Series C convertible preferred stock was issued at \$12.32 per share and the common stock value was estimated to be \$4.03 per share at the time of grant. Subsequently, for accounting purposes, we determined the common stock fair value to be \$4.51 per share and we used this higher valuation for the purposes of recording share based compensation

expense in our consolidated financial statements. From January 2018 through July 2018, options to purchase approximately 571,000 shares of common stock were issued with an exercise price of \$4.03 per share.

In August 2018, we considered a near-term initial public offering to be more likely, and no new stock options were issued in August or September 2018 until a new third-party valuation report was prepared. In October 2018, our board of directors made a new valuation determination in which the fair value of our common stock was estimated using a hybrid Probability Weighted Expected Return Model (“PWERM”) that incorporated aspects of the market and income approaches. The hybrid method applied the PWERM for the going public and mergers and acquisitions transaction scenarios and applied an OPM in the stay-private scenario. The hybrid method was used because of a near-term potential initial public offering scenario that also factored in the inherent uncertainty associated with being able to complete an initial public offering. In October and November 2018, options to purchase a total of approximately 445,000 shares of common stock were issued with an exercise price of \$6.71 per share. No stock options were issued in December 2018. The increase in the estimated fair value of our common stock during 2018 is primarily attributed to our board of directors’ assessment of an increased probability of an initial public offering in the near term. An initial public offering scenario contemplates that the preferred stock will convert to common stock and that the preferred stock will lose its liquidation preference, thereby decreasing the difference in valuation between preferred stock and common stock. Also, the incorporation of a near-term liquidity event, such as an initial public offering, reduces the period of discount for the lack of marketability of the common stock and further increases the value of the common stock. We issued Series D convertible preferred stock in December 2018 at \$13.75 per share, representing a 12% increase in the preferred stock valuation compared to the Series C round. The overall increase in the preferred stock valuation reflected the continued progress by us in developing our products and continued trends of increasing revenues. The valuation of the common stock increased 49% during 2018, incorporating the increased probability of a near-term initial public offering in addition to the overall increase in the valuation of the Company.

Given the absence of a public trading market for our common stock, our board of directors exercised their judgment and considered a number of objective and subjective factors to determine the best estimate of the fair value of our common stock, including valuations performed by an independent third party, developments in our operations, sales of preferred stock, the prices, rights, preferences and privileges of our preferred stock relative to the common stock, actual operating results and financial performance and capital resources, the conditions in the medical device industry and the economy and capital markets in general, the stock price performance and volatility of comparable public companies, the likelihood of achieving a liquidity event for shares of our common stock underlying these stock options, such as an initial public offering or sale of our company, and the lack of liquidity of our common stock, among other factors. After the closing of this offering, our board of directors will determine the fair value of each share of underlying common stock based on the closing price of our common stock as reported on the date of the grant. Our board of directors intended all options granted to be exercisable at a price per share not less than the per share fair value of our common stock underlying those options on the grant date.

#### **Emerging Growth Company Status**

In April 2012, the JOBS Act was enacted. Section 107 of the JOBS Act provides that an “emerging growth company” may take advantage of the extended transition period provided in Section 7(a)(2)(B) of the Securities Act for complying with new or revised accounting standards. Therefore, an emerging growth company can delay the adoption of certain accounting standards until those standards would otherwise apply to private companies. We have irrevocably elected not to avail ourselves of this exemption from new or revised accounting standards, and, therefore, will be subject to the same new or revised accounting standards as other public companies that are not emerging growth companies.

### **Recent Accounting Pronouncements**

See Note 2 to our consolidated financial statements included elsewhere in this prospectus for more information.

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

#### ***Interest rate risk***

Our cash and cash equivalents as of December 31, 2018 consisted of \$39.6 million in bank deposits and money market funds. Such interest-earning instruments carry a degree of interest rate risk. The goals of our investment policy are liquidity and capital preservation; we do not enter into investments for trading or speculative purposes and have not used any derivative financial instruments to manage our interest rate exposure. We believe that we do not have any material exposure to changes in the fair value of these assets as a result of changes in interest rates due to the short-term nature of our cash and cash equivalents.

As of December 31, 2018, we had \$15.0 million in variable rate debt outstanding. The 2018 Loan and Security Agreement matures in December 2021, with interest-only monthly payments until September 2019. The term loan accrues interest at a floating per annum rate equal to the greater of the Wall Street Journal prime rate minus 1.75% and 2.75% (3.75% as of December 31, 2018).

#### ***Foreign currency exchange risk***

As we expand internationally, our results of operations and cash flows may become increasingly subject to fluctuations due to changes in foreign currency exchange rates. Our revenue is denominated primarily in U.S. dollars and Euros. For the years ended December 31, 2017 and 2018, approximately 43% and 26% of our product revenue, respectively, was denominated in Euros. Our expenses are generally denominated in the currencies in which our operations are located, which is primarily in the United States. A 10% change in exchange rates could result in a change in fair value of \$0.2 million in cash and accounts receivable in 2018. As our operations in countries outside of the United States grow, our results of operations and cash flows may be subject to fluctuations due to changes in foreign currency exchange rates, which could harm our business in the future. To date, we have not entered into any material foreign currency hedging contracts, although we may do so in the future.

## BUSINESS

### Company Overview

We are a medical device company focused on developing and commercializing products intended to transform the way calcified cardiovascular disease is treated. We aim to establish a new standard of care for medical device treatment of atherosclerotic cardiovascular disease through our differentiated and proprietary local delivery of sonic pressure waves for the treatment of calcified plaque, which we refer to as intravascular lithotripsy (“IVL”). Our IVL system (our “IVL System”), which leverages our IVL technology (our “IVL Technology”), is a minimally invasive, easy-to-use and safe way to significantly improve patient outcomes. Our Shockwave M5 IVL catheter (“M5 catheter”) was CE-Marked in April 2018 and cleared by the U.S. Food and Drug Administration (“FDA”) in July 2018 for use in our IVL System for the treatment of peripheral artery disease (“PAD”). Our Shockwave C2 IVL catheter (“C2 catheter”), which we are currently marketing in Europe, was CE-Marked in June 2018 for use in our IVL System for the treatment of coronary artery disease (“CAD”). We have ongoing clinical programs across several products and indications which, if successful, will allow us to expand commercialization of our products into new geographies and indications. Importantly, we are undertaking ongoing clinical trials of our C2 catheter intended to support a pre-market application (“PMA”) in the United States and a Shonin submission in Japan for the treatment of CAD. We anticipate having final data from these ongoing clinical trials intended to support a U.S. launch of our C2 catheter in the first half of 2021 and a Japan launch in the second half of 2021.

### *The Opportunity*

Atherosclerosis is a common disease of aging in which arteries become narrowed (“stenotic”) and the supply of oxygenated blood to the affected organ is reduced by the progressive growth of plaque. Atherosclerotic plaque is comprised of fibrous tissue, lipids (fat) and, when it progresses, calcium. This calcium is present both deep within the walls of the artery (“deep” or “medial” calcium) and close to the inner surface of the artery (“superficial” or “intimal” calcium).

The first two indications we are targeting with our IVL System are occlusive PAD, the narrowing or blockage of vessels that carry blood from the heart to the extremities, and CAD, the narrowing or blockage of the arteries that supply blood to the heart. In the future, we see significant opportunity in the potential treatment of Aortic Stenosis (“AS”), a condition in which the heart’s aortic valve becomes increasingly calcified with age, causing it to narrow and obstruct blood flow from the heart.

The PAD population in the United States has been estimated to be at least eight million people, according to the National Institutes of Health. The global PAD device market size for treatment of occlusive disease is estimated at approximately \$2.9 billion and is expected to grow approximately 3% annually due to the fundamental drivers of an aging population and increasing prevalence of diabetes. The “calcium” segment of the PAD market represents a significant percentage of the market, with 50% or more of the population having moderate-to-severe calcium in their vessels, according to our estimates. Current technologies are often not able to safely and effectively treat heavily calcified vessels. Accordingly, we believe our IVL System to treat PAD has a total addressable market opportunity of over \$1.7 billion.

The global device market in coronary intervention for CAD is estimated to be nearly \$10 billion, according to Millennium Research Group, Inc. (“MRG”). The most common treatment for patients is percutaneous coronary intervention (“PCI”). This involves a suite of devices to facilitate successful angioplasty and stenting, the most commonly used device being drug-eluting stents (“DES”). Moreover, there are nearly four million PCI procedures performed globally every year, and the number of PCI procedures is growing at a rate of more than 5% annually. We believe our IVL System can help grow this market through the improved treatment of patients undergoing PCI in whom the currently available solutions pose a higher degree of clinical risk, as well as through increased adoption of IVL by cardiologists compared to currently available plaque modification devices.

A study published in the *American Journal of Cardiology* in 2014 demonstrated that more than 30% of patients undergoing PCI have calcified lesions and this percentage is growing. Minimizing complications is particularly important in the coronary vessels, but current plaque modification devices carry meaningful safety risks and are inherently challenging to use, which is why these devices are used very sparingly for PCI procedures in patients with calcified coronary disease. Despite significant under-penetration of the market, these devices still represented a market of nearly \$100 million in 2018 within the United States alone, according to MRG; we believe this market is significantly larger globally. Due to the increasing prevalence of calcified cardiovascular disease, the market growth for plaque modification devices exceeds that of PCI procedure growth. We believe the safety, ease of use and efficient impact on calcium of our IVL System will result in rapid adoption and market expansion in markets where our C2 catheter is introduced. We believe there is an over \$2 billion total addressable market opportunity for our IVL System to treat CAD.

The global market for Aortic Valve Replacement (“AVR”), the main treatment for AS, is growing rapidly, and is dominated by the emergence of Transcatheter Aortic Valve Replacement (“TAVR”) devices. TAVR has rapidly developed into a multibillion-dollar market globally. According to an article published in the *Journal of Thoracic Disease* in 2017, the global market for TAVR is over 125,000 procedures performed worldwide in 2018 and is expected to grow to nearly 300,000 by 2025. We believe our IVL System may be able to improve the treatment of AS among patients in whom currently available solutions are inadequate. We are currently developing an IVL catheter which we believe can safely and effectively treat patients with AS. If successful, this represents a potential total addressable market of over \$3 billion for our IVL System to treat AS.

### **Current Challenges**

The primary approaches to treat vascular disease are angioplasty balloons (“balloons”), drug-coated balloons (“DCB”), bare metal stents and DES. These devices all work by using pressurized balloons to expand the diseased blood vessels. Calcified plaque creates challenges for these therapies in achieving optimal outcomes in treating PAD and CAD because the calcified vessels fail to expand under safe pressures. This, in turn, can lead to acute failure, damage to the blood vessel, which increases the rate of restenosis (re-occlusion of the vessel following endovascular treatment) or complications requiring adjunctive tools, future re-interventions or conversion to bypass surgery. These complications are significantly increased when treating calcified cardiovascular disease and include dissections, embolization, restenosis, vessel perforations and vessel recoil.

Plaque modification devices (including atherectomy and specialty balloons) have enhanced the treatment of some moderately calcified cardiovascular lesions by improving the ability of stent and balloon therapies to effectively expand in the vessel. Atherectomy devices are designed to break or remove superficial calcium by cutting or sanding the calcium in order to improve vessel expansion. Specialty balloon devices incorporate metallic elements like wires and cutting blades onto standard angioplasty balloons; these devices are intended to make discreet cuts in the plaque and surrounding tissue in order to improve vessel expansion. Despite improvements in plaque modification devices, significant limitations remain, including being difficult to use and creating complications and inconsistent efficacy. Further, because medial calcium is encased in the vessel wall, the existing plaque modification devices are unable to impact medial calcium without damaging the vessel. Combined, these limitations decrease the utilization of plaque modification devices for treating calcified cardiovascular disease, thereby reducing the clinical benefit of angioplasty and stent therapies compared to their use in non-calcified anatomies.

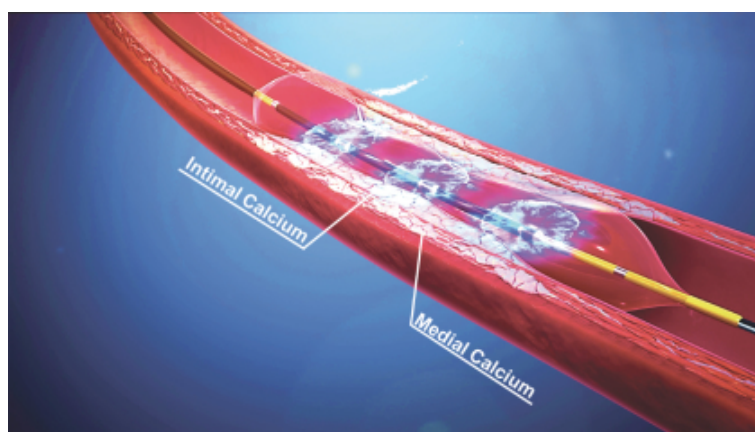
### **Our Solution**

We have adapted the use of lithotripsy to the cardiovascular field with the aim of creating what we believe can become the safest, most effective means of addressing the growing challenge of cardiovascular calcification. Lithotripsy has been used to successfully treat kidney stones (deposits of hardened calcium) for over 30 years. By integrating lithotripsy into a device that resembles a standard balloon catheter, physicians can prepare, deliver and treat calcified lesions using a familiar form factor, without disruption to their standard procedural workflow.

Our differentiated IVL System works by delivering shockwaves through the entire depth of the artery wall, modifying calcium in the medial layer of the artery, not just in the intimal layer. The shockwaves crack this calcium and enable the stenotic artery to expand at low pressures, thereby minimizing complications inherent to traditional balloon dilations, such as dissections or tears. Preparing the vessel with IVL facilitates optimal outcomes with other therapies, including stents and drug-eluting technologies. Using IVL also avoids complications associated with atherectomy devices such as dissection, perforation and embolism. When followed by an anti-proliferative therapy such as a DCB or DES, the micro-fractures may enable better drug penetration into the arterial wall and improve drug uptake, thereby improving the effectiveness of the combination treatment.

Our IVL System includes a generator, connector cable and a variety of IVL catheters designed to treat PAD and CAD. Our IVL System employs our IVL Technology to crack calcium through short bursts of sonic pressure waves, which are generated within the IVL catheter, travel through the vessel and crack calcium with an effective pressure of up to 50 atmospheres (“atm”) (a unit of pressure) without harming the soft tissue. Our IVL catheters utilize multiple lithotripsy emitters that are integrated into a standard, semi-compliant balloon-catheter platform. The IVL catheter is advanced to the target lesion and the integrated balloon is inflated with fluid at a low pressure to make contact with the arterial wall. IVL is then activated through the generator with the touch of a button, creating a small bubble within the catheter balloon which rapidly expands and collapses. The rapid expansion and collapse of the bubble creates sonic pressure waves that travel through the vessel and crack the calcium, allowing the blood vessel to expand under low static pressure.

We believe there is a significant opportunity to apply our IVL Technology as a platform to treat a wide array of indications throughout the cardiovascular system. Ultimately, our plan is to have a family of IVL catheters that can treat calcium-related diseases across a wide variety of vasculatures and structures.



*Our IVL System delivers lithotripsy directly to the calcified vessels using a standard interventional balloon catheter delivery system that is able to make contact with the vessel wall and transmit energy efficiently.*

In addition to the treatment of PAD and CAD, we believe our IVL Technology has the potential to improve the care of patients with AS. AVR is the standard of care for patients suffering from symptomatic severe AS, performed either by surgery (“surgical aortic valve replacement” or “SAVR”) or through a less-invasive TAVR approach. Currently, our M<sup>5</sup> catheters are used in our IVL System to enable transfemoral access above-the-knee in patients for whom severely stenotic and calcified ilio-femoral disease puts them at risk for cardiovascular complications associated with TAVR devices. We believe that increasing the number of patients who can have TAVR performed via transfemoral access, the preferred delivery pathway for TAVR, will help reduce complications associated with the procedure. We are also evaluating the use of our IVL Technology to directly treat patients with symptomatic severe AS in clinical feasibility trials as an alternative to AVR. Our transcatheter aortic valve lithotripsy system (our “TAVL System”) is designed to safely crack calcium in the aortic valve



leaflets, thereby improving leaflet mobility and reducing the severity of AS. The prospect of being able to offer an alternative that either delays or obviates the need for AVR in some patients represents a substantial opportunity to provide a meaningfully safer and less invasive approach to treating AS.

Since inception, we have focused on generating clinical data to demonstrate the safety and effectiveness of our IVL Technology. These initial studies have consistently delivered low rates of complications regardless of which vessel was being studied. In addition to gaining regulatory approvals or clearances, the data from our clinical studies strengthen our ability to drive adoption of IVL Technology across multiple therapies in existing and new market segments. Our past studies have demonstrated that our IVL Technology reduces residual stenosis and vascular complications in infrapopliteal and femoropopliteal PAD, with outstanding durability and sustained improvement in functional outcome in 115 patients. Our past studies have also guided optimal IVL procedure technique and informed the design of our IVL System and future products in development. In the treatment of CAD, our past studies have demonstrated both safety and effectiveness of our IVL System in heavily calcified coronary lesions prior to stenting in 60 patients. Feasibility studies have shown the potential of our TAVL System to safely improve the aortic valve area and reduce transvalvular gradients in AS. We are currently enrolling patients in multiple studies to support applications for approvals and clearances in a variety of indications and geographies, as well as a randomized trial to assess the combination of IVL with DCB for treating PAD.

We market our IVL System to hospitals whose interventional cardiologists, vascular surgeons and interventional radiologists treat patients with PAD and CAD. We have dedicated meaningful resources to establish direct sales capability in the United States, Germany, Austria and Switzerland, and we have complemented those direct teams with distributors, including in Australia, the Baltics, Canada, Czech Republic, France, Italy, the Netherlands, New Zealand, the Nordic region, Poland, Spain and the United Kingdom. We are actively expanding our international field presence through new distributors, additional sales and clinical personnel, and are adding new U.S. sales territories.

We are headquartered in Santa Clara, California, and we have additional operations and facilities in Fremont, California. We currently manufacture our IVL catheters in Fremont, California. As of December 31, 2018, we had 162 full-time employees. Our revenue was \$1.7 million and \$12.3 million for the years ended December 31, 2017 and 2018, respectively, and we incurred a net loss of \$30.6 million and \$41.1 million for those same periods, respectively.

For the treatment of CAD, our C<sup>2</sup> catheter has a CE Mark that indicates its use in calcified, stenotic *de novo* coronary arteries prior to stenting. For the treatment of PAD, our M<sup>5</sup> and S<sup>4</sup> catheters have a CE Mark and have FDA clearances that indicate their use in calcified, stenotic peripheral arteries in patients who are candidates for percutaneous therapy. Our products are not indicated for the treatment of cerebrovascular or carotid arteries; our M<sup>5</sup> and S<sup>4</sup> catheters are not indicated for the treatment of coronary arteries.

While we believe that, from a technological or medical perspective, there are no material disadvantages to the use of our products in comparison to other commercially available alternative products, our products are relatively new, we currently have limited commercialization, sales and marketing experience and our products compete against alternative products that are well-established and are widely accepted by physicians, patients and third-party payors. Many of our competitors are large, well-capitalized companies with significantly greater market share and resources than we have. Our success will depend in part on our ability to increase adoption of our products, expand existing relationships with our customers, obtain regulatory clearances or approvals for our planned or future products, conduct clinical trials on our existing and planned or future products, maintain existing reimbursement and obtain reimbursement where it does not currently exist, and develop new products or add new features to our existing products.

### Why ShockWave? Safe – Simple – Effective

- **Treatment of both superficial and deep calcium.** Our IVL System employs our IVL Technology to create shockwaves that penetrate through the entire depth of the artery wall, modifying calcium in the medial layer of the artery, not just at the superficial, most intimal layer. We believe our IVL System is the only available cardiovascular therapy able to safely and effectively treat medial calcium, which is highly prevalent and for which other existing therapies have limited utility.
- **Improved safety through unique mechanism of action.** By relying on locally delivered sonic pressure, our IVL System safely modifies both intimal and medial calcium without causing perforations, distal embolization or damage to the vasculature and surrounding tissues. We believe that by reducing complications, physicians will also be able to reduce the number of additional devices required to successfully complete the treatment of the patient.
- **Improved efficacy for angioplasty, stents and drug-eluting therapies.** We believe our IVL System enables better interventions in complex calcified lesions by improving the likelihood of the procedure’s success and facilitating optimal outcomes in conjunction with other therapies, including stents, drug-eluting technologies and structural heart interventions.
- **Seamless integration into interventional practice with exceptional ease-of-use.** Our IVL System is portable and easy to install and set-up. There are no special facility requirements, no external connections and no settings to adjust. Physicians prepare and deliver our IVL catheters just as they would a standard angioplasty catheter, and they maintain the ability to use guidewires and other interventional tools of their choice.
- **Expanded access to interventional techniques for patients.** The ability to treat complex calcium effectively and with low safety risk may enable endovascular therapy in multiple underserved patient cohorts, including: common femoral artery stenosis cases currently avoided due to the risk of stenting; critical limb ischemia (“CLI”) patients scheduled for bypass or amputation; transfemoral access instead of alternate access or surgical cut-down for TAVR, Endovascular Aneurysm Repair (“EVAR”) and Thoracic Endovascular Aneurysm Repair (“TEVAR”) procedures; and PCI in patients who may otherwise need a surgical coronary bypass procedure.
- **Cost-saving potential of our IVL System.** We believe that our IVL System will provide economic value to the healthcare system. Multiple value streams can result in cost saving benefits:
  - reduced time required by physicians to understand and adopt our IVL System relative to other therapies;
  - reduced expense to train and support physicians compared to the burdensome and expensive physician certification programs required by manufacturers of some atherectomy devices;
  - reduced cost to hospitals to treat complex calcified disease due to lower risk of complications, less lab time and lower equipment costs per case than other commercially available options; and
  - reduced need for complex, risky and expensive alternative procedures, such as surgery or surgical access for TAVR, EVAR and TEVAR.

### Our Growth Strategy

Our mission is to provide safe, effective and easy-to-use treatments to optimize outcomes for calcified cardiovascular disease. We believe the following strategies will advance our mission and will contribute to our future success and growth.

- **Address unmet clinical needs in multiple large markets.** Calcified cardiovascular disease is a growing treatment challenge that is not safely and effectively treated by existing therapies. Treatment of this disease represents a large, growing total addressable market opportunity across multiple

indications. Patients with calcified arteries are typically excluded from clinical trials and are often referred to highly specialized hospitals and physicians for treatment. This habitual avoidance of complex calcium cases is due to the difficulty in using, and high complication rates associated with, existing therapies. Our IVL System is safe, easy to use and effective for its approved indications. We are targeting PAD and CAD as our first two indications, which represent an existing combined global medical device market of nearly \$13 billion as of 2018, according to MRG. Calcified vascular disease represents an immediate total addressable market opportunity of over \$3.5 billion for our IVL Technology. We believe treating AS, our third target indication which is currently being developed, represents a potential \$3 billion total addressable market opportunity.

- **Advance our IVL System as a common treatment for calcified PAD and CAD.** Our clinical studies demonstrate our IVL System's safety and effectiveness in treating calcified cardiovascular disease. In addition, our IVL System is as familiar and easy to use as a standard angioplasty catheter, making it an attractive option for physicians. Procedures using our IVL System are generally reimbursed by public and private insurers, and there is potential to improve the existing reimbursement profile in the future. To grow our business, we plan to continue to establish and strengthen our clinical evidence and commercial presence in our first two target indications, PAD and CAD.
- **Grow our specialized sales force across indications and geographies to foster deep relationships with physicians and drive revenue growth.** We sell our IVL System through our direct sales organization in the United States, Germany, Austria and Switzerland, and through distribution partners in other geographies. We have assembled a team with in-depth knowledge of the target markets in which we compete and seek to compete. We have also collaborated with many of the physician thought leaders in the interventional cardiology, interventional radiology and vascular surgery communities; they have helped us deliver new and improved products that meet their clinical needs and inform our product pipeline. We intend to grow our sales organization meaningfully as we launch new products, expand our indications and enter new geographies.
- **Execute on our clinical program to expand indications and build a robust body of clinical evidence.** Our clinical and regulatory strategies are designed to gain approval for new products in new indications and new geographies, including our Shockwave S4 IVL catheter ("S4 catheter") and our TAVL System, among others. They are also designed to demonstrate the benefits of our IVL Technology when combined with existing therapies. We are currently enrolling patients in Disrupt PAD III, a study designed to demonstrate the benefit of combining our IVL Technology with DCB as an alternative to standalone DCB in severely calcified femoropopliteal lesions. CAD III, a study designed to demonstrate the safety and efficacy of our IVL Technology when combined with DES in the treatment of severely calcified CAD, began enrolling patients in early 2019. If successful, we expect the data from CAD III will support the approval of our C2 catheter to be used in our IVL System for the treatment of CAD in the United States in the first half of 2021 and Japan in the second half of 2021.
- **Leverage our IVL Technology to develop new products that satisfy significant unmet clinical needs.** For its approved uses, our IVL System has been shown to be safe, effective and easy to use. We see a significant opportunity for the expansion of our IVL Technology beyond our current indications, and we have robust research and development capabilities and a growing intellectual property portfolio to support such expansion. We believe our ability to rapidly and cost-effectively develop innovative products is in large part attributable to our fully integrated product development process. Ultimately, our plan is to have a family of IVL catheters that can be used in our IVL System to treat calcium-related vascular disease throughout the body.
- **Drive profitability by scaling our business operations to achieve cost and production efficiencies.** We plan to drive profitability by expanding the scale and improve the efficiency of our manufacturing process with the goal of lowering our costs and having enough supply to meet demand as we grow our business. We intend to move our production to our new facility in Santa Clara, California in 2019,

which we expect to provide us enough manufacturing space to support our business for the foreseeable future. In the future we intend to lower our cost of goods sold through productivity improvements, the implementation of lean manufacturing and fixed cost absorption as we grow volume.

## The Market

### *Occlusive Calcified Cardiovascular Disease (Atherosclerosis)*

Atherosclerosis is a common disease associated with aging in which arteries become narrowed and the supply of oxygenated blood to the affected organ is reduced by the progressive growth of plaque. Atherosclerotic plaque is comprised of fibrous tissue, lipids (fat) and, when it progresses, calcium. This calcium can be present in multiple layers of the artery. Primarily, it is found in the intimal layer and the medial layer. None of the commercially available technologies, other than our IVL System, are able to adequately target both the intimal and medial layers of calcium.

The first two indications which we have sought to develop our IVL Technology to treat atherosclerotic occlusive PAD and CAD. These diseases decrease the diameter of the blood vessel which impedes the heart's ability to pump oxygenated blood throughout the body and can lead to heart attacks, organ failure, claudication (severe leg pain), tissue loss (including amputation) and ultimately death. In the future, we see a significant opportunity for the use of our IVL Technology in the potential paradigm shifting treatment of AS, a disease characterized by calcification of the aortic valve, which can also lead to death if left untreated.

As of 2018, the global market opportunities for medical devices that treat occlusive PAD and CAD are approximately \$2.9 billion and \$10 billion, respectively, according to MRG. Within these segments, the presence of calcified disease is as high as 30% to 75% of procedures, representing a combined, immediately total addressable market opportunity of over \$3.5 billion for our IVL System. Likewise, our TAVL System could potentially have a total addressable opportunity of over \$3 billion if it is determined to be safe and effective for treating the aortic valve and we are able to obtain relevant regulatory approvals or clearances. We expect these markets to grow significantly due to the following trends:

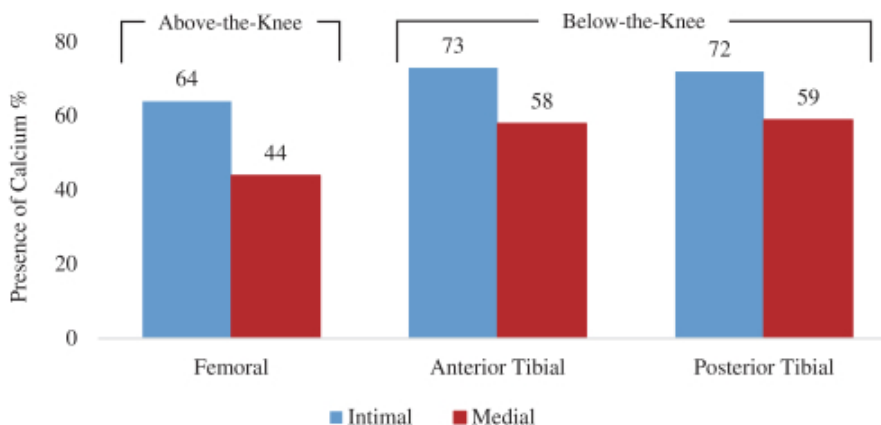
- global, aging population;
- meaningful increase in the number of diabetic patients;
- additional clinical evidence that supports endovascular treatment of cardiovascular disease;
- improvement of technologies to enable safer and more effective endovascular treatment;
- growing evidence of the complications and costs associated with surgical treatment of cardiovascular disease;
- continued support and education of the growing number of physicians who treat cardiovascular disease; and
- increasing patient awareness and physician adoption of less invasive endovascular treatment options.

### *Peripheral Artery Disease (PAD)*

PAD is the narrowing or blockage of vessels that carry blood from the heart to the extremities, caused by the buildup of plaque within the walls of arteries. It is a common, under-diagnosed and under-treated disease whose global patient population, estimated at more than 200 million in 2010 by a paper published in *The Lancet*, is driven by an aging population and increased rates of diabetes, among other causes. The most common symptom of PAD in the lower extremities is claudication and painful muscle cramping in the hips, thighs or calves when walking, climbing stairs or exercising. The more advanced form of PAD, CLI, is characterized by resting pain and sores or wounds that heal slowly and, if not resolved, can lead to amputation of a limb. The PAD population in the United States is estimated to be at least eight million people. Calcium is a prevalent problem and the "calcium" segment of the PAD market is a relatively high percentage of the current commercial market.

Moderate-to-severe calcium can occur in different parts of the peripheral vasculature, including:

- **Femoropopliteal:** Over 325,000 estimated worldwide cases of heavily calcified procedures annually, representing a nearly \$700 million total addressable market opportunity for our IVL System.
- **Common Femoral Artery, Iliac Artery:** Over 300,000 estimated worldwide cases of heavily calcified procedures annually, representing a \$600 million total addressable market opportunity for our IVL System.
- **Infrapopliteal (Below-the-Knee (“BTK”)):** Over 180,000 estimated worldwide cases of heavily calcified procedures annually, representing a nearly \$400 million total addressable market opportunity for our IVL System.



*Medial Calcification Prevalence is higher in PAD below-the-knee than above-the-knee, creating additional challenges for effective treatment and the potential for complications increasing the risk of amputation. Soor, et al, Pathology, June 2008; from ScienceDirect.*

There are expected to be nearly 750,000 PAD endovascular procedures performed in the United States and an additional 500,000 PAD endovascular procedures performed in other developed international markets to treat occlusive disease in 2018, according to MRG. A significant portion of these procedures involves moderate-to-severe calcium, which varies in intensity between vessels. In 2018, the total market for endovascular devices used to treat occlusive PAD was estimated to be approximately \$2 billion and \$950 million in the United States and international markets, respectively, as reported by MRG. Of this, the plaque modification market for PAD is estimated to be over \$600 million annually, nearly all of which is in the United States.

Vessel(s)	Region	Endovascular Procedure Volume(1)	% Calcification(2)
<b>Femoropopliteal (includes superficial femoral artery (“SFA”))</b>	United States	339,000	50%
	International	337,000	
<b>Iliac</b>	United States	212,000	70%
	International	182,000	
<b>Infrapopliteal (BTK)</b>	United States	152,000	65%
	International	133,000	
<b>TAVR Access</b>	United States	55,000	15%
	International	70,000	
<b>EVAR / TEVAR Access</b>	United States	53,000	15%
	International	107,000	
<b>Common Femoral (Surgical Endarterectomy (“CFE”) + Endovascular)</b>	United States	50,000	75%

- (1) Annual procedures in the United States and internationally (nine European countries and Japan), according to MRG, an article published in the *Journal of Thoracic Disease* in June 2017 and Company estimates.
- (2) Proportion of annual procedures associated with calcified disease, according to Yost, M. L., *Prevalence and Significance of Calcium, Vulnerable Plaque and Plaque Morphology in Peripheral Artery Disease (PAD)*. Beaufort, SC: THE SAGE GROUP; 2016 (for femoropopliteal, BTK, TAVR and common femoral) and Company estimates based on multiple occlusive disease studies (for iliac and EVAR / TEVAR).

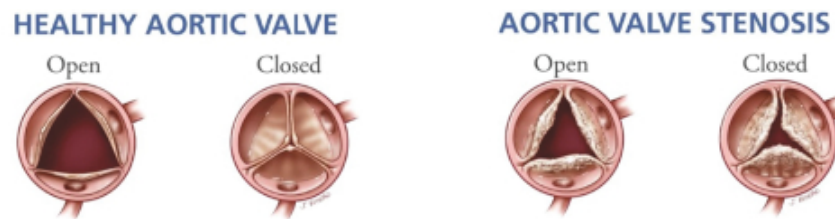
### **Coronary Artery Disease (CAD)**

CAD is the narrowing or blockage of the arteries that supply blood to the heart, caused by the buildup and rupture of plaque within the walls of arteries. As with PAD, its growing prevalence is driven by an aging population and increased rates of diabetes, among others. According to the American Heart Association, approximately 15.5 million people in the United States suffered from CAD in 2016. Patients are treated for CAD following either a heart attack or after presenting symptoms, such as angina, which is an acute pain in the chest. As is the case with PAD, the primary goal of treatment of CAD is to re-open the coronary artery in order to restore adequate blood flow to the heart muscle.

Plaque modification devices for treating CAD are under-penetrated in the market due to a number of reasons, including the difficulty to use available devices, their limited effectiveness in some cases and the potential for serious complications to the patient. Despite these significant limitations, they still represent a market of nearly \$100 million in 2018 in the United States and Japan alone, according to MRG, an amount we believe is significantly larger globally. Moreover, due to increasing prevalence of calcified disease, we believe that our safe, simple and effective solution in approved indications can increase the utilization of IVL Technology beyond the existing market for plaque modification devices.

### **Aortic Stenosis (AS)**

AS is a condition where the heart's aortic valve, which regulates oxygenated blood flow from the heart to the rest of the body, becomes increasingly calcified with age. As the calcium burden on the valve increases, the valve narrows and stiffens, reducing the ability to pump blood from the heart to the rest of the body. Patients who become symptomatic and/or are diagnosed with severe AS are treated by surgically replacing the aortic valve. Historically, this procedure, SAVR, was a highly invasive surgical procedure. Over the last decade, a new class of devices known as TAVR has enabled interventional cardiologists to replace the valve through a less invasive, catheter-based endovascular approach. According to an article published in the *Journal of Thoracic Disease* in 2017, the global market for TAVR is estimated to be over 125,000 procedures performed worldwide in 2018 and is expected to grow to nearly 300,000 by 2025.



AS results from calcification that inhibits the aortic valve from opening and closing effectively.

### **Current Treatments & Limitations**

#### **Occlusive Calcified Cardiovascular Disease (Atherosclerosis)**

The primary approaches to treat occlusive cardiovascular disease are balloons, DCB, stents and DES. The drug-eluting technologies were designed to reduce restenosis rates associated with balloons and bare metal stents.

The application of medical therapy via balloons or stents targets the inflammatory response caused by the use of devices, to reduce the risk of restenosis. The delivery of drugs in conjunction with vessel dilation has been shown to improve long-term results in atherosclerotic disease. Treatment with balloons and stents is often suboptimal because calcified vessels fail to expand under pressure. This in turn can lead to acute failure, damage to the intimal layer leading to restenosis or acute complications requiring adjunctive tools or conversion to bypass surgery.

Plaque modification devices have also meaningfully contributed to the advancement in the treatment of cardiovascular disease. These devices are designed to improve the outcomes of angioplasty and stenting by modifying the calcium, thus improving the ability of the vessels to expand. Some of these devices are incremental, such as specialty angioplasty balloons, and others are more paradigm-shifting, such as atherectomy. The specialty balloon devices incorporate metallic elements like wires and cutting blades onto standard angioplasty balloons; these devices are intended to make discreet cuts in the plaque and surrounding tissue. The atherectomy devices vary in function with mechanisms, including carving, “sanding”, high-pressure mechanical disruption, focused dissection and laser ablation of the plaque and surrounding tissue.

In patients with moderate and severe calcium, the complications associated with endovascular treatment are significantly increased. Particularly in cases where there is medial calcium, where existing plaque modification devices cannot effectively modify the calcium without damaging the surrounding tissue. These severe complications commonly include:

- **Dissections:** The abnormal, and usually abrupt, formation of a tear along the inside wall of an artery. If the tear is large enough, blood can accumulate behind the tear creating blood clots or the tear itself can block the flow of blood. Treatment options for managing a dissection include additional balloons, stenting or for PAD, implantation of a covered stent.
- **Embolization:** Particles that travel down the bloodstream and occlude the artery as it narrows. These particles can be blood clots, thrombus, vascular tissue or calcium. While embolization is inherently a risk with all procedures, the use of cutting or sanding tools increases the risk of creating these particles as part of the procedure to occlude blood flow.
- **Restenosis:** Re-occlusion of the vessel following endovascular treatment, leading to the need for one or more repeat treatments.
- **Vessel Perforations:** A hole or break in the vessel wall. Depending on where the perforations occur in the vasculature, this could be a life-threatening event. Treatment is usually implantation of a covered stent.
- **Vessel Recoil:** After expansion is created by ballooning or stenting, the vessel does not maintain its larger diameter and recoils to a smaller diameter which continues to inhibit blood flow. With balloons, this may mean insufficient lumen gain. With stenting, this may result in an under-expanded stent, which is a serious complication that may require surgery to repair.

Advances in technologies have addressed many of the challenges associated with non-calcified lesions. However, these advancements do not adequately address the challenges posed by calcified lesions. For example, DCB and DES have generally been studied in patients without severe calcification. In the limited PAD clinical trials where DCB have been evaluated in severely calcified arteries, their effectiveness was significantly lower than in non-calcified arteries and not noticeably different than other treatment modalities, according to a study published in *CardioVascular and Interventional Radiology* in May 2014.

Plaque modification devices were initially considered the advancement needed to effectively treat all lesion types, including calcified lesions. However, due to the nature of how these devices modify the vessel, their use can create additional complications, including severe dissection, perforation and distal embolism. Furthermore, because these devices can cause damage to the surrounding healthy artery, they may increase the risk of restenosis, which would put the patient at an increased risk of requiring a repeat procedure.

We believe that by successfully addressing cardiovascular calcification and by enabling safer and more effective treatment of the disease, the use of our IVL Technology delivered through our IVL System will lead to an increase in the number of patients who receive endovascular treatment for calcified cardiovascular disease rather than surgery in approved indications.

### ***Peripheral Artery Disease (PAD)***

Initial treatment for PAD is through medication and lifestyle adjustments. More advanced cases are treated using invasive CFE (surgical removal of the inside of the blood vessel), surgical bypass or minimally invasive interventional procedures. The primary goal of interventional therapy is to re-open the peripheral artery to restore adequate blood flow, thereby eliminating leg pain or supporting wound healing.

Percutaneous Balloon Angioplasty (“PTA”) is a catheter-based procedure that uses a balloon to open a blood vessel. It is the most common tool for PAD due to its simplicity and low cost. However, balloons often fail to open the vessel due to vessel recoil, which occurs when the diseased vessel fails to stay open immediately after the PTA procedure. PTA procedures also use high pressure which can cause vessel injury, and which is associated with poor long-term outcomes. When PTA fails, stent implantation can help improve acute outcomes and has better long-term outcomes than PTA. But in many cases, stent implantation is not preferred because it leaves metal in the peripheral arteries reducing future treatment options. Considerations for selecting a device to treat PAD include planning for the best acute outcome, choosing a therapy that may provide good long-term outcomes and the eventual likelihood of re-intervention or intervention in another part of the vasculature.

Moderate-to-severe calcium poses different challenges and an unmet need in various parts of the peripheral vasculature. The use of high-pressure balloons and stents can result in dissection, perforation and barotrauma, which result in restenosis. The use of atherectomy devices damages the vessel and can cause embolization. Further, heavy calcium can prevent full stent expansion and can also cause vessel recoil after angioplasty due to the stiffness of the vessel.

- **Femoropopliteal:** Endovascular intervention is the most common treatment for occlusive disease in the femoropopliteal arteries, principally via atherectomy, PTA and stenting. While endovascular procedures are generally profitable for hospitals, treating complex lesions is much more resource intensive, and treatment of these types of patients can be unprofitable for hospitals.
- **Common Femoral Artery:** The common femoral artery is found at the junction between the SFA and the iliac arteries. Occlusive disease in this location is typically treated by CFE. Recent studies, however, have shown that CFE is not a benign procedure and not all patients are good candidates for this therapy. CFE can lead to complications such as infection and an increased length of hospital stay for the patient. Endovascular treatment has not been considered a primary treatment option previously due to calcium-related risks, such as embolization and dissection, which is subsequently treated with stenting and risks blocking blood flow.
- **Infrapopliteal (BTK):** BTK lesions are more commonly found in patients with the more advanced CLI. The most common clinical treatment approach is PTA. Failure of PTA, including balloon rupture, is more common in BTK lesions because medial calcification is most prevalent in these vessels and because the vessels are smaller and more tortuous. Reinterventions due to failed treatment are also more common, as they are required to ensure adequate blood flow for ongoing wound healing. Importantly, calcium has been shown to be an independent predictor of poor wound healing and increased amputation risk in patients with CLI. Further, distal emboli can be a severe complication in patients with CLI.
- **Iliac Artery:** Stenting is considered the standard of care for symptomatic iliac disease with good acute diameter gain and long-term outcomes. Though calcium is common in the iliac arteries, modifying calcium in these vessels has not previously been an option because of the large diameter and potentially catastrophic outcome if the iliac is ruptured during treatment. As a result, atherectomy devices are not approved for use in the iliac arteries.



Calcified iliac and femoral arteries can hinder the delivery of large endovascular devices for other catheter-based procedures, including those that treat aortic aneurysms (EVAR and TEVAR), severe aortic stenosis treated with TAVR and cardiac support devices for high-risk PCI (e.g. Abiomed's Impella). The standard practice for these procedures is to gain vascular access in the femoral artery and insert large diameter sheaths that facilitate the delivery of the treatment devices to the aorta or the heart. However, when significant calcium is present in these arteries, it can prevent delivery of the devices, and thus may require more invasive treatments, increase complications or prevent the device from being used altogether. For example, in up to 20% of patients, the transfemoral approach through the iliac and femoral arteries is not viable for TAVR delivery or creates risk due to the extent of vascular calcification, according to a 2018 study in the *Journal of the American College of Cardiology*.

With increasing frequency, our IVL System using our M<sup>5</sup> catheters is being used to crack the ilio-femoral calcium prior to insertion of devices that are delivered via large-diameter catheters. Treating these arteries with our IVL System makes them more pliable and enables them to stretch and bend, thus accommodating the large-diameter catheters required for TAVR, EVAR, TEVAR and Impella. We have observed that many of the cardiologists using TAVR and Impella in Europe also perform PCI in the same interventional lab. Introducing physicians in the United States to our IVL System for large bore access can be beneficial in terms of building awareness and access to our IVL Technology in advance of the regulatory approval or clearance of our C<sup>2</sup> catheters in the United States.

In December 2018, we entered into a collaboration with Abiomed, a leading global provider of medical devices that provide circulatory support. Pursuant to this collaboration, we will work with Abiomed to integrate our products into Abiomed's physician training and education programs. In connection with the collaboration, Abiomed purchased shares of our Series D convertible preferred stock.

There are multiple treatment options for PAD across the different vessel types throughout the vascular system. Each treatment type presents different limitations and safety issues, which restrict their use by physicians. The following table summarizes the treatment options for each vessel type, their frequency of use and the challenges calcium poses for each treatment option.

<b>Vessels</b>	<b>Endovascular Treatment</b>	<b>Frequency of Use</b>	<b>Challenges Associated with Use in Calcified Lesions</b>
<b>Femoropopliteal &amp; Common Femoral</b>	PTA & DCB	Moderate	<ul style="list-style-type: none"> <li>• Perforation, Dissection, Recoil</li> </ul>
	Stents & DES	Moderate	<ul style="list-style-type: none"> <li>• Limited Drug Uptake (DCB)</li> <li>• Crushed Stents</li> </ul>
	Plaque Modification	Moderate	<ul style="list-style-type: none"> <li>• Perforation, Dissection, Recoil</li> <li>• Lack of efficacy in medial calcium</li> <li>• Difficulty of use and procedure time</li> </ul>
<b>Iliac</b>	PTA Stents/covered stents	Moderate High	<ul style="list-style-type: none"> <li>• Dissection</li> <li>• Perforation</li> <li>• Recoil</li> </ul>
	Plaque Modification	Low	<ul style="list-style-type: none"> <li>• Catastrophic perforation</li> <li>• Large vessel size</li> <li>• Embolization</li> </ul>
<b>Infrapopliteal (BTK)</b>	Angioplasty	High	<ul style="list-style-type: none"> <li>• Perforation, Dissection, Recoil</li> </ul>
	Stents	Low	<ul style="list-style-type: none"> <li>• High restenosis rates</li> <li>• Increases complexity of reintervention</li> </ul>
	Plaque Modification	Moderate	<ul style="list-style-type: none"> <li>• Embolization</li> <li>• Lack of efficacy in medial calcium</li> </ul>

### Coronary Artery Disease (CAD)

The most common treatment for patients with CAD is PCI. This involves a suite of devices to facilitate successful angioplasty and stenting (most commonly DES) of the culprit artery or arteries. According to MRG, there are nearly 4 million PCI procedures performed globally every year, and the growth in PCI procedures is more than 5% annually. A study published in the *American Journal of Cardiology* in 2014 demonstrated that more than 30% of patients undergoing PCI have calcified lesions and that this percentage is growing. Calcium can impair the ability to deliver and expand coronary stents. The complication rates for patients undergoing PCI increase significantly with a greater calcium burden. Further, the long-term outcomes in patients who have increased calcium are worse, including increased risk of death and increased need for target lesion revascularization. Due to the demographic changes discussed earlier, the percentage of PCI cases that include moderate-to-severe calcium are increasing at a faster rate than the growth of non-calcified PCI cases. There is an unmet need for tools to safely and effectively treat calcified CAD, which is increasing.

As with PAD treatment, plaque modification devices are used to facilitate PCI in patients with moderate-to-severe calcium. This class includes atherectomy devices and specialty angioplasty balloons. The most common mechanism in coronary atherectomy is to “sand” the calcium with miniature, high-speed, drill-like catheters known as either “rotational” or “orbital” atherectomy. Physicians typically use these devices in conjunction with, and in preparation for, stents and balloons. When there is significant calcium present and plaque modification devices are not used successfully, however, it is difficult to fully expand the stent due to the under-treated calcium, and when stents are under-expanded there is an increased risk of stent thrombosis, creating an increased risk that the patient suffers from chest pain or a future heart attack.

Due to the risk of complications and complexity of the anatomy, coronary atherectomy devices are difficult to use. They necessitate specialized training, physician certification and significant support from manufacturers. Use of these devices can cause severe complications and damage to healthy tissue due to the high-speed rotation of atherectomy and the high-pressure mechanical trauma of specialty balloons. These complications include severe dissection, perforation and distal embolism. When these complications occur during treatment of a coronary artery, the patient may experience major adverse events (“MAE”), including greater damage to the heart (myocardial infarction) and even death. Because these devices can damage the surrounding healthy artery, they may increase the risk of future restenosis, which puts the patient at risk of a heart attack or the need for a repeat procedure. Specialty balloon devices also incorporate metallic elements like wires and cutting blades onto standard angioplasty balloons. These devices are intended to make discreet cuts in the plaque and surrounding tissue.

For many interventional cardiologists and treatment centers, the burden of training and certification, the increased time and complexity in using plaque modification devices and the risk of serious procedural complications limit the use of such devices. This has led to a low penetration in cases with significant calcium burden.

Device Type	Device Utilization in Calcified Cases	Challenges
<b>Atherectomy</b>	<b>Low</b>	<ul style="list-style-type: none"><li>• Ease of Use</li><li>• Dissections &amp; Perforations</li><li>• Distal Embolism</li><li>• Bifurcated lesions</li><li>• Large vessels (i.e., Left Main Artery)</li><li>• Damage to healthy vessel</li><li>• Tortuous vessels</li></ul>
<b>Specialty Balloon</b>	<b>Low</b>	<ul style="list-style-type: none"><li>• Efficacy in severe, diffuse calcium</li><li>• Dissections &amp; Perforations</li><li>• Damage to healthy vessel</li></ul>

### ***Aortic Stenosis (AS)***

Patients who become symptomatic and/or are diagnosed with severe AS are treated by replacing the aortic valve. Historically, this procedure was a highly invasive surgical procedure. Over the last decade, however, TAVR has enabled interventional cardiologists to replace the valve through a less invasive, catheter-based endovascular approach. The introduction of TAVR has led to a paradigm shift in treating patients with severe AS and has enabled access to a life-saving therapy for severe AS patients who otherwise would generally have no safe and effective option. TAVR has also led to an increasing diagnosis of patients with symptomatic severe AS. TAVR, however, introduces the potential for certain significant complications, including risk of ischemic stroke and cardiovascular complications associated with the delivery of the catheter. In patients with severely stenotic and calcified iliofemoral disease, the large diameter catheters required to deliver TAVR devices can create severe cardiovascular complications or even necessitate the use of alternative access routes, such as the subclavian, direct aortic, transcaval and transapical approaches. Furthermore, TAVR outcomes can be compromised or can be prohibitive in patients with poor ventricular function or other co-morbidities that preclude safe administration of the pharmaceutical regimen required after the TAVR procedure. We believe there is significant potential for our IVL Technology to be used as a synergistic procedure to facilitate TAVR access and thus avoid a potentially more invasive procedure. Additionally, we are evaluating the use of our IVL Technology to directly treat patients with symptomatic severe AS in clinical feasibility trials as an alternative to aortic valve replacement. Our TAVL System is designed to safely crack calcium in the aortic valve leaflets, thereby improving leaflet mobility and reducing the severity of AS.

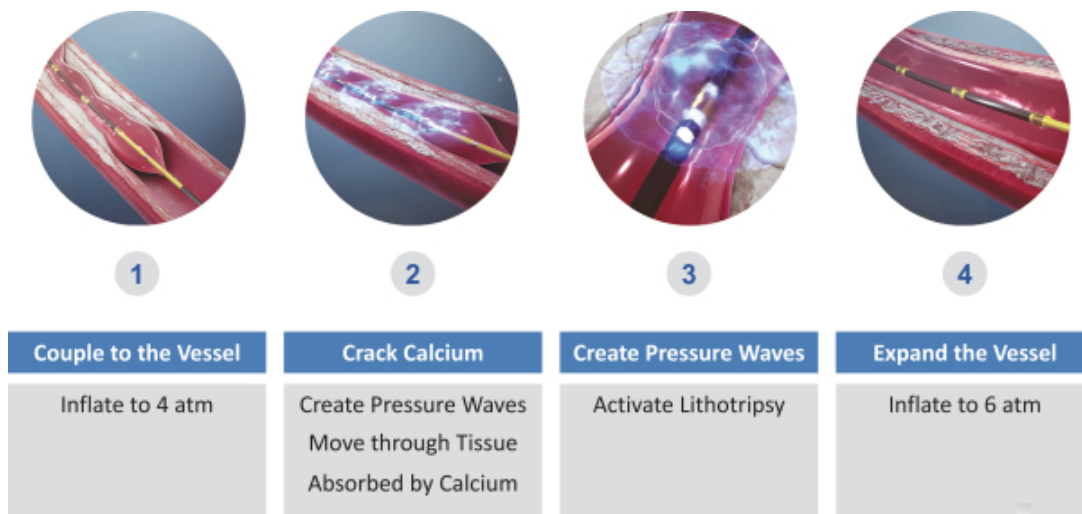
### **Our Approach**

Our IVL System utilizes a generator, connector cable and IVL catheter to create short bursts of sonic pressure waves that travel through the diseased vessel. These pressure waves crack calcium with an effective pressure of up to 50 atm without harming the soft tissue of the vessel. The IVL catheter consists of a semi-compliant balloon catheter integrated with multiple lithotripsy emitters specific to each region of the body.

During the procedure, the IVL catheter is advanced to the target lesion, and the integrated balloon is inflated with fluid at a low pressure so the balloon is able to make contact with the artery wall and facilitate efficient energy transfer. IVL is then activated with the touch of a button on the connector cable, creating a small bubble that rapidly expands and collapses within the catheter balloon. The expansion and collapse of this bubble creates sonic pressure waves that pass through the artery and cracks both intimal and medial calcium, making the artery more compliant, enabling it to be dilated by the balloon at very low pressures. This minimizes injury inherent with traditional high-pressure balloon dilations or atherectomy devices typically used to treat calcified lesions.

After cracking the calcium with IVL, the physician may decide to perform additional endovascular treatments, depending on the location and type of lesion. IVL enables more effective delivery and expansion of stents or balloons at lower pressure. When followed by an anti-proliferative therapy such as DCB or DES, the micro-fractures may enable better drug penetration into the arterial wall and improved drug uptake, thereby improving the effectiveness of the combined treatment.

**The IVL Procedure**



We believe there is significant opportunity to apply our IVL Technology as a platform to treat a broad scope of vasculature, and therefore a broad scope of indications. The interchangeability of specific catheters enables delivery of IVL therapy across diseased vasculature throughout the body. Ultimately, our plan is to have a family of IVL catheters that can treat calcium-related vascular disease.

### ShockWave IVL System Components



**ShockWave IVL Catheters:** Our IVL catheters are prepared in the interventional lab and delivered through the blood vessel, just like traditional balloon angioplasty devices. Our IVL catheters incorporate proximal and distal radiopaque markers for visibility under fluoroscopy. At the touch of a button, miniaturized lithotripsy emitters create high-pressure sonic waves through a conversion of electrical energy into mechanical energy. These pressure waves are created along the length of the balloon at a frequency of one per second and propagate spherically from the emitters to impact calcium in all directions.



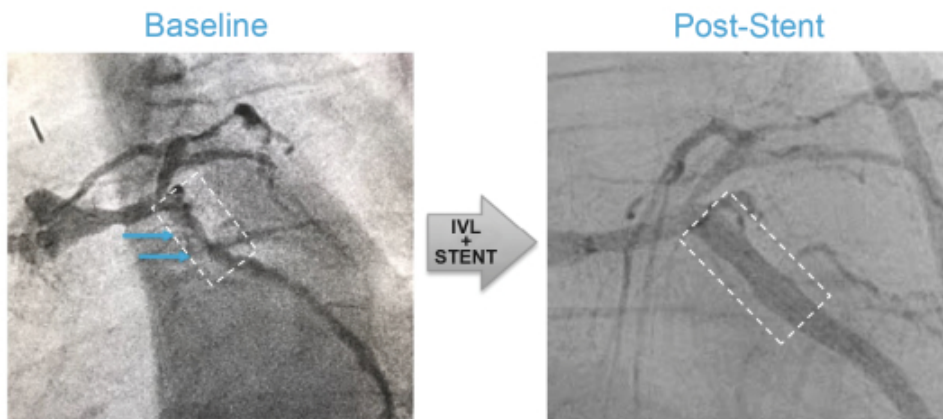
**IVL Connector Cable:** Our IVL catheters attach to our IVL connector cable through a magnetic plug designed to provide a simple and secure connection. The physician activates the lithotripsy by pushing a button on the IVL connector cable.



**IVL Generator:** Our compact, battery-powered, rechargeable IVL generator is linked to the balloon catheter via the IVL connector cable. By design, the IVL generator recognizes which type of IVL catheter is connected and the generator software then determines how much power and how many pulses to deliver.

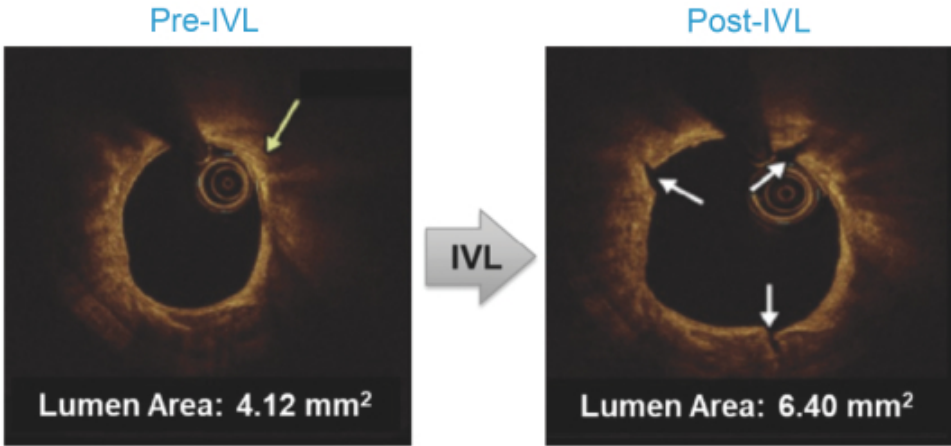
### Angiographic Images of Calcified Coronary Lesion Prior to IVL, Post-IVL and Post-Stent

The angiogram images below show the treatment of a heavily calcified left anterior descending artery in the heart. Baseline imaging shows a calcified stenosis, to which IVL is delivered at a balloon pressure of only 4 atm. With subsequent pulses and without increasing the balloon pressure, the balloon expands, demonstrating IVL's efficacy in cracking calcium and making the artery more compliant. The final angiogram shows a widely patent vessel after stent implantation.



*OCT Images of Calcified Coronary Lesion Prior to IVL and After IVL*

Below, optical coherence tomography (“OCT”) imaging shows on the left, stenotic vessel with circumferential calcium prior to treatment by IVL and on the right, cracks in the calcium and luminal diameter gain (from 4.1 mm<sup>2</sup> to 6.4 mm<sup>2</sup>) following IVL.



**Broad Anatomical Applications**

Below is a summary of the vasculature in which IVL can be used and what we believe are its benefits:

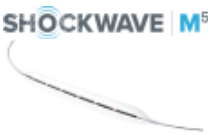


<b>Patient Segment</b>	<b>Expected IVL Advantages</b>	
<b>PAD</b>	Femoropopliteal (including SFA)	<ul style="list-style-type: none"> <li>• Improves ease of use</li> <li>• Reduces procedure time</li> <li>• Lowers complications</li> <li>• Helps with cost containment</li> <li>• Addresses medial calcium</li> </ul>
	Iliac Occlusive Disease	<ul style="list-style-type: none"> <li>• Reduces risk of complications (e.g. dissection, rupture)</li> <li>• Enables stent delivery and full expansion</li> </ul>
	Common Femoral	<ul style="list-style-type: none"> <li>• Avoids embolic debris in the profunda artery</li> <li>• Enables safe endovascular treatment options</li> <li>• Avoids risks associated with surgical endarterectomy</li> <li>• Improves outcomes</li> <li>• Provides option for treating the trifurcation</li> </ul>
	Infrapopliteal (BTK)	<ul style="list-style-type: none"> <li>• Lowers complications vs. atherectomy</li> <li>• Reduces recoil</li> <li>• Addresses medial calcium</li> </ul>
<b>EVAR &amp; TEVAR</b>	Access	<ul style="list-style-type: none"> <li>• Reduces complications associated with large-diameter delivery systems</li> <li>• Enables transfemoral access and contains costs</li> </ul>
	Stent-graft Deployment	<ul style="list-style-type: none"> <li>• Reduces complications associated with under-expanded iliac grafts</li> </ul>
<b>CAD</b>	Stable Angina	<ul style="list-style-type: none"> <li>• Improves ease of use</li> <li>• Reduces procedure time</li> <li>• Lowers complications</li> <li>• Improves outcomes</li> </ul>
	Acute Coronary Syndromes (unstable/emergency patients)	<ul style="list-style-type: none"> <li>• Lowers complications vs. direct stenting</li> <li>• Improves outcomes vs. direct stenting</li> <li>• Reduces hospitalization time vs. staged procedures</li> </ul>
<b>AS</b>	TAVR Access	<ul style="list-style-type: none"> <li>• Reduces complications</li> <li>• Enables transfemoral access</li> <li>• Reduces costs associated with alternate access</li> </ul>
	Primary Therapy	<ul style="list-style-type: none"> <li>• Stabilizes patients to improve future treatment options</li> <li>• Avoids the long-term risks associated with an implant</li> </ul>

**Our Products****Current Marketed Products**

We are marketing our IVL System using M5 catheters (“medium” vessel, five-emitters) for treating PAD in the United States and internationally. We are marketing our IVL System using C2 catheters (coronary, two-emitters) for treating CAD in select international markets. We received an investigational device exemption (“IDE”) to conduct our pivotal global study for our IVL System using our C2 catheters, which is intended to support U.S. FDA and Japanese Shonin approval of the device. We commenced enrollment of the study in early 2019. Our IVL catheters resemble in form and function a standard balloon angioplasty catheter, the device most


commonly used by interventionalists. This familiarity makes our IVL System easy to learn, adopt and use on a day-to-day basis.

Our IVL catheters are single-use and are powered in our IVL System by our non-disposable IVL generator and IVL connector cable.

<u>Disposable Products</u>	<u>Specifications</u>	<u>Indications</u>	<u>Regulatory Status</u>
	<ul style="list-style-type: none"> <li>• 3.5 – 7.0 mm diameter</li> <li>• 60 mm length</li> <li>• 5 lithotripsy emitters</li> <li>• 6 &amp; 7 Fr sheath compatible</li> <li>• 300 pulses (max)</li> </ul>	Peripheral vascular use excluding carotid and cerebral vessels	FDA 510(k) clearance and CE Mark in 2018
	<ul style="list-style-type: none"> <li>• 2.5 – 4.0 mm diameter</li> <li>• 12 mm length</li> <li>• 2 lithotripsy emitters</li> <li>• 6 Fr guide compatible</li> <li>• 80 pulses (max)</li> </ul>	Calcified <i>de novo</i> coronary arteries in CAD	CE Mark in 2018 Ongoing global IDE study. Enrollment began in early 2019.
<u>Reusable Products</u>	<u>Specifications</u>	<u>Indications</u>	<u>Regulatory Status</u>
	<ul style="list-style-type: none"> <li>• Compact &amp; portable</li> <li>• Rechargeable power supply</li> <li>• 3 kV output at 1 Hz</li> <li>• Intuitive controls</li> <li>• Ergonomic handle</li> <li>• Reusable</li> </ul>	For use with ShockWave Medical IVL catheters	FDA 510(k) in 2016 and CE Mark in 2014

**Our Product Pipeline**

We believe there is a significant opportunity to apply our IVL Technology to additional cardiovascular indications. Our strategy is to maintain a robust, efficient product development team that will continue to create lithotripsy-based products that meet our customers’ unmet needs. In addition to our pipeline of new products, we will continue to focus on building clinical evidence through both company-sponsored and investigator-sponsored research.

<u>Pipeline Product</u>	<u>Specifications</u>	<u>Indications</u>	<u>Regulatory Status</u>
	<ul style="list-style-type: none"> <li>• 2.5 – 4.0 mm diameter</li> <li>• 40 mm length</li> <li>• 4 lithotripsy emitters</li> <li>• 5 Fr sheath compatible</li> <li>• 160 pulses (max)</li> </ul>	Peripheral vascular use excluding carotid and cerebral vessels	FDA 510(k) and CE Mark in 2018

The next product that we plan to broadly commercialize through our IVL System will be our S4 catheter (“small” vessel, four-emitters) for treating PAD BTK. We have 510(k) clearance and CE Mark for the use of our S4 catheters in our IVL System. Our experience to date suggests the S4 catheter may be effective at modifying the calcium below-the-knee (which includes significant medial calcium) without causing distal embolic clinical events. We are continuing to assess the performance of the product, including its deliverability and durability in long, calcified and stenotic lesions. The S4 catheter is powered by the same generator and connector cable that power the other IVL catheters.

In July 2018, we initiated and subsequently completed a voluntary recall of the S4 catheters based on an inability of the balloon to maintain inflation due to suboptimal balloon wall thickness in some of the sizes. We



are currently engaged in a redesign and a limited market release of the product to test its performance in the heavily calcified and challenging BTK environment and expect to launch the new catheters in the second half of 2019. There were no reports of adverse clinical events related to this issue.

### ***Transcatheter Aortic Valve Lithotripsy (TAVL)***

We are also exploring the ability of our IVL Technology to directly treat calcified aortic valves to safely reduce the symptoms of and potentially delay or negate valve replacement treatment for AS. Our IVL Technology can potentially be used to apply lithotripsy directly to the aortic valve leaflets, called transcatheter aortic valve lithotripsy (“TAVL”). This represents a potentially significant long-term opportunity and is currently in clinical feasibility trials. Our TAVL System is designed to safely crack calcium in the aortic valve leaflets, thereby improving leaflet mobility and reducing the severity of AS. If TAVL-mediated calcium fracture is successful, valve leaflets will be re-mobilized and the valve will open more effectively, allowing increased blood delivery from the heart to the rest of the body. The initial goal of this technology is to safely, and without the associated risks of a prosthetic valve implant, decrease the severity of AS and its associated symptoms. We believe our TAVL System could provide a valuable alternative treatment option for a significant population of patients with AS including those who are:

- absolutely contraindicated for SAVR or TAVR;
- at higher risk for complications from SAVR or TAVR;
- in need of treatment for other conditions prior to receiving TAVR, such as hip or knee replacement, cancer surgery, correction of metabolic or nutritional deficiency;
- younger, for whom delaying valve replacement may reduce the likelihood of needing a subsequent valve-in-valve procedure; and
- suffering from moderate AS (in whom treatment with our TAVL System could delay the onset of symptomatic severe AS).

## **Clinical Studies**

### ***Overview of Clinical Programs***

We are committed to obtaining clinical evidence to support the safety and effectiveness of our products based on our IVL Technology. The data from our clinical studies strengthen our ability to drive the adoption of products based on our IVL Technology across multiple therapies in existing and new market segments. We expect our clinical evidence will support regulatory approvals, provide physicians with safety and efficacy data on the appropriate use of our IVL System and demonstrate the cost effectiveness of our IVL System. A recurring theme across the studies we have conducted is our ability to treat calcified lesions with a strong safety profile.

Investment in clinical evidence is a core strategy of our company. We involve physician advisors who are recognized for excellence in cardiovascular medicine to assist us with clinical study designs. We also seek to ensure rigorous, high-quality data collection and reporting using imaging core laboratories and clinical events committees (“CEC”) for an independent assessment of safety and imaging-based effectiveness endpoints.

We have completed five clinical studies with a total of 179 patients, across 22 centers in multiple countries, for peripheral and coronary artery and cardiac valve diseases. We are currently conducting or planning five other studies, involving nearly 2,000 patients in up to 190 centers in the United States and internationally.

Below is a chart of our completed, ongoing and planned clinical programs:

	Name	Trial	Size	Sites	Product	Geography	Primary Endpoint(s)	Outcome / Conclusion	Enrolled
Peripheral	<b>Disrupt PAD I</b>	Pre-market, OUS, single arm	n=35	3	MV60	EU; NZ	Acute; 30d	CE Approval	2014
	<b>Disrupt PAD II</b>	Pre-market, OUS, single arm	n=60	8	MV60	EU; NZ	30d; 12m	510(k) Approval	2015
	<b>Disrupt PAD III</b>	Global, post-market RCT	n=400	60	M5	US; EU; NZ	Acute; 12m	Market adoption	—
	<b>Disrupt PAD III Observational Study</b>	Global, post-market registry	n=1,000	60	M5	US; EU	Acute	Market adoption	—
	<b>BTK Registry</b>	Post-market, OUS, single arm	n=20	3	MV60	EU; NZ	30d	Support CE Mark and 510(k) for S4	2016/2017
Coronary	<b>Disrupt CAD I</b>	Pre-market, OUS, single arm	n=60	7	C2	EU; AUS	30d	CE Approval	2015/2016
	<b>Disrupt CAD II</b>	Post-market, EU, single arm	n=120	15	C2	EU	30d	Post-Market Study	—
	<b>Disrupt CAD III</b>	Pre-market, Global, single arm	n=392	50	C2	US; EU	30d	US Coronary PMA Approval	—
	<b>Disrupt CAD IV</b>	Pre-market, JP, single arm	n=64	5	C2	JPN	30d	JP Coronary Shonin Approval	—
TAVL	<b>TAVL FIM Study</b>	First-in-man feasibility study	n=4	1	TAVL	Paraguay	30d	Feasibility	2016
	<b>TAVL Chronic Study</b>	Feasibility study	n=20	3	TAVL	Australia	30d	Safety & Feasibility	2019

## Completed Clinical Studies

### *Clinical Studies to Support Use of our IVL System in the Treatment of PAD to Date*

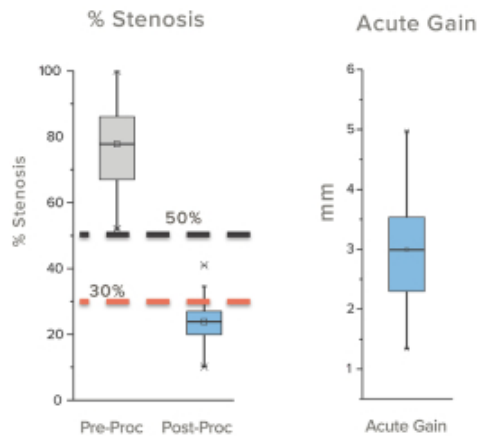
To date, all of our PAD studies were performed using our first generation IVL catheter called MV60. MV60 is identical to our recently introduced M5 catheters in all but two ways. The first difference is that each M5 catheter is able to deliver up to 300 pulses, whereas the MV60 catheter was only able to deliver 180 pulses. The second difference is that each pulse from an M5 catheter delivers approximately 40% more energy than a pulse from the MV60 catheter. These changes have improved the efficacy of our IVL System and helped reduce the overall procedure cost by requiring fewer devices to complete the treatment. In 2019, we expect that all of our M5 catheters will have replaced our MV60 catheters for commercial and clinical trial use.

**The Disrupt PAD I** study was a prospective, non-randomized, multicenter study to demonstrate the safety and performance of our IVL System using the MV60 catheter in heavily calcified femoropopliteal lesions. This study demonstrated the safety and effectiveness of our IVL System as a standalone treatment in calcified, femoropopliteal PAD up to six months. The study showed 100% procedural results, excellent safety and a low use of adjunctive therapies. The data from this study was supportive of the 510(k) clearance for the use of our M5 catheters in our IVL System.

Between January 2014 and September 2014, 35 patients were enrolled at three centers in Europe and New Zealand. All patients had heavily calcified, femoropopliteal lesions and were treated with standalone IVL System

therapy. Key study endpoints included MAEs at 30 days and six months, procedural success, and vessel patency and freedom from target lesion revascularization (“TLR”) at 30 days and six months. All results were adjudicated by an independent core lab and CEC.

The delivery of IVL catheters was successful in 100% of patients with minimal pre- or post-dilation (8.6% and 14.3%, respectively) and no stent implants. There were no vascular complications or MAEs. The results showed a significant reduction in percent diameter stenosis, large acute diameter gain and excellent durability of results at 30 days and six months.



**High Acute Gain, Low Residual Stenosis, and Minimal Complications**

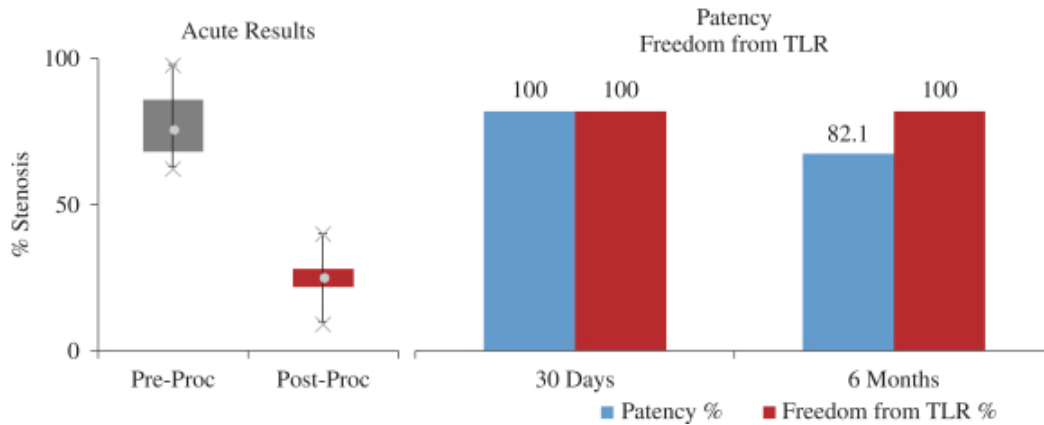
	Post Procedure N=60
Dissections D1/E/F	1.7% (1)
Perforations	0% (0)
Abrupt Closure	0% (0)
Slow/ No Reflow	0% (0)
Thrombosis	0% (0)

(Left) Pre-procedural (Pre-Proc) stenosis ( $76.3 \pm 13.5\%$ ) measured at baseline, post-procedural (Post-Proc) ( $23.4 \pm 5.7\%$ ) measured post-index procedure.  
(Right) Patency and freedom from TLR

**The Disrupt PAD II** study was a prospective, non-randomized, multicenter study to demonstrate the safety and performance of our IVL System using the MV60 catheter in heavily calcified femoropopliteal lesions. This study demonstrated the safety and effectiveness of our IVL System in calcified, femoropopliteal PAD up to 12 months. We believe it is the first and only core lab adjudicated study to exclusively enroll heavily calcified disease. The results demonstrated safety and long-term functional benefit from our IVL System in this challenging patient population.

Between June 2015 and December 2015, 60 patients were enrolled at eight centers in Europe and New Zealand. 85% of patients had heavily calcified, femoropopliteal lesions, and all patients were treated with standalone IVL System therapy. Key study endpoints included MAEs at 30 days, six months and 12 months, procedural success, in addition to vessel patency, freedom from TLR and improvement in functional outcomes at 30 days, six months and 12 months. All results were adjudicated by an independent core lab and CEC, and the study incorporated revised definitions of severe calcification and primary patency as published in the Peripheral Academic Research Consortium (“PARC”) paper.

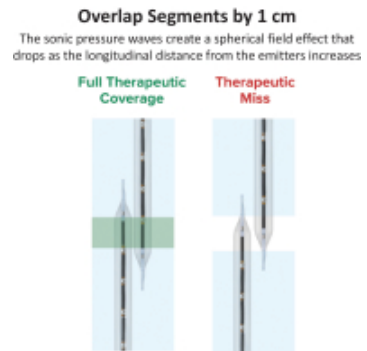
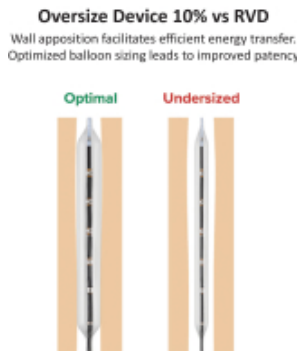
The acute safety and performance results were positive, particularly for a severely calcified patient population. The delivery of IVL catheters was successful in 100% of patients. The original stenosis was 78.2% and the final residual stenosis after IVL System therapy was 24.2%, with an average acute gain of 3.0 mm. The 30-day MAE rate was very low at 1.7%, with a bail-out stenting rate of 1.7% and only one grade D dissection that was resolved following stent placement. There were no instances of vessel perforation, distal embolization, thrombus, abrupt closure and slow flow or no-reflow events.

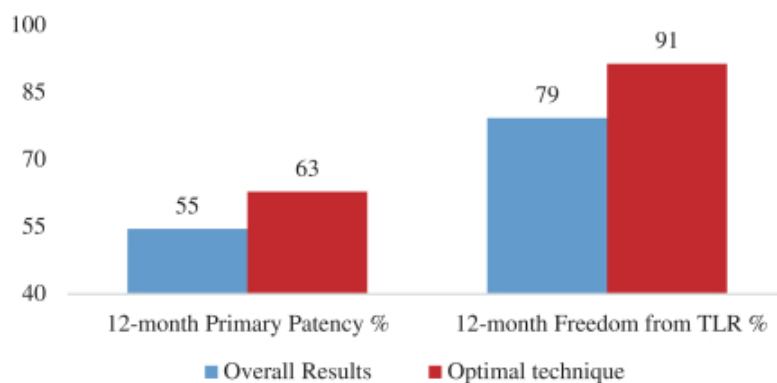


The long-term functional results demonstrated strong durability of our IVL System as a standalone therapy. The safety profile continued to be strong, with no additional MAEs beyond 30 days. Freedom from clinically-driven revascularization at 12 months was 79% and revascularizations were completed using simple, endovascular procedures. Functional outcomes, including patient symptoms measured by Rutherford Category and arterial pulse pressures measured by the ankle-brachial index (“ABI”), showed statistically significant and sustained improvements from baseline.

This study led to an increased understanding of how to teach physicians to optimize our IVL System procedure and obtain better outcomes. Through analysis of the study data, we learned that correct balloon sizing and appropriate therapeutic overlap resulted in improved 12-month primary patency and TLR outcomes. Patients treated with optimal technique had less than 9% TLR at 12 months. Balloon sizing and appropriate therapeutic overlap are simple, intuitive techniques that have been incorporated into physician training to achieve optimal results.

**Optimal Technique Can Enhance IVL Energy Delivery and Improve Clinical Patency**





Primary Patency: 55% for intent-to-treat versus 63% for those with optimal technique

Freedom from TLR: 79% for intent-to-treat versus 91% for those with optimal technique

*Optimal IVL System Technique* was defined as the correct balloon sizing and the avoidance of therapeutic miss. In patients who received optimal technique, 12-month primary patency increased from 55% to 63% and 12-month clinically driven TLR decreased from 21% to 9%.

**The Disrupt BTK study** was a prospective, non-randomized, multicenter study to demonstrate the safety and feasibility of our IVL System using the MV60 catheter in heavily calcified infrapopliteal lesions. We believe this study demonstrated the safety and feasibility of our IVL System in calcified, infrapopliteal lesions up to 30 days. Despite using a first generation MV60 catheter, it was successfully delivered in over 95% of this challenging patient population. We also believe that the safety of IVL System therapy for treatment of BTK was demonstrated in this study.

Between June 2016 and April 2017, 20 patients were enrolled at three centers in Europe and New Zealand. All patients had heavily calcified, infrapopliteal lesions, and were treated with standalone IVL System therapy. Key study endpoints included MAEs at 30 days, reduction in stenosis and procedural success. All results were adjudicated by an independent core lab.

The delivery of IVL catheters was successful in 95% of patients. The original stenosis was 72.6% and the final residual stenosis after IVL System therapy was 26.2%. There were no MAEs and no vascular complications, including flow-limiting dissections, perforation, distal embolization, abrupt closure and slow flow or no-reflow events. Two stents were placed per the physician discretion. The results showed a low residual stenosis and large acute gain, with minimal vascular complications that are consistent with IVL System results in femoropopliteal lesions. The Disrupt BTK experience informed the design of the S<sup>4</sup> catheter in heavily calcified infrapopliteal lesions. These patients present with CLI, which has a risk of target limb major amputation and responds poorly to traditional balloon angioplasty.

#### ***Clinical Studies to Support IVL System Use in the Treatment of CAD to Date***

**The Disrupt CAD I study** was a prospective, non-randomized, multicenter study to demonstrate the safety and performance of our first generation coronary IVL catheter in heavily calcified coronary lesions prior to stenting. This study was our first in CAD and we believe it demonstrated the safety and performance of our IVL System in heavily calcified coronary lesions prior to stenting. The results of this study supported CE Mark approval of the use of our C<sup>2</sup> catheters in our IVL System.

Between December 2015 and September 2016, 60 patients were enrolled at seven centers in Europe and Australia. All patients had heavily calcified, coronary lesions and were treated with IVL System therapy followed by DES implantation. Key study endpoints included major adverse cardiac events (“MACE”) at 30 days, and procedural success was defined as residual stenosis < 50% after stenting and no in-hospital MACE. Additional

endpoints include MACE at six months and angiographic success. All results were adjudicated by an independent core lab and CEC.

### Angiographic Complications

**Achieved <50% stenosis in all patients, despite >90% of patients having moderate-to-severe CAD**

Complications	Procedural	Post Stent	Safety	Results	Events	Efficacy	Results
Dissections D E F	3.3% 0% 0%	0% 0% 0%	30 day MACE <sup>1</sup> Cardiac death, MI or TVR	5%	Death N = 0 QWMI N = 0 *NQWMI N = 3 TVR N = 0	Clinical Success <sup>2</sup> Residual stenosis <50% post-PCI with no evidence of in-hospital MACE	95%
Perforation	0.0%	0.0%					
Abrupt Closure	0.0%	0.0%	6 month MACE <sup>1</sup> Cardiac death, MI or TVR	8.5%	Death N = 2 QWMI N = 0 *NQWMI N = 3 TVR N = 0	Device Success Successful device delivery and IVL treatment at target lesion	98.3%
Slow flow	0.0%	0.0%					
No reflow	0.0%	0.0%				Stent Delivery	100%

<sup>1</sup>Core Lab adjudicated  
<sup>2</sup>CEC adjudicated  
<sup>\*</sup>NQWMI defined as 2x upper limit CK-MB

### Disrupt CAD I results showed safety and effectiveness at 30 days and six months

The results of Disrupt CAD I Study were positive and we believe demonstrated the safety and effectiveness of our IVL System in heavily calcified coronary lesions prior to stenting. There were no instances of perforation, abrupt closure or slow flow or reflow events. There were two procedural dissections that were treated as per the standard of care with a DES and did not require additional procedures or result in an event. The 30-day MAE rate was five percent. There were only three non-Q-wave myocardial infarctions, as determined by cardiac biomarkers and all three patients were discharged without additional events. The IVL catheter was delivered in 98% of patients, and all patients were treated with a DES and successfully facilitated stent delivery and expansion. We believe this trial showed excellent procedural results and safety at 30 days and six months.

**The Disrupt CAD I OCT Sub-study** was a pre-specified sub-study to demonstrate the mechanism of action and effectiveness of coronary IVL in heavily calcified coronary lesions prior to stenting. The study utilized intravascular OCT imaging to demonstrate the mechanistic effects of our IVL System on calcium. OCT imaging clearly showed cracks in the calcified lesions after being treated with IVL System therapy. These cracks are consistent with the intended effect that IVL has on calcium.

Thirty-one of the 60 enrolled CAD I patients underwent OCT imaging at three time points: prior to IVL; after IVL but prior to stenting; and at the end of procedure. The goal was to assess the impact of IVL System therapy on calcified coronary lesions using high resolution, OCT intravascular imaging. Key study endpoints included acute area gain, minimal stent area, stent expansion and vascular complications. An independent core lab analyzed all images, showing that IVL resulted in calcium fractures at multiple locations along the treated lesion, resulting in a significant gain in the vessel area and favorable stent expansion.

### Other Clinical Studies to Date

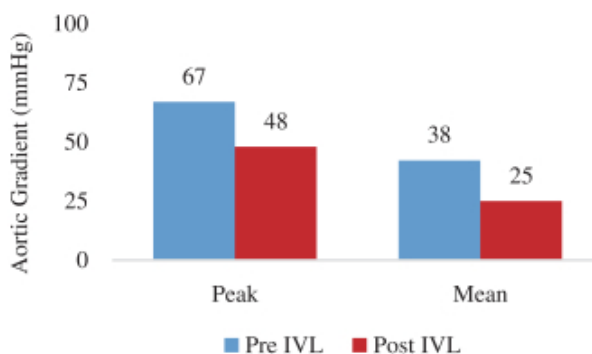
**The Transcatheter Aortic Valve Lithotripsy Feasibility Study** was a preliminary, first-in-man feasibility study to assess the early safety and feasibility of our TAVL System in calcified, stenotic aortic valves prior to a surgical valve replacement. In a small series, we believe we were able to demonstrate that our IVL Technology can be safely applied to calcified aortic valves and result in acutely increased valve areas and reduced gradients.

#### Aortic Regurgitation

Patient	Pre	Post
Patient 1	Trace	Trace
Patient 2	Trace	Trace
Patient 3	Trace	Trace
Patient 4	Mild Central	Mild Central

**Aortic Regurgitation:** Data from the TAVL FIM study show that application of TAVL did not change the degree of aortic valve regurgitation.

In December 2016, four patients at a single center with severe AS were treated with TAVL therapy immediately prior to surgical valve replacement. Distal embolic filters were placed in bilateral carotid arteries to confirm athero-embolic debris following TAVL treatment. Key study endpoints included MAEs at 30 days, successful delivery of IVL to the aortic valve and various success criteria, including reduction in the mean pressure gradient, improvement in leaflet mobility and successful AVR surgery. All results were adjudicated by an independent echocardiographic core lab.



**Gradient Reduction:** Data from the TAVL FIM study show that both the peak and mean transvalvular gradients were reduced by TAVL.

We believe this first-in-man study demonstrated that our IVL Technology could be safely delivered to calcified, stenotic aortic valves prior to AVR. All patients had improvement in aortic valve area and a reduction in peak and mean transvalvular gradients of 19 and 13 mmHg, respectively. IVL did not cause a change in aortic regurgitation, indicating that the native valve was not damaged. No embolic debris was identified in the filters following TAVL treatment.

### Ongoing and Planned Clinical Studies

#### Further Clinical Studies to Support IVL System use in Peripheral Arterial Disease

**The Disrupt PAD III Study** is a prospective, randomized, multicenter, post-market study to demonstrate the safety and effectiveness of our IVL System using the MV60 and M5 catheters in combination with DCB

compared to standalone DCB in heavily calcified femoropopliteal lesions. The study is designed to demonstrate the optimal therapy to dilate heavily calcified, femoropopliteal lesions and to demonstrate the benefit of our IVL System when combined with DCB vs. standalone DCB, in severely calcified femoropopliteal lesions up to 24 months. Disrupt PAD III is the largest randomized clinical trial to assess the ideal treatment strategy for this difficult to treat patient population.

The study is currently enrolling, with enrollment expected to be completed in the second half of 2019 and clinical data expected in 2020. It is expected to enroll up to 400 patients at 60 global centers in the United States, Europe and New Zealand. All patients will present with severely calcified, femoropopliteal lesions. Patients will be randomized in a one-to-one fashion with IVL System therapy combined with DCB in the treatment arm and standalone DCB in the control arm. Patients with sub-optimal acute results may be treated with a bailout stent in both arms. Key study endpoints include MAEs at 30 days, six, 12 and 24 months, procedural success, in addition to primary patency and freedom from TLR at 12 and 24 months and functional outcomes at 30 days, six, 12 and 24 months. All results will be adjudicated by an independent core lab and CEC.

**The Disrupt PAD III Observational Study** is a prospective, multicenter, observational study to assess the real-world, acute performance of our IVL System using the MV60 and M<sup>5</sup> catheters in calcified, peripheral arteries. The study will assess the real-world, acute performance of our IVL System in heavily calcified peripheral lesions. Lesions may include multi-level treatment of calcified iliac, common femoral, superficial femoral, popliteal and infrapopliteal lesions, in patients with claudication or CLI.

The study is currently enrolling patients, with enrollment expected to be completed in the second half of 2019. It is expected to enroll up to 1,000 patients presenting with heavily calcified, peripheral lesions. Patients may be treated with standalone IVL System therapy or adjunctive interventional therapies including DCB, atherectomy and bare metal or DES. Key study endpoints include procedural success and in-hospital adverse events.

***Further Clinical Studies to Support IVL System use in Coronary Artery Disease***

**The Disrupt CAD II Study** is a prospective, non-randomized, multicenter, post-market study to demonstrate the ongoing safety and performance of the coronary IVL catheter in heavily calcified coronary lesions up to 30 days prior to stenting. The study is a condition to support the CE Mark.

The study is currently enrolling patients, with enrollment expected to be completed in the first half of 2019. It will enroll up to 120 patients at 15 centers in Europe. All patients are expected to present with heavily calcified, stenotic coronary lesions, and will be treated with coronary IVL System therapy followed by DES implantation. Key study endpoints include in-hospital MACE, 30-day cardiac death and procedural success defined as residual stenosis <50% after stenting with no in-hospital MACE. All results will be adjudicated by an independent core lab and CEC. An OCT sub-study of approximately 60 patients will be included.

**The Disrupt CAD III Study** is a prospective, non-randomized, multicenter study to demonstrate the safety and effectiveness of our IVL System using the C<sup>2</sup> catheter in heavily calcified coronary lesions prior to stenting. The study is an IDE study that has been approved by the FDA. The goal of this study is to provide the clinical evidence needed to support a PMA for the use of our C<sup>2</sup> catheters in our IVL System in the United States.

This study is expected to enroll approximately 392 patients at 50 global centers in the United States and Europe. The first patient was enrolled in early 2019 and clinical data is expected in the second half of 2020. All patients will present with heavily calcified, coronary lesions, and will be treated with our IVL System followed by DES implantation. Key study endpoints will include 30-day MACE and procedural success compared to objective performance goals. Additional endpoints include MACE at six, 12 and 24 months, and device delivery success. All results will be adjudicated by an independent core lab and CEC. An OCT sub-study of approximately 100 patients will be included to show mechanistic effects and demonstrate acute area gain, minimal stent area, stent expansion and vascular complications.



**The Disrupt CAD IV Study** is a pre-market clinical trial notification (“CTN”) that is currently in the early planning phase with the Japanese PMDA. This study is expected to enroll approximately 60 patients at five centers in Japan. All patients will present with heavily calcified, coronary lesions and will be treated with our IVL System followed by DES implantation. The goal of this confirmatory study is to show that the safety and effectiveness results of IVL System therapy prior to stenting are consistent in a Japanese patient population. A Shonin submission would then be completed for Japanese approval.

***Further Clinical Studies to Support TAVL System use in Aortic Stenosis***

**The TAVL Chronic Feasibility Study** is a prospective, single-arm, multi-center study to demonstrate the safety and feasibility of our TAVL System in patients with symptomatic, severe aortic stenosis.

The study is currently enrolling, with enrollment expected to be completed in the first half of 2019. It is expected to enroll up to 20 patients at three centers in Australia. All patients will present with symptomatic, severe aortic stenosis. Patients will be treated with our TAVL System. The primary study endpoint is major adverse cardiac and cerebrovascular events (“MACCE”) defined as a composite of all-cause mortality, myocardial infarction, stroke, life-threatening and major bleeding events, stage two or three acute kidney injury or major vascular complications at 30 days post-procedure. The primary effectiveness endpoint is mean aortic valve pressure gradient at 30 days post-procedure measured by transthoracic echocardiography (“TTE”). Patients will have additional follow-up at three, six and 12 months to assess safety, mean gradients and quality of life measures. All results will be adjudicated by an independent core lab and CEC.

**Research and Development**

We invest in research and development efforts that advance our IVL Technology with the goal to expand and improve upon our existing product offerings. Our research and development expenses totaled \$18.0 million and \$22.7 million for the years ended December 31, 2017, and December 31, 2018, respectively.

We believe our ability to rapidly develop innovative products is attributable to the dynamic product innovation process that we have implemented, the versatility and leveragability of our core technology and the management philosophy behind that process. We have recruited and retained engineers and scientists with significant experience in the development of medical devices. We have a pipeline of products in various stages of development that are expected to provide additional commercial opportunities. Our research and development efforts are based at our facility in Santa Clara, California.

**Manufacturing**

We produce substantially all of our IVL catheters in-house at our facilities in Fremont, California which, together with our research and development, controlled environment room and office space, currently totals 12,000 square feet. We stock inventory of raw materials, components and finished goods at our facilities in Fremont and with our direct sales representatives, who travel to our hospital customers’ locations as part of their sales efforts. Our electronics (*i.e.*, our generators and connector cables) are produced by original equipment manufacturing (“OEM”) partners using our design specifications. We plan to move our production of IVL catheters to our new 35,000 square foot facility in Santa Clara, California in 2019. We rely on a single or limited number of suppliers for certain raw materials and components, and we generally have no long-term supply arrangements with our suppliers, as we order on a purchase order basis. In the United States, we generally ship our IVL products from Fremont to our hospital customers in the United States on a consignment basis, but also may sell our IVL products directly to our hospital customers through our direct sales representatives, who deliver such products to hospital customers in the field. Internationally, we ship our IVL products from Fremont to either our third-party logistic provider located in the Netherlands who then ship directly to hospital customers and distributors pursuant to purchase orders or from Fremont directly to hospital customers and distributors pursuant to purchase orders. We also ship to some customers in Germany, Austria and Switzerland on a consignment basis from our third-party logistic provider located in the Netherlands. As of December 31, 2018, we had approximately 43 manufacturing employees.

Our rigorous quality control management programs have earned us a number of quality-related manufacturing designations. Our manufacturing facilities are EN ISO 13485 compliant with ISO 13485:2016 edition certification achieved in 2017. In 2014, we achieved compliance with MDD standards, allowing our products to be CE marked. We use annual internal audits, combined with external audits by regulatory agencies, to help ensure strong quality control practices. An internal, on-going staff training and education program contributes to our quality assurance program; training is documented and considered part of the employee evaluation process.

## **Sales & Marketing**

We market our products to hospitals whose interventional cardiologists, vascular surgeons and interventional radiologists treat patients with PAD and CAD. We have dedicated meaningful resources to establish a direct sales capability in the United States, Germany, Austria and Switzerland, which we have complemented with distributors in Australia, the Baltics, Canada, Czech Republic, France, Italy, the Netherlands, New Zealand, the Nordic region, Poland, Spain and the United Kingdom. We are actively expanding our international field presence through new distributors, additional sales and clinical personnel, and are adding new U.S. sales territories. We have the CE Mark in Europe and the 510(k) clearance in the United States for our IVL System using our peripheral catheters (our M<sup>5</sup> catheters and S<sup>4</sup> catheters) and CE Mark in Europe for our IVL System using our C<sup>2</sup> catheter.

Our sales representatives and sales managers generally have substantial and applicable medical device experience, specifically in the vascular space and market our products directly to interventional cardiologists, vascular surgeons and interventional radiologists who treat patients with PAD and CAD. We are focused on developing strong relationships with our physician and hospital customers in order to educate them on the use and benefits of our products. Similarly, our marketing team has a significant amount of domain expertise and a strong track record of success. Our global sales and marketing team totals 53 professionals as of December 31, 2018.

In the United States, our IVL generators and connector cables are typically provided, on loan, to our hospital customers at no charge, while our disposable IVL catheters are provided on a consignment basis whereby title to such catheters passes to the hospital once they are used in a clinical procedure. Following such use, we charge the hospital a predetermined set fee for each IVL catheter, which fee may be determined based on the hospital's overall use of our IVL catheters.

In addition to our direct sales organizations, we sell to distributors in certain geographies outside the United States where we have determined that selling through third party distributors is the best way to optimize our opportunities and resources. We select distribution partners who have deep experience in our markets, have strong customer relationships and have a demonstrated track record of launching innovative products.

Our IVL System is simple, intuitive, easy to install and easy to use. This provides value to our customers, but also makes our sales model a source of competitive advantage. Lower service burden means we can develop a cost-efficient sales model by optimizing a mix of clinical specialists and sales people. Moreover, our vascular IVL catheters have similar call points, meaning we can further leverage our field sales team.

## **Reimbursement**

### ***United States***

In the United States, hospitals are the primary purchasers of our products. Hospitals bill various third-party payors, primarily Medicare in the case of PAD and CAD, for the total healthcare services required to treat the patient. Endovascular interventions to treat PAD and CAD are performed in two primary settings of care:

hospital inpatient and hospital outpatient, each with different coding and payment schemes. For PAD, a minority of interventions are performed in a third setting of care known as physician office-based labs (“OBLs”).

Setting	Payment System	Common Setting for IVL Application
<b>Inpatient</b>	Medicare Severity Diagnosis Related Groups (“MS-DRGs”)	<ul style="list-style-type: none"> <li>• CLI (more severe PAD)</li> <li>• Infrapopliteal (BTK)</li> <li>• EVAR &amp; TEVAR Access</li> <li>• TAVR Access</li> <li>• PCI</li> </ul>
		<ul style="list-style-type: none"> <li>• Claudicants (less severe PAD)</li> </ul>
<b>Outpatient</b>	Ambulatory Payment Classifications (“APCs”)	<ul style="list-style-type: none"> <li>• Femoropopliteal</li> <li>• Iliac occlusive</li> <li>• PCI</li> </ul>

Our IVL System incorporates an integrated balloon that is used by the physicians to perform angioplasty during the relevant procedure. Angioplasty procedures have coding, coverage and payment in all settings of care. The IVL System therapy delivered by our vascular IVL catheters is novel and, as is typical of novel technologies, does not yet have its own specific reimbursement coding. We believe there is an opportunity in the future for increased reimbursement over current levels for procedures using our IVL System by generating additional clinical evidence, gaining advocacy in the respective physician societies and by working with the Centers for Medicare and Medicaid Services (“CMS”) and payors.

Absent any incremental payment to hospitals for IVL System procedures to treat PAD, our initial commercial success suggests that our IVL System provides compelling economic value. We address the procedural complications that drive up supply costs for complex calcified lesions. As has been published in the *Journal of Vascular Surgery*, while the treatment of standard lesions can be profitable, a minority of severe lesions can cause a hospital to lose money because the significantly higher number of devices needed to complete treatment exceeds reimbursement levels.

**Hospital Inpatient**

Medicare reimbursement in the hospital inpatient department is determined according to the hospital inpatient prospective payment system (“IPPS”). Payment is determined by the applicable MS-DRGs, which groups patients by similar diagnoses and/or performed procedures and are used to determine the payment rate that is used to reimburse hospitals for an inpatient stay. The IPPS payment covers the entire admission, including any secondary procedures. For endovascular interventions, the difference between whether a patient is classified as an inpatient or outpatient is a medical decision, but in general, sicker patients and/or those expected to need a longer length of stay are admitted as inpatients.

In the inpatient setting, endovascular treatment of PAD and CAD is assigned to one of two groups of surgical MS-DRGs, depending if atherectomy is also performed during the procedure or not. These MS-DRGs are independent of anatomical location. When IVL System therapy is performed as an adjunctive therapy during an EVAR, TEVAR or TAVR procedure, the applicable MS-DRG is based on those procedures, not the IVL System procedure.

**U.S. Hospital Inpatient Payments for PAD & CAD Interventions  
(FY19 Unadjusted Medicare Payment)**

IVL Performed in Conjunction with	DRG Codes*	FY19 National Average Hospital Payment**
PAD Intervention: PTA, Stent	DRG 254, 253, 252	\$11,050.94 - \$19,902.68
PAD Intervention: Atherectomy	DRG 272, 271, 270	\$15,984.78 - \$30,904.16
CAD Intervention: DES with or without Atherectomy	DRG 247, 246	\$12,681.71 - \$19,774.46

EVAR (AAA)	DRG 269,268	\$25,343.28 - \$40,929.37
TAVR	DRG 267, 266	\$35,705.52 - \$43,907.63

\* DRG coding groups listed are assigned depending if complications and comorbidities present.

\*\*Medicare rates for the same or similar procedures vary due to geographic location, nature of facility in which the procedure is performed (i.e., teaching or community hospital) and other factors.

**Hospital Outpatient**

Reimbursement is determined by Medicare’s comprehensive APC, which is a smaller bundle than a DRG more specifically related to a single procedure. Hospitals receive a Medicare outpatient payment based on the APC group assigned to the physician service or procedure performed, which are described by Current Procedure Terminology (“CPT”) codes. CPT codes are specific to the approach, the technique used and the specific anatomy in which the procedure is performed. For PAD and CAD interventions, the main drivers of APC assignment are anatomical location and which devices are used during the procedure.

**U.S. Hospital Outpatient Payments for PAD & CAD Interventions  
(FY19 National Payment Rates)**

Vessel Anatomy	Treatment Strategy			
	IVL + PTA	IVL + Stent	IVL + Atherectomy + PTA	IVL+ Atherectomy + Stent
Iliac	\$4,755.58 (APC 5192)	\$9,765.28 (APC 5193)	Atherectomy not indicated for use in iliac arteries	Atherectomy not indicated for use in iliac arteries
Femoropopliteal	\$4,755.58 (APC 5192)	\$9,765.28 (APC 5193)	\$9,765.28 (APC 5193)	\$15,503.79 (APC 5194)
Tibial-Peroneal	\$9,765.28 (APC 5193)	\$15,503.79 (APC 5194)	\$15,503.79 (APC 5194)	\$15,503.79 (APC 5194)
Coronary	IVL will be indicated for use prior to stenting	\$9,765.28 (APC 5193)	IVL will be indicated for use prior to stenting	\$15,503.79 (APC 5194)

**Office-Based Procedures**

A minority of U.S. PAD interventions are performed in non-hospital, freestanding facilities that may be treated by payors like physician offices. Medicare pays for procedures in the physician office setting based on submission of a claim using one or more eligible CPT or Healthcare Common Procedure Coding System codes. Procedures are reimbursed based on Medicare under the Medicare physician fee schedule, which reimburses for supplies, equipment, professional fees and overhead to perform the procedure. These non-hospital, freestanding facilities are a highly financially sensitive segment of the U.S. PAD market and as such are not an initial target of our sales and marketing efforts.

**Commercial Third-Party Payors**

No uniform policy for coverage and reimbursement for medical procedures exists in the United States. Third-party payors often rely upon Medicare coverage policy and payment limitations in setting their own

reimbursement rates, but also have their own methods and approval process apart from Medicare determinations. Therefore, coverage and reimbursement can differ significantly from payor to payor.

### ***International***

Outside the United States, market acceptance of medical devices depends partly upon the availability of reimbursement within the prevailing healthcare payment system. Reimbursement levels vary significantly by country and, within some countries, by region. Reimbursement is obtained from a variety of sources, including government-sponsored and private health insurance plans, and combinations of both. PCI is a standard of care in developed international markets and procedure reimbursement exists. However, specific reimbursement for plaque modification devices is not common in most developed international markets. For PAD, the standard of care varies widely by country and so does reimbursement. Our plan is to broadly access international markets for coronary IVL System therapies and we plan to selectively approach markets and opportunities for peripheral IVL System therapies where it makes economic sense and where we believe the clinical benefit is large enough that the overall value to the system outweighs the cost of the device.

In Germany, in contrast to the other major European markets, there is an established path to secure reimbursement, making incremental payments viable in that market. We have obtained codes for peripheral and coronary IVL System therapies to track procedure costs, and we expect that the data will support incremental payment in the near- to mid-term.

Japan also provides incremental payment for atherectomy devices used during PCI procedures. We intend to work with Japanese regulators to secure payment for IVL System therapy that is similar to atherectomy.

### **Competition**

The medical device industry is intensely competitive, subject to rapid change and significantly affected by new product introductions and other market activities of industry participants. We compete or plan to compete with manufacturers and distributors of cardiovascular medical devices. Our most notable competitors in the highly competitive cardiovascular field include Boston Scientific Corporation, Cardiovascular Systems, Inc., Medtronic plc and Philips N.V. Many of these competitors are large, well-capitalized companies with significantly greater market share and resources than we have. As a consequence, they are able to spend more on product development, marketing, sales and other product initiatives than we can. We also compete with smaller medical device companies that have single products or a limited range of products. Some of our competitors have:

- significantly greater name recognition;
- broader or deeper relations with healthcare professionals, customers and third-party payors;
- more established distribution networks;
- additional lines of products and the ability to offer rebates or bundle products to offer greater discounts or other incentives to gain a competitive advantage;
- greater experience in conducting research and development, manufacturing, clinical trials, marketing and obtaining regulatory clearance or approval for products; and
- greater financial and human resources for product development, sales and marketing and patent prosecution.

We believe that our proprietary IVL Technology, our focus on calcified cardiovascular disease and our organizational culture and strategy, will be important factors in our future success. We compete primarily on the basis that our products are designed to treat patients with calcified cardiovascular disease safely, easily and

effectively, with improved outcomes and procedural cost savings. Our continued success depends on our ability to:

- develop innovative, proprietary products that can cost-effectively address significant clinical needs in a manner that is safe and effective for patients and easy to use for physicians;
- continue to innovate and develop scientifically advanced technology;
- obtain and maintain regulatory clearances or approvals;
- demonstrate efficacy in our sponsored and third-party clinical trials and studies;
- obtaining and maintaining adequate reimbursement for procedures using our products;
- apply technology across product lines and markets;
- attract and retain skilled research and development and sales personnel; and
- cost-effectively manufacture and successfully market and sell products.

### **Intellectual Property**

Our success depends in part on our ability to obtain, maintain, protect and enforce our proprietary technology and intellectual property rights, in particular, our patent rights, preserve the confidentiality of our trade secrets, and operate without infringing the valid and enforceable patents and other proprietary rights of third parties. We rely on a combination of patent, trademark, trade secret, copyright and other intellectual property rights and measures to protect the intellectual property rights that we consider important to our business. We also rely on know-how and continuing technological innovation to develop and maintain our competitive position.

We seek to protect our proprietary rights through a variety of methods, including confidentiality agreements and proprietary information agreements with suppliers, employees, consultants and others who may have access to our proprietary information. However, trade secrets and proprietary information can be difficult to protect. While we have confidence in the measures we take to protect and preserve our trade secrets and proprietary information, such measures can be breached, and we may not have adequate remedies for any such breach. In addition, our trade secrets and proprietary information may otherwise become known or be independently discovered by competitors.

As of December 31, 2018, we owned 31 issued U.S. patents and 38 issued foreign patents, 19 pending U.S. patent applications and 21 pending foreign patent applications (including six Patent Cooperation Treaty (“PCT”) applications). This portfolio includes 16 issued U.S. patents, 23 issued foreign patents, five pending U.S. patent applications and 11 pending foreign patent applications (including one PCT application) relating to our current IVL Technology. These issued patents, and any patents granted from such applications, are expected to expire between 2029 and 2037, without taking potential patent term extensions or adjustments into account. U.S. Pat. Nos. 9,642,673, 8,956,371 and 8,728,091, which are three of our issued U.S. patents relating to our current IVL Technology, are the subject of *inter partes* review proceedings filed by Cardiovascular Systems, Inc., one of our competitors. For more information regarding these proceedings, please see the section titled “Business—Legal Proceedings.”

The term of individual patents depends upon the legal term for patents in the countries in which they are granted. In most countries, including the United States, the patent term is 20 years from the earliest claimed filing date of a non-provisional patent application in the applicable country. In the United States, a patent’s term may, in certain cases, be lengthened by patent term adjustment, which compensates a patentee for administrative delays by the United States Patent and Trademark Office in examining and granting a patent, or may be shortened if a patent is terminally disclaimed over a commonly owned patent or a patent naming a common inventor and having an earlier expiration date. We cannot be sure that our pending patent applications that we

have filed or may file in the future will result in issued patents, and we can give no assurance that any patents that have issued or might issue in the future will protect our current or future products, will provide us with any competitive advantage, and will not be challenged, invalidated, or circumvented.

For more information regarding the risks related to our intellectual property, including the above referenced *inter partes* reviews, please see the section titled “Risk Factors—Risks Related to Our Intellectual Property.”

## **Government Regulation**

### ***United States***

Our products are medical devices subject to extensive and ongoing regulation by the FDA under the Federal Food, Drug, and Cosmetic Act (“FD&C Act”) and its implementing regulations, as well as other federal and state regulatory bodies in the United States and comparable authorities in other countries under other statutes and regulations. The laws and regulations govern, among other things, product design and development, preclinical and clinical testing, manufacturing, packaging, labeling, storage, recordkeeping and reporting, clearance or approval, marketing, distribution, promotion, import and export and post-marketing surveillance. Failure to comply with applicable requirements may subject a device and/or its manufacturer to a variety of administrative sanctions, such as issuance of warning letters, import detentions, civil monetary penalties and/or judicial sanctions, such as product seizures, injunctions and criminal prosecution.

### ***FDA’s Pre-market Clearance and Approval Requirements***

Each medical device we seek to commercially distribute in the United States will require either a prior 510(k) clearance, unless it is exempt, or a pre-market approval from the FDA. Generally, if a new device has a predicate that is already on the market under a 510(k) clearance, the FDA will allow that new device to be marketed under a 510(k) clearance; otherwise, a PMA is required. Medical devices are classified into one of three classes—Class I, Class II or Class III—depending on the degree of risk associated with each medical device and the extent of control needed to provide reasonable assurance of safety and effectiveness. Class I devices are deemed to be low risk and are subject to the general controls of the FD&C Act, such as provisions that relate to: adulteration; misbranding; registration and listing; notification, including repair, replacement, or refund; records and reports; and good manufacturing practices. Most Class I devices are classified as exempt from pre-market notification under section 510(k) of the FD&C Act, and therefore may be commercially distributed without obtaining 510(k) clearance from the FDA. Class II devices are subject to both general controls and special controls to provide reasonable assurance of safety and effectiveness. Special controls include performance standards, post market surveillance, patient registries and guidance documents. A manufacturer may be required to submit to the FDA a pre-market notification requesting permission to commercially distribute some Class II devices. Devices deemed by the FDA to pose the greatest risk, such as life-sustaining, life-supporting or implantable devices, or devices deemed not substantially equivalent to a previously cleared 510(k) device, are placed in Class III. A Class III device cannot be marketed in the United States unless the FDA approves the device after submission of a PMA. However, there are some Class III devices for which FDA has not yet called for a PMA. For these devices, the manufacturer must submit a pre-market notification and obtain 510(k) clearance in orders to commercially distribute these devices. The FDA can also impose sales, marketing or other restrictions on devices in order to assure that they are used in a safe and effective manner.

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

When a 510(k) clearance is required, we must submit a pre-market notification to the FDA demonstrating that our proposed device is substantially equivalent to a predicate device, which is a previously cleared and legally marketed 510(k) device or a device that was in commercial distribution before May 28, 1976. By regulation, a pre-market notification must be submitted to the FDA at least 90 days before we intend to distribute

a device. As a practical matter, clearance often takes significantly longer. To demonstrate substantial equivalence, the manufacturer must show that the proposed device has the same intended use as the predicate device, and it either has the same technological characteristics, or different technological characteristics and the information in the pre-market notification demonstrates that the device is equally safe and effective and does not raise different questions of safety and effectiveness. The FDA may require further information, including clinical data, to make a determination regarding substantial equivalence. If the FDA determines that the device, or its intended use, is not substantially equivalent to a previously cleared device or use, the FDA will place the device into Class III.

There are three types of 510(k)s: traditional; special; and abbreviated. Special 510(k)s are for devices that are modified and the modification needs a new 510(k) but does not affect the intended use or alter the fundamental scientific technology of the device. Abbreviated 510(k)s are for devices that conform to a recognized standard. The special and abbreviated 510(k)s are intended to streamline review, and the FDA intends to process special 510(k)s within 30 days of receipt.

#### **De Novo Classification**

Medical device types that the FDA has not previously classified as Class I, II or III are automatically classified into Class III regardless of the level of risk they pose. The Food and Drug Administration Modernization Act of 1997 established a new route to market for low to moderate risk medical devices that are automatically placed into Class III due to the absence of a predicate device, called the “Request for Evaluation of Automatic Class III Designation,” or the *de novo* classification procedure.

This procedure allows a manufacturer whose novel device is automatically classified into Class III to request down-classification of its medical device into Class I or Class II on the basis that the device presents low or moderate risk, rather than requiring the submission and approval of a PMA application. Prior to the enactment of the Food and Drug Administration Safety and Innovation Act of 2012 (“FDASIA”), a medical device could only be eligible for *de novo* classification if the manufacturer first submitted a 510(k) pre-market notification and received a determination from the FDA that the device was not substantially equivalent. FDASIA streamlined the *de novo* classification pathway by permitting manufacturers to request *de novo* classification directly without first submitting a 510(k) pre-market notification to the FDA and receiving a not substantially equivalent determination. Under FDASIA, the FDA is required to classify the device within 120 days following receipt of the *de novo* application. If the manufacturer seeks reclassification into Class II, the manufacturer must include a draft proposal for special controls that are necessary to provide a reasonable assurance of the safety and effectiveness of the medical device. In addition, the FDA may reject the reclassification petition if it identifies a legally marketed predicate device that would be appropriate for a 510(k) or determines that the device is not low to moderate risk or that general controls would be inadequate to control the risks and special controls cannot be developed.

#### **Pre-market Approval Pathway**

A pre-market approval application must be submitted to the FDA for Class III devices for which the FDA has required a PMA. The pre-market approval application process is much more demanding than the 510(k) pre-market notification process. A pre-market approval application must be supported by extensive data, including but not limited to technical, preclinical, clinical trials, manufacturing and labeling to demonstrate to the FDA’s satisfaction reasonable evidence of safety and effectiveness of the device.

After a pre-market approval application is submitted, the FDA has 45 days to determine whether the application is sufficiently complete to permit a substantive review and thus whether the FDA will file the application for review. The FDA has 180 days to review a filed pre-market approval application, although the review of an application generally occurs over a significantly longer period of time and can take up to several years. During this review period, the FDA may request additional information or clarification of the information



already provided. Also, an advisory panel of experts from outside the FDA may be convened to review and evaluate the application and provide recommendations to the FDA as to the approvability of the device.

Although the FDA is not bound by the advisory panel decision, the panel's recommendations are important to the FDA's overall decision making process. In addition, the FDA may conduct a preapproval inspection of the manufacturing facility to ensure compliance with the Quality System Regulation ("QSR"). The agency also may inspect one or more clinical sites to assure compliance with FDA's regulations.

Upon completion of the PMA review, the FDA may: (i) approve the PMA which authorizes commercial marketing with specific prescribing information for one or more indications, which can be more limited than those originally sought; (ii) issue an approvable letter which indicates the FDA's belief that the PMA is approvable and states what additional information the FDA requires, or the post-approval commitments that must be agreed to prior to approval; (iii) issue a not approvable letter which outlines steps required for approval, but which are typically more onerous than those in an approvable letter, and may require additional clinical trials that are often expensive and time consuming and can delay approval for months or even years; or (iv) deny the application. If the FDA issues an approvable or not approvable letter, the applicant has 180 days to respond, after which the FDA's review clock is reset.

### ***Clinical Trials***

Clinical trials are almost always required to support pre-market approval and are sometimes required for 510(k) clearance. In the United States, for significant risk devices, these trials require submission of an application for an IDE to the FDA. The IDE application must be supported by appropriate data, such as animal and laboratory testing results, showing it is safe to test the device in humans and that the testing protocol is scientifically sound. The IDE must be approved in advance by the FDA for a specific number of patients at specified study sites. During the trial, the sponsor must comply with the FDA's IDE requirements for investigator selection, trial monitoring, reporting and recordkeeping. The investigators must obtain patient informed consent, rigorously follow the investigational plan and study protocol, control the disposition of investigational devices and comply with all reporting and recordkeeping requirements. Clinical trials for significant risk devices may not begin until the IDE application is approved by the FDA and the appropriate institutional review boards ("IRBs") at the clinical trial sites. An IRB is an appropriately constituted group that has been formally designated to review and monitor medical research involving subjects and which has the authority to approve, require modifications in, or disapprove research to protect the rights, safety and welfare of human research subjects. A nonsignificant risk device does not require FDA approval of an IDE; however, the clinical trial must still be conducted in compliance with various requirements of FDA's IDE regulations and be approved by an IRB at the clinical trials sites. The FDA or the IRB at each site at which a clinical trial is being performed may withdraw approval of a clinical trial at any time for various reasons, including a belief that the risks to study subjects outweigh the benefits or a failure to comply with FDA or IRB requirements. Even if a trial is completed, the results of clinical testing may not demonstrate the safety and effectiveness of the device, may be equivocal or may otherwise not be sufficient to obtain approval or clearance of the product.

Sponsors of clinical trials of devices are required to register with [clinicaltrials.gov](http://clinicaltrials.gov), a public database of clinical trial information. Information related to the device, patient population, phase of investigation, study sites and investigators and other aspects of the clinical trial is made public as part of the registration.

### ***Ongoing Regulation by the FDA***

Even after a device receives clearance or approval and is placed on the market, numerous regulatory requirements apply. These include:

- establishment registration and device listing;

- the QSR, which requires manufacturers, including third-party manufacturers, to follow stringent design, testing, control, documentation and other quality assurance procedures during all aspects of the manufacturing process;
- labeling regulations and the FDA prohibitions against the promotion of products for uncleared, unapproved or “off-label” uses and other requirements related to promotional activities;
- medical device reporting regulations, which require that manufactures report to the FDA if their device may have caused or contributed to a death or serious injury, or if their device malfunctioned and the device or a similar device marketed by the manufacturer would be likely to cause or contribute to a death or serious injury if the malfunction were to recur;
- corrections and removal reporting regulations, which require that manufactures report to the FDA field corrections or removals if undertaken to reduce a risk to health posed by a device or to remedy a violation of the FD&C Act that may present a risk to health; and
- post market surveillance regulations, which apply to certain Class II or III devices when necessary to protect the public health or to provide additional safety and effectiveness data for the device.

After a device receives 510(k) clearance, any modification that could significantly affect its safety or effectiveness, or that would constitute a major change in its intended use, will require a new clearance or possibly a pre-market approval. The FDA requires each manufacturer to make this determination initially, but the FDA can review any such decision and can disagree with a manufacturer’s determination. If the FDA disagrees with our determination not to seek a new 510(k) clearance, the FDA may retroactively require us to seek 510(k) clearance or possibly a pre-market approval. The FDA could also require us to cease marketing and distribution and/or recall the modified device until 510(k) clearance or pre-market approval is obtained. Also, in these circumstances, we may be subject to significant regulatory fines and penalties.

Some changes to an approved PMA device, including changes in indications, labeling or manufacturing processes or facilities, require submission and FDA approval of a new PMA or PMA supplement, as appropriate, before the change can be implemented. Supplements to a PMA often require the submission of the same type of information required for an original PMA, except that the supplement is generally limited to that information needed to support the proposed change from the device covered by the original PMA. The FDA uses the same procedures and actions in reviewing PMA supplements as it does in reviewing original PMAs.

FDA regulations require us to register as a medical device manufacturer with the FDA. Additionally, the California Department of Health Services (“CDHS”), requires us to register as a medical device manufacturer within the state. Because of this, the FDA and the CDHS inspect us on a routine basis for compliance with the QSR. These regulations require that we manufacture our products and maintain related documentation in a prescribed manner with respect to manufacturing, testing and control activities. We have undergone and expect to continue to undergo regular QSR inspections in connection with the manufacture of our products at our facilities. Further, the FDA requires us to comply with various FDA regulations regarding labeling. Failure by us or by our suppliers to comply with applicable regulatory requirements can result in enforcement action by the FDA or state authorities, which may include any of the following sanctions:

- warning or untitled letters, fines, injunctions, consent decrees and civil penalties;
- customer notifications, voluntary or mandatory recall or seizure of our products;
- operating restrictions, partial suspension or total shutdown of production;
- delay in processing submissions or applications for new products or modifications to existing products;
- withdrawing approvals that have already been granted; and
- criminal prosecution.

The Medical Device Reporting laws and regulations require us to provide information to the FDA when we receive or otherwise become aware of information that reasonably suggests our device may have caused or contributed to a death or serious injury as well as a device malfunction that likely would cause or contribute to death or serious injury if the malfunction were to recur. In addition, the FDA prohibits an approved device from being marketed for off-label use. The FDA and other agencies actively enforce the laws and regulations prohibiting the promotion of off-label uses, and a company that is found to have improperly promoted off-label uses may be subject to significant liability, including substantial monetary penalties and criminal prosecution.

Newly discovered or developed safety or effectiveness data may require changes to a product's labeling, including the addition of new warnings and contraindications, and also may require the implementation of other risk management measures. Also, new government requirements, including those resulting from new legislation, may be established, or the FDA's policies may change, which could delay or prevent regulatory clearance or approval of our products under development.

We are also subject to other federal, state and local laws and regulations relating to safe working conditions, laboratory and manufacturing practices.

### ***European Union***

Our products are regulated in the European Union as medical devices per the European Union Directive (93/42/EEC), also known as the Medical Device Directive. An authorized third party, Notified Body, must approve products for CE marking. The CE Mark is contingent upon continued compliance to the applicable regulations and the quality system requirements of the ISO 13485 standard.

### ***Other Regions***

Most major markets have different levels of regulatory requirements for medical devices. Modifications to the cleared or approved products may require a new regulatory submission in all major markets. The regulatory requirements, and the review time, vary significantly from country to country. Products can also be marketed in other countries that have minimal requirements for medical devices.

### ***Fraud and Abuse and Other Healthcare Regulations***

Federal and state governmental agencies and equivalent foreign authorities subject the healthcare industry to intense regulatory scrutiny, including heightened civil and criminal enforcement efforts. These laws constrain the sales, marketing and other promotional activities of medical device manufacturers by limiting the kinds of financial arrangements we may have with hospitals, physicians and other potential purchasers of our products. Federal healthcare fraud and abuse laws apply to our business when a customer submits a claim for an item or service that is reimbursed under Medicare, Medicaid or other federally-funded healthcare programs. Patient privacy statutes and regulations by foreign, federal and state governments may also apply in the locations in which we do business. Descriptions of some of the U.S. laws and regulations that may affect our ability to operate follows.

#### ***Federal Healthcare Anti-Kickback Statute***

The federal healthcare Anti-Kickback Statute ("Anti-Kickback Statute") prohibits, among other things, persons or entities from knowingly and willfully soliciting, offering, receiving or paying any remuneration, directly or indirectly, overtly or covertly, in cash or in kind, to induce or reward either the referral of an individual for, or the purchasing, leasing, ordering, or arranging for or recommending the purchase, lease, or order of any good or service for which payment may be made, in whole or in part, by federal healthcare programs, such as the Medicare and Medicaid programs. The term "remuneration" has been broadly interpreted to include anything of value, and the government can establish a violation of the Anti-Kickback Statute without

proving that a person or entity had actual knowledge of the law or a specific intent to violate it. In addition, the government may assert that a claim, including items or services resulting from a violation of the Anti-Kickback Statute, constitutes a false or fraudulent claim for purposes of the federal civil False Claims Act. The Anti-Kickback Statute is subject to evolving interpretations and has been applied by government enforcement officials to a number of common business arrangements in the medical device industry. There are a number of statutory exceptions and regulatory safe harbors protecting certain business arrangements from prosecution under the Anti-Kickback Statute; however, those exceptions and safe harbors are drawn narrowly, and there is no exception or safe harbor for many common business activities, such as reimbursement support programs, educational and research grants or charitable donations. The failure of a transaction or arrangement to fit precisely within one or more applicable statutory exceptions or regulatory safe harbors does not necessarily mean that it is illegal or that prosecution will be pursued. However, conduct and business arrangements that do not fully satisfy all requirements of an applicable safe harbor may result in increased scrutiny by government enforcement authorities and will be evaluated on a case-by-case basis based on a cumulative review of all facts and circumstances.

#### ***Federal Civil False Claims Act***

The federal civil False Claims Act prohibits, among other things, persons or entities from knowingly presenting, or causing to be presented, a false or fraudulent claim for payment of government funds, or knowingly making, using or causing to be made or used a false record or statement material to a false or fraudulent claim to avoid, decrease or conceal an obligation to pay money to the federal government. A claim including items or services resulting from a violation of the Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the federal civil False Claims Act. Actions under the federal civil False Claims Act may be brought by the government or as a qui tam action by a private individual in the name of the government. These individuals, sometimes known as “relators” or, more commonly, as “whistleblowers,” may share in any amounts paid by the entity to the government in fines or settlement. The number of filings of qui tam actions has increased significantly in recent years. Qui tam actions are filed under seal and impose a mandatory duty on the U.S. Department of Justice to investigate such allegations. Most private citizen actions are declined by the Department of Justice or dismissed by federal courts. However, the investigation costs for a company can be significant and material even if the allegations are without merit. Various states have adopted laws similar to the federal civil False Claims Act, and many of these state laws are broader in scope and apply to all payors, and therefore, are not limited to only those claims submitted to the federal government. Medical device manufacturers and other healthcare companies also are subject to other federal false claims laws, including, among others, federal criminal healthcare fraud and false statement statutes that extend to non-government health benefit programs.

#### ***Healthcare Fraud Statute***

The federal Health Insurance Portability and Accountability Act (“HIPAA”) and its implementing regulations created federal criminal statutes that prohibit, among other things, knowingly and willfully executing, or attempting to execute, a scheme to defraud any healthcare benefit program, including private third-party payors knowingly and willfully falsifying, concealing or covering up a material fact or making any materially false, fictitious or fraudulent statement or representation, or making or using any false writing or document knowing the same to contain any materially false, fictitious or fraudulent statement or entry, in connection with the delivery of or payment for healthcare benefits, items or services.

#### ***Sunshine Act***

The federal Physician Payments Sunshine Act requires certain manufacturers of drugs, devices, biologics and medical supplies for which payment is available under Medicare, Medicaid or the Children’s Health Insurance Program to report annually with certain exceptions to CMS information related to payments or other transfers of value made to a physician or teaching hospital, or to a third party at the request of a physician or

teaching hospital, and requires applicable manufacturers and group purchasing organizations to report annually to CMS ownership and investment interests held by physicians and their immediate family members. Beginning in 2022, applicable manufacturers also will be required to report information regarding payments and transfers of value provided to physician assistants, nurse practitioners, clinical nurse specialists, certified nurse anesthetists and certified nurse-midwives.

#### ***Patient Data Privacy***

HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act (“HITECH Act”), and their implementing regulations impose obligations on covered entities, such as health plans, healthcare clearinghouses and certain healthcare providers, as well as business associates that provide services involving the use or disclosure of personal health information to or on behalf of covered entities. These obligations, such as mandatory contractual terms, relate to safeguarding the privacy and security of protected health information. Many states also have laws governing the privacy and security of health information in certain circumstances, many of which differ from each other in significant ways and often are not preempted by HIPAA.

#### ***Other State Laws***

Certain states also mandate implementation of commercial compliance programs, impose restrictions on device manufacturer marketing practices and/or require tracking and reporting of gifts, compensation and other remuneration to healthcare professionals and entities.

State and federal regulatory and enforcement agencies continue to actively investigate violations of healthcare laws and regulations, and the U.S. Congress continues to strengthen the arsenal of enforcement tools. Most recently, the Bipartisan Budget Act of 2018 (“BBA”) increased the criminal and civil penalties that can be imposed for violating certain federal healthcare laws, including the Anti-Kickback Statute. Enforcement agencies also continue to pursue novel theories of liability under these laws. In particular, government agencies recently have increased regulatory scrutiny and enforcement activity with respect to manufacturer reimbursement support activities and other patient support programs, including bringing criminal charges or civil enforcement actions under the Anti-Kickback Statute, federal civil False Claims Act and violations of healthcare fraud and HIPAA privacy provisions.

#### ***Enforcement and Penalties for Noncompliance with Fraud and Abuse Laws and Regulations***

Compliance with these federal and state laws and regulations requires substantial resources. If our operations are found to be in violation of any of the laws described above or any other governmental regulations that apply to us, we may be subject to significant civil, criminal and administrative penalties, damages, fines, imprisonment, disgorgement, exclusion from participation in government healthcare programs such as the Medicare and Medicaid programs, reputational harm, administrative burdens, diminished profits and future earnings, and the curtailment or restructuring of our operations. Companies settling federal civil False Claims Act, Anti-Kickback Statute and other fraud and abuse cases also may be required to enter into a Corporate Integrity Agreement with the U.S. Department of Health and Human Services Office of Inspector General in order to avoid exclusion from participation (i.e., loss of coverage for their products) in federal healthcare programs such as Medicare and Medicaid. Corporate Integrity Agreements typically impose substantial costs on companies to ensure compliance.

For additional information regarding obligations under federal healthcare statutes and regulations, please see the section titled “Risk Factors—If we fail to comply with U.S. federal and state fraud and abuse laws and regulations, including those relating to kickbacks and false claims for reimbursement, we could face substantial penalties and our business operations and financial condition could be adversely affected.”

## **United States Healthcare Reform**

There have been and continue to be proposals by the federal government, state governments, regulators and third-party payors to control or manage the increased costs of healthcare and, more generally, to reform the U.S. healthcare system.

For example, in the United States, in March 2010, the Patient Protection and Affordable Care Act, as amended by the Health Care and Education and Reconciliation Act (collectively, the “ACA”), was enacted. The ACA contains a number of significant provisions, including those governing enrollment in federal healthcare programs, reimbursement changes and fraud and abuse measures, all of which will impact existing government healthcare programs and will result in the development of new programs. The ACA, among other things, imposes an excise tax of 2.3% on the sale of most medical devices.

There have been judicial and Congressional challenges to certain aspects of the ACA, as well as recent efforts by the Trump administration to repeal or replace certain aspects of the ACA. For example, since January 2017, President Trump has signed two Executive Orders and other directives designed to delay the implementation of certain provisions of the ACA or otherwise circumvent some of the requirements for health insurance mandated by the ACA. Concurrently, Congress has considered legislation that would repeal or repeal and replace all or part of the ACA. While Congress has not passed comprehensive repeal legislation, two bills affecting the implementation of certain taxes under the ACA have been signed into law. The Tax Cuts and Jobs Act of 2017 (“TCJA”) includes a provision repealing, effective January 1, 2019, the tax-based shared responsibility payment imposed by the ACA on certain individuals who fail to maintain qualifying health coverage for all or part of a year that is commonly referred to as the “individual mandate.” On January 22, 2018, President Trump signed a continuing resolution on appropriations for fiscal year 2018 that delayed the implementation of certain ACA-mandated fees, including the 2.3% excise tax imposed on manufacturers and importers for certain sales of medical devices through December 31, 2019. The BBA, among other things, amended the ACA, effective January 1, 2019, to close the coverage gap in most Medicare drug plans, commonly referred to as the “donut hole.” In July 2018, CMS published a final rule permitting further collections and payments to and from certain ACA qualified health plans and health insurance issuers under the ACA risk adjustment program in response to the outcome of federal district court litigation regarding the method CMS uses to determine this risk adjustment. On December 14, 2018, a Texas U.S. District Court Judge ruled that the ACA is unconstitutional in its entirety because the “individual mandate” was repealed by Congress as part of the TCJA. While the Texas U.S. District Court Judge, as well as the Trump administration and CMS, have stated that the ruling will have no immediate effect pending appeal of the decision, it is unclear how this decision, subsequent appeals, and other efforts to repeal and replace the ACA will impact the ACA.

In addition, other legislative changes have been proposed and adopted since the ACA was enacted. On August 2, 2011, the Budget Control Act of 2011 was signed into law, which, among other things, includes reductions to Medicare payments to providers of 2% per fiscal year, which went into effect on April 1, 2013 and, due to subsequent legislative amendments to the statute, including the BBA, will remain in effect through 2027 unless additional Congressional action is taken. On January 2, 2013, the American Taxpayer Relief Act of 2012 was signed into law, which, among other things, reduced Medicare payments to several providers, including hospitals, and increased the statute of limitations period for the government to recover overpayments to providers from three to five years.

Further, recently there has been heightened governmental scrutiny over the manner in which manufacturers set prices for their marketed products, which has resulted in several U.S. Congressional inquiries and proposed, and enacted federal and state legislation designed to bring transparency to product pricing and reduce the cost of products and services under government healthcare programs. Congress and the Trump administration have each indicated that it will continue to seek new legislative and/or administrative measures to control product costs. Additionally, regional healthcare authorities and individual hospitals are increasingly using bidding procedures to determine what products to purchase and which suppliers will be included in their healthcare programs.

### **Employees**

As of December 31, 2018, we had 162 employees worldwide. None of our employees are represented by a collective bargaining agreement and we have never experienced a work stoppage. We believe our employee relations are good.

### **Facilities**

We produce substantially all of our IVL catheters in-house at our facilities in Fremont, California which, together with our research and development, controlled environment room and office space, currently totals 12,000 square feet. We plan to move our production of IVL catheters to our new 35,000 square foot facility in Santa Clara, California in 2019.

We believe that our Santa Clara facility meets our current and future anticipated needs.

### **Legal Proceedings**

Petitions for *inter partes* review of U.S. Pat. Nos. 9,642,673, 8,956,371 and 8,728,091 (the “IPR Patents”), which are three of our issued U.S. patents that relate to our current IVL Technology, were filed in December 2018 at the USPTO’s Patent Trial and Appeal Board (the “PTAB”) by Cardiovascular Systems, Inc., one of our competitors. Our preliminary responses to these petitions are due by April 2019, and the PTAB is expected to decide whether or not to institute the *inter partes* reviews by July 2019. If the PTAB decides to institute an *inter partes* review with respect to one or more of the IPR Patents, it could result in the loss or narrowing in scope of such patents, which could limit our ability to stop others from using or commercializing products and technology similar or identical to ours. For more information regarding the risks presented by such proceedings, please see the section titled “Risk Factors—Risks Related to Our Intellectual Property.”

We may be subject to other legal proceedings and claims in the ordinary course of business. We have received, and may from time to time receive, letters from third parties alleging patent infringement, violation of employment practices or trademark infringement, and we may in the future participate in litigation to defend ourselves. We cannot predict the results of any such disputes, and despite the potential outcomes, the existence thereof may have an adverse material impact on us due to diversion of management time and attention as well as the financial costs related to resolving such disputes.

## MANAGEMENT

### Executive Officers and Directors

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

<u>Name</u>	<u>Age</u>	<u>Position</u>
Douglas Godshall	54	President, Chief Executive Officer & Director
Dan Puckett	55	Chief Financial Officer & Secretary
Isaac Zacharias	44	Chief Commercial Officer
C. Raymond Larkin, Jr.(2)(3)	70	Chairman & Director
F.T. “Jay” Watkins(1)	66	Director
Antoine Papiernik(2)	52	Director
Colin Cahill(1)(3)	43	Director
Frederic Moll, M.D.(3)	67	Director
Marc-Andre Marcotte(4)	44	Director
Laura Francis(1)(2)	52	Director

(1) Member of the audit committee.

(2) Member of the compensation committee.

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

(4) Mr. Marcotte will resign from our board of directors effective immediately prior to the effectiveness of the registration statement of which this prospectus forms a part. As Mr. Marcotte is a partner at Sectoral Asset Management Inc., the firm’s policy prohibits Mr. Marcotte from serving on the board of directors of a public company of the firm’s portfolio companies.

### Executive Officers

**Douglas Godshall.** Mr. Godshall has served as our President and Chief Executive Officer and as a member of our board of directors since May 2017. Previously, Mr. Godshall served as the Chief Executive Officer of HeartWare International, Inc. (“HeartWare”), a Nasdaq-listed company, from September 2006 until August 2016 and as director from October 2006 until its acquisition by Medtronic plc in August 2016. Prior to joining HeartWare, Mr. Godshall served in various executive, managerial and leadership positions at Boston Scientific Corporation (“Boston Scientific”), where he had been employed since 1990. Mr. Godshall also serves on the board of directors of Eyepoint Pharmaceuticals, Inc. Mr. Godshall has a B.A. in Business from Lafayette College and M.B.A from Northeastern University. Mr. Godshall’s experience in the clinical development, business execution, and regulatory strategy for medical devices and pharmaceuticals provides him with the qualifications and skills to serve on our board of directors.

**Dan Puckett.** Mr. Puckett has served as our Chief Financial Officer since April 2016 and has served as our Secretary since November 2018. Prior to joining ShockWave Medical, from June 2015 to April 2016, Mr. Puckett served as Chief Financial Officer for Counsyl, a venture backed DNA testing and genetic counseling company. From 2011 to June 2015, Mr. Puckett served as Chief Financial Officer for Ariosa Diagnostics, Inc. (“Ariosa”), a molecular diagnostics company, until June 2015. Ariosa was acquired by Roche in January 2015. Mr. Puckett came to Ariosa from Forest Laboratories, Inc. in September 2011, where he served as Executive Director, Operations of Cerexa, Inc., a Forest Laboratories, Inc. subsidiary. Prior to Cerexa, Inc., Mr. Puckett held senior finance and operations positions at Affymetrix, Inc. and AOL. Mr. Puckett holds an M.B.A. from the University of San Francisco and a B.A. in Accounting from Washington State University.

**Isaac Zacharias.** Mr. Zacharias has served as our Chief Commercial Officer since November 2018. Previously, Mr. Zacharias served as our General Manager of Structural Heart and Vice President of International



Sales from March 2018 to November 2018. Prior to joining Shockwave Medical, Mr. Zacharias served as the Vice President, General Manager for the PCI Guidance business at Boston Scientific from July 2011 to March 2018. Prior to that, Mr. Zacharias also served as the Vice President, New Business Development for Boston Scientific where he negotiated investments and acquisitions for the Cardiology, Rhythm Management and Vascular business units. Mr. Zacharias began his career as an R&D engineer and has held a variety of clinical and marketing roles. Mr. Zacharias holds B.S. and M.S. degrees in Mechanical Engineering from the University of California, Davis.

#### *Nonemployee Directors*

**C. Raymond Larkin, Jr.** Mr. Larkin has served as a member and as Chairman of our board of directors since January 2019. Mr. Larkin has served as a principal of Group Outcome LLC., a merchant banking firm concentrating on medical technologies, since 2000. Mr. Larkin is presently also Chairman of the Board of Align Technology Inc., where he has served as a director since March 2004 and as Chairman of the Board since February 2006. In addition, Mr. Larkin has also served as Chairman of the Board of Reva Medical Inc. since July 2017. Previously, Mr. Larkin served as a director of HeartWare International, Inc. from October 2008 and as Chairman of its Board from June 2010 until its acquisition by Medtronic, plc in August 2016. Previously, he was President and Chief Executive Officer of Nellcor Puritan Bennett, Inc., one of the world's preeminent respiratory products companies. Mr. Larkin also served as Chief Executive Officer of Eunoe, a company focused a developing a technology to slow the progression of Alzheimer's disease. Mr. Larkin received his B.S. in Industrial Management from LaSalle University. Mr. Larkin's experience in the healthcare industry provides him with the qualifications and skills to serve on our board of directors.

**F.T. "Jay" Watkins.** Mr. Watkins has served as a member of our board of directors since 2013. He previously served as the Chairman of our board from May 2017 to January 2019. Mr. Watkins has been a Managing Director at De Novo Ventures ("De Novo") since 2002. Prior to joining De Novo in 2002, Mr. Watkins was a co-founder and founding Chief Executive Officer of Origin Medsystems, Inc. ("Origin"), a venture funded medical technology start-up, until its acquisition by Eli Lilly & Company ("Eli Lilly") in 1995. When Eli Lilly spun out its medical device businesses as Guidant Corporation ("Guidant"), Mr. Watkins became a member of Guidant's Management Committee and served as president of several divisions including the Minimally Invasive Surgery Group, the Cardiac and Vascular Surgery Group and Heart Rhythm Technologies. Mr. Watkins also co-founded Gynecare, Inc., a woman's health care company, which was spun out, taken public and subsequently acquired by Johnson & Johnson. Mr. Watkins was also the founding president of Compass, Guidant's corporate business development and new ventures group. where he was involved in the acquisition of two public companies and led venture investments in 14 companies. Prior to joining Origin, Mr. Watkins also held management positions in several start-ups, including Microgenics (acquired by Boehringer Mannheim) and was a consultant with McKinsey & Company. Mr. Watkins received his M.B.A. from Harvard Business School and his B.A. from Stanford University. Mr. Watkin's experience in the healthcare industry provides him with the qualifications and skills to serve on our board of directors.

**Antoine Papiernik.** Mr. Papiernik has served as a member of our board of directors since July 2013. Mr. Papiernik has been Managing Partner of Sofinnova Partners since 1997. Mr. Papiernik has been an initial investor and a board member in public companies, including ProQr Therapeutics N.V. and Mainstay Medical International plc. Mr. Papiernik is also a board member of private companies MedDay Pharmaceuticals, MD Start, Reflexion Medical, Gecko Biomedical, SafeHeal, Highlife and Rgenix. Mr. Papiernik served on the boards of EOS (Ethical Oncology Science S.p.A., CoAxia, Lectus Therapeutics Ltd, Entourage Medical Technologies, Inc., Corwave SA, Auris Medical Holding and Impatiens. Mr. Papiernik previously was an initial investor and a board member of the following companies, Actelion Pharmaceuticals Ltd. ("Actelion"), NovusPharma S.p.A. (sold to Cell Therapeutics, Inc.), Movetis NV (sold to Shire Plc), Pixium Vision SA and Stentys S, which went public respectively on the Zürich stock exchange, Nasdaq, the Stockholm stock exchange, the Milan Nuovo Mercato, the Belgium Stock Exchange and the EuroNext Paris. He was also a board member for Cotherix Inc. (initially Nasdaq listed, then sold to Actelion), CoreValve (sold to Medtronic plc), Fovea Pharmaceuticals (sold

to Sanofi-Aventis S.A.) and ReCor Medical, Inc. (sold to Otsuka Pharmaceutical Co., Ltd.). Mr. Papiernik received his M.B.A. from the Wharton School of Business, University of Pennsylvania and his B.S. from Institut Etudes Economiques Commerciales. Mr. Papiernik's experience in the healthcare industry provides him with the qualifications and skills to serve on our board of directors.

**Colin Cahill.** Mr. Cahill has served as a member of our board of directors since May 2015. Mr. Cahill has been Vice-President of Venrock since 2012 and focuses on Venrock's public and cross-over biotech fund. Prior to joining Venrock, Mr. Cahill was a co-founder and Chief Development Officer at Sampirica Spine, Inc. ("Sampirica"), a Bay Area medical device company focused on the development and commercialization of devices for spinal stabilization. Mr. Cahill also served as Sampirica's Chief Executive Officer from 2006 until 2009. Prior to graduate school, Mr. Cahill worked at the Boston Consulting Group as a strategy consultant. Mr. Cahill received a M.B.A. from the Stanford Graduate School of Business and his M.S. in biological sciences from Stanford University. Mr. Cahill received his B.A. and B.S. in biological sciences and economics, respectively, from Stanford University. Mr. Cahill's experience in life science operations and investment provides him with the qualifications and skills to serve on our board of directors.

**Frederic Moll, M.D.** Dr. Moll has served as a member of our board of directors since 2011. Dr. Moll has been a member and served as Chairman of the board of Restoration Robotics, Inc. since November 2002. Dr. Moll is also a co-founder, and, since September 2012, has been the Chairman and Chief Executive Officer of Auris Health, Inc. Dr. Moll has served in a leadership capacity of Circuit Therapeutics since 2011. From 2002 to 2010, Dr. Moll served as the Chief Executive Officer of Hansen Medical, which he also co-founded. Previously, Dr. Moll co-founded Intuitive Surgical, Inc. and from 1995 to 2002 served as its first Chief Executive Officer. Dr. Moll also co-founded Endo-Therapeutics, Inc. and Origin, which later became an operating company within Guidant Corporation following its acquisition by Eli Lilly & Company. Dr. Moll serves on the boards of directors of IntersectENT, Inc. Dr. Moll received a B.A. in economics from the University of California at Berkeley, an M.S. in management from Stanford University and an M.D. from the University of Washington. Dr. Moll's experience in the healthcare sector and his medical background and experience provide him with the qualifications and skills to serve on our board of directors.

**Marc-Andre Marcotte, CFA.** Mr. Marcotte has served as a member of our board of directors since August 2018. He serves as Partner at Sectoral Asset Management Inc., which he joined in 2006. There, Mr. Marcotte has been Chief Operating Officer since April 2018. Prior to his current position, Mr. Marcotte was a Managing Director of Sectoral Asset Management from December 2013 to April 2018. Prior to Sectoral Asset Management Inc., Mr. Marcotte served at CryoCath Technologies, Inc. as the Director of Quality. Prior to that, Mr. Marcotte worked at Arterial Vascular Engineering in Vancouver as an engineer on angioplasty catheters and stents. Mr. Marcotte has been a C.F.A. charterholder since 2010. Mr. Marcotte graduated from Sherbrooke University in 1997 with a B.E. and completed a M.B.A. at HEC Montreal in 2004. Mr. Marcotte's perspective as a partner of a healthcare investment firm, along with his experience in the healthcare industry, provides him with the qualifications and skills to serve on our board of directors. Mr. Marcotte will resign from our board of directors effective immediately prior to the effectiveness of the registration statement of which this prospectus forms a part. As Mr. Marcotte is a partner at Sectoral Asset Management Inc., the firm's policy prohibits Mr. Marcotte from serving on the board of directors of a public company of the firm's portfolio companies.

**Laura Francis.** Ms. Francis has served as a member of our board of directors since January 2019. Ms. Francis has been Chief Financial Officer of SI-BONE, Inc., an orthopedic device company, since May 2015. Prior to that position, she was the Chief Financial Officer for Auxogyn, Inc., a women's health company, from December 2012 to September 2014. From September 2004 to December 2012, Ms. Francis served as Vice President of Finance, Chief Financial Officer and Treasurer for Promega Corporation, a life science reagent company. From March 2002 to September 2004, she served as the Chief Financial Officer of Bruker BioSciences Corporation, a public life science instrumentation company. From May 2001 to March 2002, Ms. Francis served as Chief Operating Officer and Chief Financial Officer of Nutra-Park Inc., an agricultural biotechnology company. From April 1999 to May 2001, Ms. Francis was Chief Financial Officer of Hypercosm, Inc., a software

company. From October 1995 to April 1999, she was an engagement manager with McKinsey & Company. Early in her career, Ms. Francis was an audit manager with Coopers & Lybrand, an accounting firm. Ms. Francis received a B.B.A. from the University of Wisconsin and an M.B.A. from Stanford University. She is a Certified Public Accountant (inactive) in the State of California. Ms. Francis's experience in the healthcare industry provides her with the qualifications and skills to serve on our board of directors.

#### **Family Relationships**

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

#### **Board Structure and Compensation of Directors**

Our board of directors currently consists of eight members, which will be reduced to seven members following the resignation of Mr. Marcotte immediately prior to the effectiveness of the registration statement of which this prospectus forms a part. In accordance with our amended and restated certificate of incorporation and our amended and restated bylaws, immediately after the completion of this offering, our directors will be divided into three classes serving staggered three-year terms. At each annual meeting of stockholders, our directors will be elected to succeed the class of directors whose terms have expired. Our current directors will be divided among the three classes as follows:

- the Class I directors will consist of C. Raymond Larkin, Jr. and Laura Francis, and their terms will expire at the annual meeting of stockholders to be held in 2020;
- the Class II directors will consist of Antoine Papiernik and Colin Cahill, and their terms will expire at the annual meeting of stockholders to be held in 2021; and
- the Class III directors will consist of Douglas Godshall, F.T. "Jay" Watkins and Frederic Moll, and their terms will expire at the annual meeting of stockholders to be held in 2022.

This classification of our board of directors could have the effect of increasing the length of time necessary to change the composition of a majority of the board of directors. In general, at least two annual meetings of stockholders will be necessary for stockholders to effect a change in a majority of the members of the board of directors.

#### ***Director Independence***

Our board of directors has undertaken a review of the independence of each director. Based on information provided by each director concerning his background, employment and affiliations, our board of directors has determined that each of F.T. "Jay" Watkins, Antoine Papiernik, Frederic Moll, Colin Cahill, C. Raymond Larkin, Jr. and Laura Francis do not have a relationship that would interfere with the exercise of independent judgment in carrying out the responsibilities of a director and is independent under applicable Nasdaq rules. In making these determinations, our board of directors considered the current and prior relationships that each non-employee director has with our company and all other facts and circumstances our board of directors deemed relevant in determining their independence, including the beneficial ownership of our capital stock by each non-employee director, and the transactions involving them described in the section titled "Certain Relationships and Related Party Transactions."

#### ***Compensation of Directors***

Upon the closing of this offering, directors who are also full-time officers or employees of our company will receive no additional compensation for serving as directors, and directors who are not full-time officers or employees of our company ("non-employee directors") will receive the following compensation.

Each non-employee director will receive an annual cash retainer in recognition of his or her service to the board, along with an additional annual cash retainer for service as chairperson or a member of each committee of our board on which the director serves.

<b>Position</b>	<b>Annual Cash Retainer</b>
<b>Board Member</b>	\$ 35,000
<b>Committee Chair:</b>	
Audit	\$ 16,000
Compensation	\$ 12,000
Nominating and Governance	\$ 8,000
<b>Committee Member:</b>	
Audit	\$ 8,000
Compensation	\$ 6,000
Nominating and Governance	\$ 4,000

#### **Equity Awards in Connection with Offering.**

In addition to the Annual Cash Retainer, in connection with the offering hereunder, certain non-employee directors will receive a one-time grant of stock options under our 2019 Plan, with an aggregate value of \$150,000 based on the Black-Scholes option-pricing model and a per share exercise price equal to the initial public offering price in this offering.

#### **Ongoing Equity Compensation.**

We are considering whether to provide annual equity grants to our non-employee directors and, if so, in what forms.

For any director whose employer or fund does not permit the director to take securities as compensation for service on the board of directors, the director compensation plan will provide for one or more cash-based awards that such a director may elect to receive in lieu of the options or other securities to which he or she would otherwise be entitled, subject to such terms and conditions as may be determined by the board of directors or the compensation committee, as applicable.

#### **Board Committees**

##### ***Audit Committee***

The members of our audit committee are Laura Francis, Colin Cahill and F.T. “Jay” Watkins. Ms. Francis is the chairwoman of our audit committee. The composition of our audit committee meets the requirements for independence under the current Nasdaq listing standards and SEC rules and regulations. Each member of our audit committee is financially literate. In addition, our board of directors has determined that Laura Francis is an “audit committee financial expert” as defined in Item 407(d)(5)(ii) of Regulation S-K promulgated under the Securities Act. This designation does not impose on either any duties, obligations or liabilities that are greater than are generally imposed on members of our audit committee and our board of directors. Our audit committee is directly responsible for, among other things:

- selecting a firm to serve as the independent registered public accounting firm to audit our financial statements;
- ensuring the independence of the independent registered public accounting firm;
- discussing the scope and results of the audit with the independent registered public accounting firm and reviewing, with management and that firm, our interim and year-end operating results;

- establishing procedures for employees to anonymously submit concerns about questionable accounting or audit matters;
- considering the adequacy of our internal controls and internal audit function;
- reviewing material related party transactions or those that require disclosure; and
- approving or, as permitted, pre-approving all audit and non-audit services to be performed by the independent registered public accounting firm.

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

#### ***Compensation Committee***

The members of our compensation committee are Antoine Papiernik, Laura Francis and C. Raymond Larkin, Jr. Mr. Papiernik is the chairman of our compensation committee. Each member of this committee is a non-employee director, as defined by Rule 16b-3 promulgated under the Exchange Act, and an outside director, as defined pursuant to Section 162(m) of the Internal Revenue Code of 1989, as amended, (the “Code”), and meets the requirements for independence under the current Nasdaq listing standards and SEC rules and regulations. Our compensation committee is responsible for, among other things:

- reviewing and approving, or recommending that our board of directors approve, the compensation of our executive officers;
- reviewing and recommending to our board of directors the compensation of our directors;
- administering our stock and equity incentive plans;
- reviewing and approving, or making recommendations to our board of directors with respect to, incentive compensation and equity plans; and
- reviewing our overall compensation philosophy.

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

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

The members of our nominating and governance committee are C. Raymond Larkin, Jr., Frederic Moll, M.D. and Colin Cahill. Mr. Larkin is the chairman of our nominating and governance committee. Mr. Larkin, Mr. Moll and Mr. Cahill all meet the requirements for independence under the current Nasdaq listing standards. Our nominating and governance committee is responsible for, among other things:

- identifying and recommending candidates for membership on our board of directors;
- reviewing and recommending our corporate governance guidelines and policies;
- reviewing proposed waivers of the code of conduct for directors and executive officers;
- overseeing the process of evaluating the performance of our board of directors; and
- assisting our board of directors on corporate governance matters.

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

#### **Code of Ethics**

In connection with this offering, our board of directors will adopt a code of ethics 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. Upon completion of this offering, the full text of our code of business conduct and ethics will be posted on the investor relations section of our website. We intend to disclose future amendments to our code of business conduct and ethics, or any waivers of such code, on our website or in public filings.

### **Limitation of Liability and Indemnification**

Our amended and restated certificate of incorporation, which will be in effect upon the completion of this offering, contains provisions that limit the liability of our directors for monetary damages to the fullest extent permitted by Delaware law. Consequently, our directors will not be personally liable to us or our stockholders for monetary damages for any breach of fiduciary duties as directors, except liability for:

- any breach of the director's duty of loyalty to us or our stockholders;
- any act or omission not in good faith or that involves intentional misconduct or a knowing violation of law;
- unlawful payments of dividends or unlawful stock repurchases or redemptions as provided in Section 174 of the Delaware General Corporation Law; or
- any transaction from which the director derived an improper personal benefit.

Our amended and restated certificate of incorporation to be in effect upon the completion of this offering will provide that we may indemnify our directors and officers, in each case to the fullest extent permitted by Delaware law. Our amended and restated bylaws to be in effect upon the completion of this offering will also provide that we are obligated to indemnify our directors and officers to the fullest extent permitted by Delaware law and advance expenses incurred by a director or officer in advance of the final disposition of any action or proceeding and permit us to secure insurance on behalf of any officer, director, employee or other agent for any liability arising out of his or her actions in that capacity regardless of whether we would otherwise be permitted to indemnify him or her under the provisions of Delaware law. We have entered into agreements to indemnify our directors, executive officers and other employees as determined by our board of directors. With specified exceptions, these agreements will provide for indemnification for related expenses including, among other things, attorneys' fees, judgments, fines and settlement amounts incurred by any of these individuals in any action or proceeding. We believe these limitations of liability provisions and indemnification agreements are necessary to attract and retain qualified persons as directors and officers. We also maintain directors' and officers' liability insurance.

The limitation of liability and indemnification provisions in our amended and restated certificate of incorporation, amended and restated bylaws and indemnification agreements may discourage stockholders from bringing a lawsuit against our directors and officers for breach of their fiduciary duty. Our amended and restated certificate of incorporation will provide that any such lawsuit must be brought in the Court of Chancery of the State of Delaware. The foregoing provisions may also reduce the likelihood of derivative litigation against our directors and officers, even though an action, if successful, might benefit us and other stockholders. Further, a stockholder's investment may be adversely affected to the extent that we pay the costs of settlement and damage awards against directors and officers as required by these indemnification provisions. Insofar as indemnification for liabilities arising under the Securities Act may be permitted to our directors, officers and controlling persons pursuant to the foregoing provisions, or otherwise, we have been advised that, in the opinion of the SEC, such indemnification is against public policy as expressed in the Securities Act, and is, therefore, unenforceable. At present, there is no pending litigation or proceeding involving any of our directors, officers or employees for which indemnification is sought, and we are not aware of any threatened litigation that may result in claims for indemnification.

**Compensation Committee Interlocks and Insider Participation**

Prior to this offering, our compensation committee consisted of F.T. “Jay” Watkins, our Chairman, Antoine Papiernik and Frederic Moll. As a result, Mr. Watkins, Mr. Papiernik and Dr. Moll determined the compensation of our executive officers. None of our executive officers has served as a member of a compensation committee (or if no committee performs that function, the board of directors) of any other entity that has an executive officer serving as a member of our board of directors.

**EXECUTIVE COMPENSATION****Summary Compensation Table**

The following table sets forth information concerning the compensation paid to our principal executive officer, and our two other most highly compensated executive officers during our fiscal year ended December 31, 2018.

**2018 SUMMARY COMPENSATION TABLE**

<b>Name and Principal Position</b>	<b>Year</b>	<b>Salary (\$)</b>	<b>Bonus (\$)(1)</b>	<b>Stock Awards (\$)</b>	<b>Option Awards (\$)(2)</b>	<b>Non-Equity Incentive Plan Compensation (\$)</b>	<b>Nonqualified Deferred Compensation Earnings (\$)</b>	<b>All Other Compensation (\$)(3)</b>	<b>Total (\$)</b>
Douglas Godshall, Chief Executive Officer	2018	375,595	135,000	—	—	—	—	330	510,925
Dan Puckett, Chief Financial Officer & Secretary	2018	314,863	88,594	—	25,965	—	—	330	429,752
Isaac Zacharias, Chief Commercial Officer(4)	2018	236,064	113,103	—	558,480	—	—	248	907,895

(1) These figures reflect the annual bonus earned by each executive based on his service in 2018, which will be paid in February 2019.

(2) Amounts shown in this column do not reflect dollar amounts actually received by our named executive officers. Instead, these amounts reflect the aggregate grant date fair value of each stock option granted in 2018 computed in accordance with the provisions of FASB ASC Topic 718. Assumptions used in the calculation of these amounts are included in Note 10 to our financial statements included in this prospectus. As required by SEC rules, the amounts shown exclude the impact of estimated forfeitures related to service-based vesting conditions. Our named executive officers will only realize compensation to the extent the trading price of our common stock is greater than the exercise price of such stock options.

(3) These figures reflect life insurance premiums paid with respect to each executive.

(4) Mr. Zacharias served as our General Manager of Structural Heart and Vice President of International Sales from March 2018 to November 2018, when he was promoted to the position of Chief Commercial Officer. As required by SEC rules, the amounts shown reflect all compensation paid or provided to Mr. Zacharias for his service to the Company in 2018, including the period prior to his promotion. The figure in the Bonus column for Mr. Zacharias includes a \$40,000 sign-on bonus granted upon Mr. Zacharias' joining the Company. The figure in the Option Awards column for Mr. Zacharias reflects the value of options granted upon Mr. Zacharias' joining the Company and upon his promotion.

**Executive Officer Employment Arrangements**

We have entered into employment agreements with each of our named executive officers, the key terms of which are described below. In addition, as a condition of employment each of our named executive officers has also entered into our standard, at-will employment, confidential information, invention assignment and arbitration agreement. Under these agreements, each officer has made a covenant not to solicit our employees, both during the officer's employment and for the 12-month period following termination of employment for any reason.

*Douglas Godshall*

We are party to an offer letter with Mr. Godshall dated April 28, 2017, under which Mr. Godshall has agreed to serve as our President and Chief Executive Officer, and as a member of our board of directors.

This offer letter provides that Mr. Godshall will receive an initial compensation package including (i) an annual base salary of \$375,000, (ii) an annual bonus with a target opportunity of 40% of annual base salary, subject to Mr. Godshall and our achievement of milestones to be established by our board of directors, and (iii) an option award to purchase 6% of the fully diluted shares of our common stock as of the date of grant, with an exercise price equal to the fair market value of the common stock on the date of grant, to vest as to 25% of the



award on the first anniversary of the date of grant, with the remainder of the award to vest in equal amounts over the next 36 months (with any then unvested shares vesting upon the closing of a change of control, if Mr. Godshall is employed through the date we sign a definitive agreement with respect to that change of control and subject to Mr. Godshall's release of claims).

Under his offer letter, Mr. Godshall's employment is for no specified period and constitutes at-will employment. In the event that Mr. Godshall's employment is terminated by us without cause (as defined in the offer letter and described below) or by Mr. Godshall for good reason (as defined in the offer letter and described below) then, subject to Mr. Godshall's release of claims in a form acceptable to us, Mr. Godshall will receive a continuation of benefits and base salary for twelve months following termination. Unless we have conducted an initial public offering and experienced a subsequent change of control prior to Mr. Godshall's termination or resignation, this severance arrangement will terminate early if Mr. Godshall commences new employment fewer than twelve months after such termination or resignation.

For purposes of Mr. Godshall's offer letter, "cause" is defined as Mr. Godshall's (i) failure to substantially perform material duties and obligations, which failure is not cured to the reasonable satisfaction of our board of directors within ten business days after written notice; (ii) act of personal dishonesty, moral turpitude, fraud, embezzlement, misrepresentation or other unlawful act that results in harm to us or our affiliates; (iii) violation of law or regulation applicable to our business; (iv) conviction of, or plea of nolo contendere or guilty to, a felony; or (v) material breach of the terms of any agreement with us or one of our affiliates.

For purposes of Mr. Godshall's offer letter, "good reason" is defined as the occurrence, without Mr. Godshall's prior written consent, of: (i) a material diminution of Mr. Godshall's base salary (unless part of a generalized reduction affecting senior level employees); (ii) a material diminution of authority, duties or responsibilities (unless in connection with a change of control if Mr. Godshall has reasonably comparable authority, duties and responsibilities after the change of control, regardless of any change in title or whether he subsequently provides services to a subsidiary, affiliate, business unit, division or otherwise); (iii) our requirement that Mr. Godshall relocate his principal residence to the state in which we conduct our principal business; or (iv) our material breach of the agreement under which Mr. Godshall provides services to us, which is not cured to Mr. Godshall's reasonable satisfaction within ten business days after notice.

For purposes of Mr. Godshall's offer letter, "change of control" is defined as: (1) our acquisition by another entity by means of any transaction (including a series of related transactions, but excluding our sale of securities for the purpose of raising additional funds) unless our stockholders of record immediately prior to such transaction hold, immediately after such transactions, at least 50% of the voting power of the surviving or acquiring entity; or (2) a sale of all or substantially all of our assets.

#### *Dan Puckett*

We are party to an offer letter with Mr. Puckett dated March 21, 2016, under which Mr. Puckett has agreed to serve as our Chief Financial Officer.

This offer letter provides that Mr. Puckett will receive an initial compensation package, including (i) an annual base salary of \$290,000 and (ii) an option award to purchase 1.01% of the fully diluted shares of our common stock as of the date of grant, with an exercise price equal to the fair market value of the common stock on the date of grant, to vest as to 25% of the award on the first anniversary of the date of grant, with the remainder of the award to vest in equal amounts over the next 36 months subject to his continued employment with the company (with any then unvested shares vesting on a "double trigger" basis in the event of a change of control). Mr. Puckett's employment with the company is on an at-will basis. We are free to conclude his employment at any time, with or without cause and with or without notice.

*Isaac Zacharias*

We are party to a letter agreement with Mr. Zacharias dated November 26, 2018, under which Mr. Zacharias has agreed to serve as our Chief Commercial Officer. This letter agreement, which is cast as an offer letter, sets forth the terms and conditions of Mr. Zacharias' continued employment with us in his new role.

This letter agreement provides that Mr. Zacharias will receive a compensation package including (i) an annual base salary of \$310,000, (ii) an annual bonus of up to 25% of annual base salary and (iii) an option award to purchase 81,967 shares of our common stock with an exercise price equal to the fair market value of the common stock on the date of grant, to vest in equal amounts over the next 48 months subject to his continued employment with the company. Mr. Zacharias' employment with the company is on an at-will basis. We are free to conclude his employment at any time, with or without cause and with or without notice.

**Changes to Executive Officer Compensation in Connection with this Offering**

In connection with our initial public offering hereunder, our Compensation Committee has approved the following changes to the compensation arrangements for our named executive officers, effective upon the closing of this offering:

- Mr. Godshall's annual base salary will increase to \$500,000 and his annual bonus target opportunity will be 75% of his annual base salary;
- Mr. Puckett's annual base salary will increase to \$350,000 and his annual bonus target opportunity will be 50% of his annual base salary; and
- Mr. Zacharias' annual base salary will remain \$310,000 and his annual bonus target opportunity will be 45% of his annual base salary.

Also in connection with our initial public offering, Mr. Godshall and Mr. Puckett will receive stock option awards to acquire up to 81,967 shares and 53,278 shares, respectively, of common stock of the Company under its 2019 Equity Incentive Plan at an exercise price equal to the initial public offering price of this offering, with such awards scheduled to vest monthly in substantially equal installments for four years from the date of grant, subject in each case to continued service through each applicable vesting date.

**Outstanding Equity Awards at Fiscal Year End**

The following table sets forth information concerning unexercised options, stock that has not vested and equity incentive plan awards for the executive officers named in the Summary Compensation Table as of the end of our fiscal year ended December 31, 2018.

## OUTSTANDING EQUITY AWARDS AT 2018 FISCAL YEAR END

Name	Grant Date	Option Awards		Equity Incentive Plan Awards: Number of Securities Underlying Unexercised Unearned Options (#)	Option Exercise Price (\$)	Option Expiration Date
		Numbers of Securities Underlying Unexercised Options (#) Exercisable	Numbers of Securities Underlying Unexercised Options (#) Unexercisable			
Douglas Godshall	05/09/2017	468,982	715,817(1)	—	3.42	05/09/2027
Dan Puckett	05/18/2016	98,360	49,180(1)	—	2.20	05/18/2026
	08/03/2017	5,805	10,588(2)	—	3.42	08/03/2027
	07/19/2018	1,280	11,015(2)	—	4.03	07/19/2028
Isaac Zacharias	04/10/2018	—	147,540(1)	—	4.03	04/10/2028
	11/14/2018	—	81,967(1)	—	6.71	11/14/2028

(1) Subject to vesting as to 1/4 of the award upon continued service through the first anniversary of the date of grant and as to 1/48 of the award upon continued service through each month thereafter, through the fourth anniversary of the date of grant.

(2) Subject to vesting as to 1/48 of the award upon continued service through each month following the date of grant, through the fourth anniversary of the date of grant.

**Employee Benefit Plans**

Our officers are entitled to participate in our equity incentive plans. All officers are eligible to participate in the company's 401(k) plan on the same terms as all other employees.

**Annual Bonus Program**

We maintain an annual bonus program that rewards each of our named executive officers for our performance against business goals, and for the officer's performance against his or her individual goals. Our board of directors establishes performance goals for this program each year and then evaluates performance to these established goals to determine the amount of each award. This program is based on performance over a calendar year and pays out on or before March 15 of the following year, subject to the executive's continued service through the payment date. All awards under this program are subject to management discretion.

**2019 Equity Incentive Plan**

In February 2019, our board of directors adopted and our stockholders approved our 2019 Equity Incentive Plan (the "2019 Plan"), which will become effective upon the effectiveness of the registration statement, of which this prospectus forms a part. Our 2019 Plan replaces our 2009 Equity Incentive Plan (the "2009 Plan"). Following the effectiveness of the 2019 Plan, no further equity awards may be granted under our 2009 Plan.

*Stock awards.* The 2019 Plan provides for the grant of incentive stock options ("ISOs"), nonstatutory stock options ("NSOs"), stock appreciation rights, restricted stock awards and restricted stock unit awards (collectively, "stock awards"). ISOs may be granted only to employees. All other awards may be granted to employees, directors and consultants.

*Share reserve.* The aggregate number of shares of our common stock initially reserved for issuance pursuant to stock awards under the 2019 Plan is 2,000,430, plus (i) any shares subject to stock options or other stock awards granted under our 2009 Plan that expire or terminate for any reason, are forfeited or repurchased by us or are reacquired, withheld or not issued to satisfy a tax withholding obligation, up to a maximum of 3,636,224 shares. The maximum number of shares that may be issued upon the exercise of incentive stock options will equal this aggregate maximum number of shares plus other shares that become available upon lapsed awards or

certain other conditions, to the extent allowed by Section 422 of the Code and the regulations promulgated thereunder. The 2019 Plan provides that the number of shares reserved and available for purchase under the plan will automatically increase on the first day of each fiscal year beginning with the 2020 fiscal year and ending with the 2028 fiscal year, in an amount equal to the least of (i) 3% of the outstanding shares of our common stock on the last business day of immediately preceding fiscal year and (ii) such number of shares of our common stock determined by our board of directors.

If a stock award granted under the 2019 Plan is forfeited back to us because of the failure to meet a contingency or condition required to vest, such shares will become available for subsequent issuance under the 2019 Plan. In addition, shares withheld to satisfy income or employment withholding taxes and shares used to pay the exercise price of a stock option will become available for the grant of new stock awards under the 2019 Plan.

*Administration.* Our board of directors, or one or more duly authorized committees thereof, have the authority to administer the 2019 Plan. Subject to the terms of the 2019 Plan, our board of directors or the authorized committee, referred to herein as the plan administrator, determines recipients, dates of grant, the numbers and types of stock awards to be granted and the terms and conditions of the stock awards, including the period of their exercisability and vesting schedule applicable to a stock award. Subject to the limitations set forth below, the plan administrator will also determine the exercise price, strike price or purchase price of awards granted and the types of consideration to be paid for the award. The plan administrator has the authority to modify outstanding awards made under the 2019 Plan, but is not authorized to reduce the exercise price of stock options or stock appreciation rights without stockholder consent.

*Stock Options.* Incentive and nonstatutory stock options are granted pursuant to stock option agreements adopted by the plan administrator. The plan administrator determines the exercise price for a stock option, within the terms and conditions of the 2019 Plan, provided that the exercise price of a stock option cannot be less than 100% of the fair market value of our common stock on the date of grant. In the case of an ISO granted to an employee who owns stock representing more than 10% of the voting power of all classes of our stock or any parent or subsidiary of us, the exercise price will be no less 110% of the fair market value on the date of the grant. Options vest at the rate specified by the plan administrator. At the time an option is granted, the plan 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.

The plan administrator determines the term of stock options granted under the 2019 Plan, up to a maximum of 10 years. In the case of an incentive stock option granted to an employee who owns stock representing more than 10% of the voting power of all classes of our stock or the stock of any of our parents or subsidiaries, the maximum term will be five years. Unless the terms of an optionholder's stock option agreement provide otherwise, if an optionholder's service relationship with us ceases for any reason other than disability or death, the optionholder may generally exercise any vested options for a period of 30 days following the cessation of service. If an optionholder's service relationship with us ceases due to disability or death, the optionholder or a beneficiary may generally exercise any vested options for a period of six months, or within such longer period of time as is specified in the award agreement. In no event may an option be exercised beyond the expiration of its term. Subject to the terms of our 2019 Plan, the plan administrator has the authority to extend the post-termination exercisability period of awards and to extend the maximum term of an option.

Acceptable consideration for the purchase of common stock issued upon the exercise of a stock option will be determined by the plan administrator and may include (1) cash, (2) check, (3) promissory note, (4) other shares, (5) a broker-assisted cashless exercise, (6) by net exercise or (7) combination of the foregoing methods of payment.

Unless the plan administrator provides otherwise, options generally are not transferable except by will or by the laws of descent and distribution. An optionholder may designate a beneficiary, however, who may exercise the option following the optionholder's death.

*Stock Appreciation Rights.* The 2019 Plan permits the grant of stock appreciation rights. Stock appreciation rights give recipients the right to acquire a specified number of shares of stock at a predetermined price. The terms of the stock appreciation rights granted under the 2019 Plan are determined by the plan administrator in the award agreement evidencing the award, including the number of shares, exercise price, expiration date and other terms.

*Restricted Stock and Restricted Stock Units.* The 2019 Plan permits the grant of restricted stock and/or restricted stock units. Restricted stock awards are grants of shares of our common stock. Restricted stock units represent the right to receive shares of our common stock (or a cash amount equal to the value of our common stock) on future specified dates. The terms of the restricted stock and/or restricted stock units granted under the 2019 Plan are determined by the plan administrator in the award agreement evidencing the award, including the number of shares, period of restriction or vesting schedule and other terms.

*Tax Limitations on Incentive Stock Options.* The aggregate fair market value, determined at the time of grant, of our common stock with respect to ISOs that are exercisable for the first time by an optionholder during any calendar year under all of our stock plans may not exceed \$100,000. Options or portions thereof that exceed such limit will generally be treated as NSOs. No ISO may be granted to any person who, at the time of the grant, owns or is deemed to own stock possessing more than 10% of our total combined voting power or that of any of our affiliates unless (1) the option exercise price is at least 110% of the fair market value of the stock subject to the option on the date of grant and (2) the option is not exercisable after the expiration of five years from the date of grant.

*Adjustments; Corporate Transactions.* In the event of certain changes in our corporate structure, including any dividend or other distribution, recapitalization, stock split, reverse stock split, reorganization, merger, consolidation, split-up, spin-off, combination, repurchase or exchange of shares of the company, the plan administrator will make appropriate adjustments to outstanding awards to prevent diminution or enlargement of the benefits or potential benefits available under the 2019 Plan.

*Merger or Change of Control.* In the event of certain corporate transactions specified in the 2019 Plan, including a merger or change of control, as defined in the 2019 Plan, each outstanding award will be treated as the plan administrator determines, without a participant's consent, including that (i) awards will be assumed or substituted by the succeeding corporation; (ii) the awards will terminate; (iii) outstanding awards will vest and become exercisable; (iv) the awards will terminate in exchange for an amount of cash and/or property, if any, equal to the amount that would have been attained upon the exercise of the award or realization of the rights under the award as of the date of the transaction; (v) the replacement of any award with rights or property selected by the plan administrator; or (vi) any combination of the above. In the event that the successor corporation does not assume or substitute 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, and all restrictions on restricted stock and restricted stock units will lapse and performance goals will be deemed achieved at 100% of the target levels. Our plan administrator is not obligated to treat all stock awards, even those that are of the same type, in the same manner. Under the 2019 Plan, a change of control is generally: (i) the acquisition by a person or entity of more than 50% of our combined voting power other than by private financing that is approved by our board of directors; (ii) if we are public, the date on which a majority of our board of directors has been replaced during any 12-month period by directors whose appointment or election is not endorsed by a majority of the members of our board of directors prior to the date of appointment or election; or (iii) change in ownership of a substantial portion of our assets.

*Amendment and Termination.* The 2019 Plan will terminate in 2029. However, our board of directors has the authority to amend, alter, or terminate our 2019 Plan, provided that such action does not materially impair the existing rights of any participant without such participant's written consent.

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

In February 2019, our board of directors adopted and our stockholders approved our Employee Stock Purchase Plan ("ESPP"). The ESPP will become effective upon the effectiveness of the registration statement of which this prospectus forms a part. Unless otherwise determined by the board of directors, the ESPP will be administered by our compensation committee.

*Share Reserve.* The ESPP authorizes the initial issuance of up to a total of 300,650 shares of our common stock to participating employees. The ESPP provides that the number of shares reserved and available for purchase under the plan will automatically increase on the first day of each fiscal year beginning with the 2020 fiscal year and ending with the 2028 fiscal year, in an amount equal to the least of (i) 1% of the outstanding shares of our common stock on the last day of immediately preceding fiscal year and (ii) such number of shares of our common stock determined by our board of directors. The number of shares authorized under the ESPP at any time is subject to antidilution adjustment in the event of a stock split, stock dividend or other change in our capitalization.

*Eligible Employees.* All employees who have been employed by us or our designated subsidiaries are eligible to participate in the ESPP, provided that the plan administrator may determine from time to time in its discretion to not include in the ESPP or any particular offering period employees who work less than 20 hours per week or less than five months in any calendar year. Any employee who owns, or would own upon such purchase under the ESPP, 5% or more of the voting power or value of our stock is not eligible to purchase shares under our the ESPP.

*Offering Periods.* Unless otherwise determined by the administrator of the ESPP, each offering to our employees to purchase stock under the ESPP will begin on each September 1 and March 1 and will end on the following February 28 or 29 and August 30, respectively, each referred to as offering periods, provided that the first offering period will begin on September 1, 2019 and will end on February 29, 2020. The administrator may designate different offering periods prior to the beginning of an offering period in its discretion, but no offering shall exceed 27 months in duration.

*Purchase Limits and Offering Price.* Each employee who is a participant in the ESPP may purchase shares by authorizing payroll deductions at a minimum of 1% and up to 15% of his or her eligible compensation for each pay period. Unless the participating employee has previously withdrawn from the offering, his or her accumulated payroll deductions will be used to purchase our common stock on the last business day of the offering period at a price equal to 85% of the fair market value of the common stock on either the first or the last day of the offering period, whichever is lower, or such higher price for any given offering period as may be determined by the Committee, provided that no more than 1,250 shares of our common stock or such other lesser maximum number established by the plan administrator may be purchased by any one employee during each offering period. Under applicable tax rules, an employee may purchase no more than \$25,000 worth of common stock, valued at the start of the purchase period, under the ESPP in any calendar year.

The accumulated payroll deductions of any employee who is not a participant on the last day of an offering period will be refunded or retained for use in the next offering period. An employee's rights under the ESPP terminate upon voluntary withdrawal from the plan or when the employee ceases employment for any reason. Eligible employees who have withdrawn from participation may reenroll effective the next offering period.

*Corporate Transaction.* Prior to the effective time of any Corporate Transaction, as defined in the ESPP, the ESPP will terminate and shares will be purchased prior to the effective time as determined by the plan administrator, unless the ESPP is continued by the company or assumed by the surviving corporation.

*Non-Transferability.* An employee may not transfer rights granted under the ESPP other than by beneficiary designation or the laws of descent and distribution.

*Amendment and Termination.* The ESPP may be terminated or amended by our board of directors at any time. Amendments that increase the number of shares of our common stock authorized under the ESPP and certain other amendments require the approval of our stockholders. The plan administrator may adopt and amend stock purchase subplans for employees of our non-U.S. subsidiaries.

### **2009 Equity Incentive Plan**

Our board of directors approved our 2009 Plan in June 2009, and was approved by our stockholders in January 2010. The 2009 Plan provides for grants of stock options, stock appreciation rights, restricted stock awards and restricted stock unit awards (collectively, stock awards) to employees, directors or consultants.

*Stock Options.* Each of our named executive officers has received one or more grants of stock options under the 2009 Plan. Each of these awards has been designated as an ISO, and will be treated as such to the extent that the award complies with the Code requirements for ISOs, including the requirement that not more than \$100,000 in ISOs shall become exercisable for any given employee in any given year. Any portion of the options granted to our named executive officers that do not comply as ISOs will be treated as NSOs.

Each stock option granted to any of our named executive officers under our 2009 Plan has an exercise price equal to the fair market value of the common stock on the date of grant, as determined by our board of directors. The first such stock option award granted to each of our named executive officers is scheduled to vest as to 25% of the award on the first anniversary of the date of grant, with the remainder of the award to vest in equal monthly amounts over the next 36 months. Each stock option award granted to a named executive officer after the officer's initial award, is scheduled to vest in equal monthly amounts over the next 48 months.

As described above, the offer letter for Mr. Godshall provides for single-trigger vesting on a change of control for his initial option grant, and Mr. Puckett's offer letter provides for double-trigger vesting on a termination in connection with a change of control for his initial option grant. Other option awards to our named executive officers under the 2009 Plan will vest upon a change of control to the extent provided in the 2009 Plan.

In the event of certain corporate transactions specified in the 2009 Plan, including a merger or change of control, as defined in the 2009 Plan, each outstanding award will be treated as the plan administrator determines, without a participant's consent, including that: (i) awards will be assumed or substituted by the succeeding corporation; (ii) the awards will terminate; (iii) outstanding awards will vest and become exercisable; (iv) the awards will terminate in exchange for an amount of cash and/or property, if any, equal to the amount that would have been attained upon the exercise of the award or realization of the rights under the award as of the date of the transaction; (v) the replacement of any award with rights or property selected by the plan administrator; or (vi) any combination of the above. In the event that the successor corporation does not assume or substitute 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, and all restrictions on restricted stock and restricted stock units will lapse and performance goals will be deemed achieved at 100% of the target levels. Our plan administrator is not obligated to treat all stock awards, even those that are of the same type, in the same manner. Under the 2009 Plan, a change of control is generally: (i) the acquisition by a person or entity of more than 50% of our combined voting power other than by private financing that is approved by our board of directors; (ii) if we are public, the date on which a majority of the board has been replaced during any 12-month period by directors whose appointment or election is not endorsed by a majority of the members of our board of directors prior to the date of appointment or election; or (iii) change in ownership of a substantial portion of our assets.

Each of these stock options will become exercisable upon vesting, and will remain exercisable until its termination date on the tenth anniversary of the award, or, if earlier, until the day that is twelve months after the

recipient ceases to be a service provider due to death or disability, or the day that is three months after the recipient ceases to be a service provider for any other reason.

Each of these options includes an agreement by the applicable named executive officer to comply with the trading restrictions under any lock-up period following a public offering of our securities.

**Defined Contribution Plan**

We currently maintain a 401(k) retirement savings plan (the “401(k) plan”) for our employees, including our named executive officers, who satisfy certain eligibility requirements. The 401(k) plan is intended to qualify as a tax-qualified plan under Section 401(k) of the Code. Our named executive officers are eligible to participate in the 401(k) plan on the same basis as our other employees. The Code allows eligible employees to defer a portion of their compensation, within prescribed limits, on a pre-tax basis through contributions to the 401(k) plan. We reserve the right to make discretionary matching contributions or non-elective contributions under the 401(k) plan. In 2018, we did not provide a matching contribution or a non-elective contribution under the 401(k) plan.

We do not maintain any defined benefit pension plans.

**Nonqualified Deferred Compensation**

We do not maintain any nonqualified deferred compensation plans.



**DIRECTOR COMPENSATION**

We have not historically provided any compensation to any member of our board of directors who has been designated to serve on our board by one of our significant investors. Our other non-employee directors each received \$15,000 for their service on our board during the year ended December 31, 2018. None of our directors have been granted stock or option awards for service on our board of directors. We do, however, reimburse our non-employee directors for reasonable travel and out-of-pocket expenses incurred in connection with attending board of directors and committee meetings.

Mr. Godshall, our Chief Executive Officer and President, did not receive additional compensation for his services as a director. For more information on Mr. Godshall's compensation as an officer, see the section titled "Executive Compensation."

In connection with this offering, we implemented a new compensation policy for certain of our independent directors pursuant to which they will each be given an annual cash payment and may be granted equity in the form of options. In connection with the appointment of Mr. Larkin and Ms. Francis to our board of directors on January 3, 2019, the board of directors approved stock option awards to each of them in the amount of 28,688 and 24,590 shares of common stock, respectively, at a price of \$6.59 per share, to vest in equal monthly installments subject to each director's continuous service through the three-year period following the date of grant. In addition the board of directors has determined to provide a one-time grant of stock options under our 2019 Plan to each of our other non-employee directors with an aggregate value of \$150,000, each based on the Black-Scholes pricing method, and a per-share exercise price equal to the initial public offering price in this offering.

The following table presents the total compensation for each person who served as a non-employee director of the Company during the fiscal year ended December 31, 2018.

**DIRECTOR COMPENSATION TABLE**

<u>Name</u>	<u>Fees Earned or Paid in Cash (\$)</u>	<u>Stock Awards (\$)</u>	<u>Option Awards (\$)(1)</u>	<u>All Other Compensation (\$)</u>	<u>Total (\$)</u>
Todd Brinton, M.D.(2)	15,000	—	—	144,000	159,000
Colin Cahill	—	—	—	—	—
Marc-Andre Marcotte(3)	—	—	—	—	—
Frederic Moll, M.D.	15,000	—	—	—	15,000
Antoine Papiernik	—	—	—	—	—
F.T. "Jay" Watkins	15,000	—	—	—	15,000

(1) As of December 31, 2018, the following stock option awards held by our directors were outstanding: an option held by Dr. Brinton to acquire 28,688 shares of common stock, options held by Dr. Moll to acquire 110,655 shares of common stock and options held by Mr. Watkins to acquire 133,314 shares of common stock. Each of these awards was granted in connection with the recipient's services to the Company as a consultant, and not in connection with service as a member of our board of directors. In addition, as of December 31, 2018, Dr. Brinton held a warrant to acquire 41,115 shares of common stock; we issued this non-compensatory warrant to Dr. Brinton in May 2015 in consideration for the transfer to the Company of the intellectual property rights of DJT, LLC ("DJT"), a dissolved entity formerly affiliated with Dr. Brinton. The warrant has an exercise price of \$2.196 per share.

(2) The figure in the All Other Compensation column reflects \$144,000 of fees paid to Dr. Brinton in consideration for services provided to the Company as a consultant. See "Certain Relationships and Related Party Transactions" for additional information. Effective January 1, 2019, Dr. Brinton has resigned from his position as a member of our board of directors.

(3) Mr. Marcotte will resign from our board of directors effective immediately upon the effectiveness of the registration statement of which this prospectus forms a part. As Mr. Marcotte is a partner at Sectoral Asset Management Inc., the firm's policy prohibits Mr. Marcotte from serving on the board of directors of a public company of the firm's portfolio companies.

**Benefit Plans for Directors**

Our directors are entitled to participate in our equity incentive plans, described above, and, following this offering, we may include equity awards in our compensation policy for independent directors.

**CERTAIN RELATIONSHIPS AND RELATED PARTY TRANSACTIONS**

We describe below transactions and series of similar transactions, during our last three fiscal years or currently proposed, to which we were a party or will be a party, in which:

- the amounts involved exceeds \$120,000; and
- any of our directors, executive officers or beneficial holders of more than 5% of any class of our capital stock had or will have a direct or indirect material interest.

Other than as described below, there have not been, nor are there any currently proposed, transactions or series of similar transactions meeting this criteria to which we have been or will be a party other than compensation arrangements, which are described where required under the sections titled “Management—Board Structure and Compensation of Directors” and “Executive Compensation.”

**Convertible Preferred Stock Financings**

*Series C Convertible Preferred Stock Financing.* In November 2016 and September 2017, we issued an aggregate of 6,492,564 shares of our Series C convertible preferred stock at \$12.3217560 per share, for an aggregate consideration of approximately \$80.0 million. All shares of our Series C convertible preferred stock will convert into shares of our common stock immediately prior to the closing of this offering in accordance with our current certificate of incorporation.

*Series D Convertible Preferred Stock Financing.* In December 2018, we issued an aggregate of 1,090,608 shares of our Series D convertible preferred stock at \$13.7537920 per share, for an aggregate consideration of approximately \$15.0 million. The Series D convertible preferred stockholder, Abiomed Inc., has the option to purchase up to \$10.0 million in common stock in a concurrent private placement at a price per share equal to the price per share of the common stock to the public in an initial public offering. All shares of our Series D convertible preferred stock will convert into shares of our common stock immediately prior to the closing of this offering in accordance with our current certificate of incorporation.

The following table sets forth the aggregate number of shares of our capital stock acquired by our directors, officers and beneficial owners of more than 5% of our capital stock in the financing transactions described above.

<u>Participant(1)</u>	<u>Series C Preferred Stock</u>	<u>Series D Preferred Stock</u>	<u>Cash Purchase Price</u>
<b>Greater than 5% Stockholders:</b>			
Sofinnova Capital VII FCPR	592,447	—	\$7,299,999.09
Entities affiliated with Venrock Funds	1,016,492	—	\$ 12,524,999.33
Entities managed by Fidelity Management & Research Company or its affiliates	2,028,929	—	\$ 24,999,999.62
Certain funds and accounts advised by T. Rowe Price Associates, Inc.	1,095,622	—	\$ 13,499,999.72
Entities affiliated with Sectoral Asset Management	783,533	—	\$ 14,199,974.40
Abiomed, Inc.(2)	—	1,090,608	\$ 15,000,000.55
<b>Directors:</b>			
Frederic Moll, M.D.	24,347	—	\$299,999.41

(1) Additional details regarding these participants and their equity holdings are provided in “Principal Stockholders.”

(2) Pursuant to the Series D convertible preferred stock financing, Abiomed, Inc. has the option to purchase up to \$10.0 million in common stock in a concurrent private placement at a price per share equal to the price per share of the common stock to the public in an initial public offering.

### **Investor Rights Agreement**

We are party to an Amended and Restated Investor Rights Agreement (the “IRA”) with the holders of our preferred stock, including certain of our directors and entities to which certain of our directors are related. The agreement provides these holders the right, subject to the terms of the lock-up agreements entered into in connection with this offering, to demand that we file a registration statement or request that their shares be covered by a registration statement that we are otherwise filing. See the section titled “Description of Capital Stock—Registration Rights” for additional information. The agreement also provides these holders pro rata participation rights and information rights, which will terminate upon completion of this offering.

### **Todd Brinton, M.D. Consulting Agreement**

On June 17, 2009, we entered into a consulting agreement with our former director, Todd Brinton, M.D., on an independent contractor basis, pursuant to which Dr. Brinton provides advisory services to us in areas including clinical study design input and other professional services related to the use of medical devices. On May 18, 2016, our board of directors increased Dr. Brinton’s compensation under the agreement to \$12,000 per month. Effective January 1, 2019, Dr. Brinton resigned as a member of our board of directors. On February 13, 2019, we entered into a revised consulting agreement with Dr. Brinton. Under the revised agreement, Dr. Brinton continues to provide clinical study design input and other professional services to us, but only in relation to the use of our device to treat calcifications with shock waves in the peripheral or coronary arteries. Dr. Brinton’s time commitment under the revised agreement is capped at twelve hours per month until February 2020, when his time commitment will be reduced to five hours per month. For his services to us under the revised agreement, Dr. Brinton will be paid a retainer of \$6,000 per month until February 2020, when his retainer will be reduced to \$2,500 per month (unless the agreement is terminated at an earlier date).

### **Director and Officer Indemnification**

We have entered into an indemnification agreement with each of our directors and executive officers. These indemnification agreements and our amended and restated certificate of incorporation and amended and restated bylaws indemnify each of our directors and officers to the fullest extent permitted by the Delaware General Corporation Law. For information regarding these indemnification arrangements, please refer to the section titled “Management—Limitations on Liability and Indemnification of Directors and Officers.”

### **Equity Grants to Executive Officers and Directors**

We have granted options to our named executive officers and certain of our non-employee directors as more fully described in the sections titled “Director Compensation” and “Executive Compensation.”

### **Policies and Procedures for Related Party Transactions**

Our board of directors will adopt a written related party transaction policy, to be effective upon the completion of this offering, setting forth the policies and procedures for the review and approval or ratification of related-party transactions. This policy will cover any transaction, arrangement or relationship or any series of similar transactions, arrangements or relationships, in which we were or are to be a participant and a related party had or will have a direct or indirect material interest, as determined by the audit committee of our board of directors, including, without limitation, purchases of goods or services by or from the related party or entities in which the related party has a material interest, and indebtedness, guarantees of indebtedness or employment by us of a related party.

All related party transactions described in this section occurred prior to adoption of this policy and as such, these transactions were not subject to the approval and review procedures set forth in the policy. However, these transactions were reviewed and approved by our board of directors.

## PRINCIPAL STOCKHOLDERS

The following table sets forth information regarding beneficial ownership of our common stock as of December 31, 2018, by:

- each person whom we know to own beneficially more than 5% of our common stock;
- each of our directors and named executive officers individually; and
- all of our directors and executive officers as a group.

In accordance with the rules of the SEC, beneficial ownership includes voting or investment power with respect to securities and includes the shares issuable pursuant to stock options that are exercisable within 60 days of December 31, 2018. Shares issuable pursuant to stock options are deemed outstanding for computing the percentage of the person holding such options but are not outstanding for computing the percentage of any other person. The number of shares of common stock outstanding after this offering includes 5,000,000 shares of common stock being offered for sale by us in this offering. The percentage ownership of our common stock in the “Shares Beneficially Owned Before the Offering” column in the table is based on 20,495,066 shares of our common stock issued and outstanding as of December 31, 2018, assuming the automatic conversion of all outstanding shares of our convertible preferred stock into shares of our common stock immediately prior to the completion of this offering. The percentage ownership of our common stock in the “Shares Beneficially Owned After the Offering” column in the table is based on 25,616,085 shares of our common stock issued and outstanding as of December 31, 2018, assuming (i) the automatic conversion described above, (ii) the net exercise of our outstanding warrants to purchase 141,777 shares of our common stock into 121,019 shares of our common stock immediately prior to the completion of this offering and (iii) the issuance of 5,000,000 shares of our common stock in this offering and no exercise of the underwriters’ option to purchase additional shares.

Unless otherwise indicated, the address for each listed stockholder is: c/o ShockWave Medical, Inc., 5403 Betsy Ross Drive, Santa Clara, California 95054. To our knowledge, except as indicated in the footnotes to this table and pursuant to applicable community property laws, the persons named in the table have sole voting and investment power with respect to all shares of common stock.

Name and Address of Beneficial Owner	Shares Beneficially Owned Before the Offering		Shares Beneficially Owned After the Offering	
	Number	Percent	Number	Percent
<b>Greater than 5% Stockholders:</b>				
Sofinnova Capital VII FCPR <sup>(1)</sup>	4,044,207	19.7%	4,044,207	15.8%
Entities affiliated with Venrock Funds <sup>(2)</sup>	2,122,021	10.4%	2,122,021	8.3%
Entities managed by Fidelity Management & Research Company or its affiliates <sup>(3)</sup>	2,028,929	9.9%	2,028,929	7.9%
Certain funds and accounts advised by T. Rowe Price Associates, Inc. <sup>(4)</sup>	1,193,176	5.8%	1,193,176	4.7%
Entities affiliated with Baran Holdings Inc. <sup>(5)</sup>	1,102,480	5.4%	1,102,480	4.3%
Abiomed, Inc. <sup>(6)</sup>	1,090,608	5.3%	1,090,608	4.3%
Entities affiliated with Sectoral Asset Management <sup>(7)</sup>	1,049,013	5.1%	1,049,013	4.1%
<b>Directors and Named Executive Officers:</b>				
Douglas Godshall <sup>(8)</sup>	518,349	2.5%	518,349	2.0%
Dan Puckett <sup>(9)</sup>	112,788	*	112,788	*
Isaac Zacharias <sup>(10)</sup>	36,885	*	36,885	*
F.T. “Jay” Watkins <sup>(11)</sup>	187,872	*	187,872	*
Antoine Papiernik <sup>(1)</sup>	4,044,207	19.7%	4,044,207	15.8%
Colin Cahill	—	*	—	*
Frederic Moll, M.D. <sup>(12)</sup>	400,510	1.9%	400,510	1.6%
Todd Brinton, M.D. <sup>(13)</sup>	476,288	2.3%	470,268	1.8%
Marc-Andre Marcotte <sup>(7)(14)</sup>	1,049,013	5.1%	1,049,013	4.1%
C. Raymond Larkin, Jr. <sup>(15)</sup>	—	*	—	*
Laura Francis <sup>(15)</sup>	—	*	—	*
<b>Directors and Officers as a Group (11 persons)<sup>(16)</sup></b>	<b>6,825,912</b>	<b>31.9%</b>	<b>6,819,892</b>	<b>25.8%</b>

\* Represents beneficial ownership of less than one percent (1%) of the outstanding common stock.

- (1) Sofinnova Partners SAS, a French corporation and the management company of Sofinnova Capital VII FCPR, may be deemed to have sole voting and dispositive power over the shares held by Sofinnova Capital VII FCPR. The managing partners of Sofinnova Partners SAS, Denis Lucquin, Antoine Papiernik (a member of our board of directors) and Monique Saulnier, may be deemed to have shared voting and dispositive power with respect to such shares. The address of Sofinnova Capital VII FCPR is Sofinnova Partners, Immeuble le Centorial, 16-18 Rue du Quatre-Septembre, 75002 Paris, France.
- (2) Consists of (a) 1,127,377 shares held by Venrock Associates VII, L.P. (“VA VII”), (b) 641,244 shares held by Venrock Healthcare Capital Partners II, L.P. (“VHCP II”), (c) 260,012 shares held by VHCP Co-Investment Holdings II, LLC (“Co-Invest II”) and (d) 93,388 shares held by Venrock Partners VII, L.P. (“VP VII”). VHCP Management II, LLC (“VHCP Management II”) is the general partner of VHCP II and the manager of Co-Invest II and may be deemed to beneficially own the shares held by VHCP II and Co-Invest II (the “VHCP II Shares”). Drs. Bong Koh and Nimish Shah are the managing members of VHCP Management II and may be deemed to beneficially own the VHCP II Shares. Drs. Koh and Shah and VHCP Management II expressly disclaim beneficial ownership over the VHCP II Shares except to the extent of their indirect pecuniary interests therein. Venrock Management VII, LLC is the general partner of VA VII and VP VII and may be deemed to beneficially own the shares held by VA VII and VP VII (the “VII Shares”). Venrock Management VII, LLC expressly disclaims beneficial ownership over the VII Shares except to the extent of its indirect pecuniary interests therein. The address for VHCP II, Co-Invest II, and Drs. Koh and Shah is 7 Bryant Park, 23<sup>rd</sup> Floor, New York, NY 10018. The address for VA VII and VP VII is 3340 Hillview Avenue, Palo Alto, CA 94304.
- (3) Consists of (a) 608,679 shares held by Fidelity Select Portfolios: Health Care Portfolio (“Fidelity Health”), (b) 608,679 shares held by Fidelity Select Portfolios: Medical Equipment and Systems Portfolio (“Fidelity Medical Equipment”), (c) 443,695 shares held by Fidelity Mt. Vernon Street Trust: Fidelity Growth Company Fund (“Fidelity Growth”), (d) 284,655 shares held by Fidelity Growth Company Commingled Pool (“Fidelity Growth Commingled Pool”) and (e) 83,221 shares held by Fidelity Mt. Vernon Street Trust: Fidelity Series Growth Company Fund (“Fidelity Series Growth”). Fidelity Health, Fidelity Medical Equipment, Fidelity Growth, Fidelity Growth Commingled Pool and Fidelity Series Growth are managed by Fidelity Management & Research Company (FMR Co.) or another direct or indirect subsidiary of FMR LLC. Abigail P. Johnson is a Director, the Chairman, the Chief Executive Officer and the President of

FMR LLC. Members of the Johnson family, including Abigail P. Johnson, are the predominant owners, directly or through trusts, of Series B voting common shares of FMR LLC, representing 49% of the voting power of FMR LLC. The Johnson family group and all other Series B shareholders have entered into a shareholders' voting agreement under which all Series B voting common shares will be voted in accordance with the majority vote of Series B voting common shares. Accordingly, through their ownership of voting common shares and the execution of the shareholders' voting agreement, members of the Johnson family may be deemed, under the Investment Company Act of 1940, to form a controlling group with respect to FMR LLC. Neither FMR LLC nor Abigail P. Johnson has the sole power to vote or direct the voting of the shares owned directly by the various investment companies registered under the Investment Company Act ("Fidelity Funds") advised by FMR Co., a wholly owned subsidiary of FMR LLC, which power resides with the Fidelity Funds' Boards of Trustees. FMR Co. carries out the voting of the shares under written guidelines established by the Fidelity Funds' Boards of Trustees. The address for FMR LLC is 200 Seaport Blvd. V12G, Boston, Massachusetts 02210.

- (4) Consists of (a) 1,015,505 shares held by T. Rowe Price Health Sciences Fund, Inc., (b) 65,997 shares held by VALIC Company I—Health Sciences Fund, (c) 57,762 shares held by T. Rowe Price Health Sciences Portfolio and (d) 53,912 shares held by TD Mutual Funds—TD Health Sciences Fund. T. Rowe Price Associates, Inc. is the investment adviser or subadviser, as applicable, for each of T. Rowe Price Health Sciences Fund, Inc., VALIC Company I—Health Sciences Fund, T. Rowe Price Health Sciences Portfolio and TD Mutual Funds—TD Health Sciences Fund. T. Rowe Price Associates, Inc. ("TRPA") serves as investment adviser or subadviser, as applicable, with power to direct investments and/or sole power to vote the securities owned by these funds and accounts (with the exception of VALIC Company I—Health Sciences Fund that retains voting authority). The T. Rowe Price Proxy Committee (the "Proxy Committee") develops the firm's positions on all major proxy voting issues, creates guidelines and oversees the voting process. Once the Proxy Committee establishes its recommendations, they are distributed to the firm's portfolio managers as voting guidelines. Ultimately, the portfolio managers for each account decide how to vote on the proxy proposals of companies in their portfolios. More information on the T. Rowe Price proxy voting guidelines is available on its website at [troweprice.com](http://troweprice.com). The T. Rowe Price portfolio manager of the funds and accounts that hold the securities is Ziad Bakri. For purposes of reporting requirements of the Securities Exchange Act of 1934, TRPA may be deemed to be the beneficial owner of all the shares listed above; however, TRPA expressly disclaims that it is, in fact, the beneficial owner of such securities. T. Rowe Price Associates, Inc. is the wholly owned subsidiary of T. Rowe Price Group, Inc., which is a publicly traded financial services holding company. The address for T. Rowe Price Associates, Inc. is 100 East Pratt Street, Baltimore, Maryland 21202. T. Rowe Price Investment Services, Inc. ("TRPIS"), a registered broker-dealer, is a subsidiary of T. Rowe Price Associates, Inc. TRPIS was formed primarily for the limited purpose of acting as the principal underwriter and distributor of shares of the funds in the T. Rowe Price fund family and complements the other services provided to shareholders of the T. Rowe Price funds. TRPIS does not engage in underwriting or market-making activities involving individual securities.
- (5) Consists of (a) 536,321 shares held by Trudell Medical Limited and (b) 566,159 shares held by Barvest Inc. Baran Holdings Inc. wholly owns Trudell Medical Limited and Barvest Inc. The address of Baran Holdings Inc. is 725 Third Street London, Ontario N5V 5G4 Canada.
- (6) The address of Abiomed, Inc. is 22 Cherry Hill Drive Danvers, MA 01923.
- (7) Consists of (a) 427,794 shares held by New Emerging Medical Opportunities Fund II Limited Partnership, (b) 422,017 shares held by New Emerging Medical Opportunities Fund III Limited Partnership and (c) 199,202 shares held by Sectoral Asset Management Holding Ltd. Marc-Andre Marcotte (a member of our board of directors), is Partner & COO for Sectoral Asset Management, Inc., which manages these funds, and may be deemed to have voting and dispositive power over the shares held by these funds. The address of each of these funds is 1010 Sherbrooke St. West, Suite 1610, Montreal, Quebec H3A 2R7, Canada.
- (8) Consists of 518,349 shares issuable pursuant to options that are exercisable within 60 days of December 31, 2018 (of which all would be vested).
- (9) Consists of 112,788 shares issuable pursuant to options that are exercisable within 60 days of December 31, 2018 (of which all would be vested).
- (10) Consists of 36,885 shares issuable pursuant to options that are exercisable within 60 days of December 31, 2018 (of which all would be vested).
- (11) Consists of (a) 112,251 shares and (b) 75,621 shares issuable pursuant to options that are exercisable within 60 days of December 31, 2018 (of which all would be vested).
- (12) Consists of (a) 290,880 shares and (b) 109,630 shares issuable pursuant to options that are exercisable within 60 days of December 31, 2018 (of which all would be vested).
- (13) Consists of (a) 422,622 shares (of which 13,320 were issued pursuant to options that were early exercised and are subject to repurchase), (b) a warrant to purchase 41,115 shares of our common stock that is currently exercisable and which this table assumes will be net exercised into 35,095 shares of our common stock immediately prior to the completion of this offering and (c) 12,551 shares issuable pursuant to options that are exercisable within 60 days of December 31, 2018 (of which all would be vested). Dr. Brinton resigned as a director of the company, effective as of January 1, 2019.
- (14) Mr. Marcotte will resign from our board of directors effective immediately prior to the effectiveness of the registration statement of which this prospectus forms a part. As Mr. Marcotte is a partner at Sectoral Asset Management Inc., the firm's policy prohibits Mr. Marcotte from serving on the board of directors of a public company of the firm's portfolio companies.
- (15) Mr. Larkin and Ms. Francis were appointed to our Board in January 2019.
- (16) Consists of (a) 6,825,912 shares held by all current executive officers and directors as a group (of which 13,320 were issued pursuant to options that were early exercised and are subject to repurchase), which includes 41,115 shares issuable pursuant to warrants that are currently exercisable and which this table assumes will be net exercised into 35,095 shares of our common stock immediately prior to the completion of this offering, and 865,824 shares issuable pursuant to options that are exercisable within 60 days of December 31, 2018 (of which all would be vested).

## DESCRIPTION OF CAPITAL STOCK

*The following descriptions are summaries of the material terms of our amended and restated certificate of incorporation, amended and restated bylaws, the amended and restated investor rights agreement to which we and certain of our stockholders are parties and of the Delaware General Corporation Law. Because the following is only a summary, it does not contain all of the information that may be important to you. For a complete description, you should refer to our amended and restated certificate of incorporation, amended and restated bylaws and amended and restated investor rights agreement, copies of which have been filed as exhibits to the registration statement of which this prospectus is part.*

### General

Following this offering and after giving effect to the conversion into common stock and retirement of all outstanding shares of our convertible preferred stock, our authorized capital stock will consist of 281,274,838 shares of common stock, par value \$0.001 per share, and 5,000,000 shares of undesignated preferred stock, par value \$0.001 per share. In February 2019, our board of directors approved the retirement, upon the conversion of all shares of outstanding convertible preferred stock into common stock in connection with the closing of this offering, of all such shares of convertible preferred stock such that they will be cancelled and will not be subject to future reissuance.

Based on 1,824,807 shares of common stock outstanding as of December 31, 2018, and after giving effect to the (i) automatic conversion of all of our outstanding convertible preferred stock into an aggregate of 18,670,259 shares of common stock, (ii) net exercise of warrants to purchase 141,777 shares of our common stock into 121,019 shares of our common stock upon the completion of this offering and (iii) the issuance of shares of common stock in this offering, there will be 25,495,066 shares of common stock outstanding upon the closing of this offering. As of December 31, 2018, we had 153 stockholders of record. As of December 31, 2018, there were 3,636,224 shares of common stock subject to outstanding options. As of December 31, 2018, there were 176,217 shares of common stock subject to outstanding warrants (of which 141,777 will net exercise as described above), with a weighted-average exercise price of \$2.55 per share. As of December 31, 2018, we had outstanding warrants to purchase up to an aggregate of 54,903 shares of our Series A-1 preferred stock with an exercise price of \$3.09636 per share.

### Common Stock

*Common stock outstanding.* As of December 31, 2018 there were 1,824,807 shares of common stock outstanding which were held of record by 84 stockholders. There will be 25,495,066 shares of common stock outstanding, assuming no exercise of the underwriters' over-allotment option and no exercise of outstanding options, after giving effect to the sale of the shares of common stock offered hereby. All outstanding shares of common stock are fully paid and non-assessable, and the shares of common stock to be issued upon completion of this offering will be fully paid and non-assessable.

*Voting rights.* The holders of common stock are entitled to one vote per share on all matters to be voted upon by the stockholders.

*Dividend rights.* Subject to preferences that may be applicable to any outstanding preferred stock, the holders of common stock are entitled to receive ratably such dividends, if any, as may be declared from time to time by our board of directors, out of funds legally available therefor. See the section titled "Dividend Policy."

*Rights upon liquidation.* In the event of liquidation, dissolution or winding up of the company, the holders of common stock are entitled to share ratably in all assets remaining after payment of liabilities, subject to prior distribution rights of preferred stock, if any, then outstanding.

*Other rights.* The holders of our common stock have no preemptive or conversion rights or other subscription rights. There are no redemption or sinking fund provisions applicable to the common stock.

### **Preferred Stock**

Effective immediately upon closing of this offering, there will be no shares of preferred stock outstanding because all our outstanding shares of preferred stock will have been automatically converted into an aggregate of 18,670,259 shares of common stock at such time. Immediately upon the completion of this offering, our amended and restated certificate of incorporation will be restated to reflect the conversion and retirement of such shares of preferred stock. Upon the consummation of this offering and after giving effect to the conversion and retirement of all outstanding shares of preferred stock, our board of directors has the authority to issue undesignated preferred stock in one or more series and to fix the rights, preferences, privileges and restrictions thereof, including dividend rights, dividend rates, conversion rights, voting rights, terms of redemption, redemption prices, liquidation preferences and the number of shares constituting any series or the designation of such series, without further vote or action by the stockholders.

The issuance of preferred stock may have the effect of delaying, deferring or preventing a change in control of the company without further action by the stockholders and may adversely affect the voting and other rights of the holders of common stock. At present, we have no plans to issue any of the preferred stock following consummation of this offering.

### **Common Stock Warrants**

As of December 31, 2018, we had common stock warrants exercisable for an aggregate of 176,217 shares of our common stock, with a weighted-average exercise price of \$2.55 per share. Of these, warrants to purchase 141,777 shares of our common stock, with an exercise price of \$2.196 per share, expire in May 2025, but would also expire earlier upon (i) certain transactions involving the merger of our company with or into another organization or the sale or disposition of all or substantially all of our assets and (ii) the closing of a firm commitment underwritten initial public offering pursuant to an effective registration statement filed under the Securities Act covering the offering and sale of the company's common stock. The remaining warrants to purchase 34,440 shares of our common stock, with an exercise price of \$4.026 per share, expire in February 2028, but would also expire earlier upon certain transactions involving the merger of our company with or into another organization or the sale or disposition of all or substantially all of our assets. The warrants contain provisions for adjustment of the exercise price and number of shares issuable upon the exercise of the warrants in the event of reclassification of shares, certain stock dividends, subdivisions and stock splits or combinations. The warrants have a net exercise provision under which its holder may, in lieu of payment of the exercise price in cash, surrender the warrant and receive a net amount of shares based on the fair market value of our stock at the time of exercise of the warrant after deduction of the aggregate exercise price.

### **Preferred Stock Warrants**

As of December 31, 2018, we had outstanding a convertible preferred stock warrant to purchase up to an aggregate of 54,903 shares of our Series A-1 preferred stock, with an exercise price of \$3.09636 per share. Upon the closing of this offering, the warrants will automatically convert into warrants to purchase 54,903 shares of our common stock with an exercise price of \$3.09636 per share, and, unless exercised earlier, will expire in June 2024.

The warrants contain provisions for the adjustment of the exercise price and the number of shares issuable upon the exercise of the applicable warrant in the event of certain stock dividends, stock splits, reorganizations, reclassifications and consolidations.

### **Common Stock Options**

As of December 31, 2018, we had outstanding options to purchase an aggregate of 3,636,224 shares of our common stock, with a weighted-average exercise price of \$3.50 per share, under our 2009 Plan. After



December 31, 2018, we issued options to purchase an aggregate of 119,667 shares of our common stock, with an exercise price of \$6.59 per share, under our 2009 Plan.

### **Registration Rights**

After the closing of this offering, certain holders of our common stock will be entitled to rights with respect to the registration of their shares under the Securities Act pursuant to the IRA as described in additional detail below. In an underwritten offering, the managing underwriter, if any, has the right, subject to specified conditions, to limit the number of shares such holders may include. In connection with this offering, each stockholder that has registration rights agreed not to sell or otherwise dispose of any securities without the prior written consent of the underwriters for a period of 180 days after the date of this prospectus, subject to certain terms and conditions. For more information regarding such restrictions, see the section captioned "Underwriting."

#### ***Demand Registration Rights***

Beginning the earlier of either 180 days following the completion of this offering or the third anniversary of the date of the initial sale of shares of our Series D convertible preferred stock, the holders of approximately 18,670,259 shares of our common stock will be entitled to certain demand registration rights. The holders of at least 40% of the registrable securities have the right to require us, on not more than two occasions, to file a registration statement under the Securities Act in order to register the resale of their shares of common stock, *provided* that such registration of shares would result in aggregate proceeds (after deducting the estimated underwriting discounts and commissions) of at least \$10.0 million. We may, in certain circumstances, defer such registrations and the underwriters have the right, subject to certain limitations, to limit the number of shares included in such registrations.

#### ***Piggyback Registration Rights***

After the closing of this offering, if we propose to register the offer and sale of any of our securities under the Securities Act, in connection with the public offering of such securities the holders of approximately 18,670,259 shares of our common stock will be entitled to certain "piggyback" registration rights, allowing the holders to include their shares in such registration, subject to certain limitations. If our proposed registration involves an underwriting, the managing underwriter of such offering will have the right to limit the number of shares to be underwritten for reasons related to the marketing of the shares.

#### ***S-3 Registration Rights***

After the closing of this offering, we are required to use commercially reasonable efforts to qualify for registration on Form S-3. After we are qualified for registration on Form S-3, the holders of registrable securities may make a written request that we register the offer and sale of their shares on Form S-3, *provided* that such registration of shares would result in an aggregate price to the public of not less than \$2,000,000 and we have not effected two such registrations in the last 12 months. We may, in certain circumstances, defer such registrations and the underwriters have the right, subject to certain limitations, to limit the number of shares included in such registrations.

#### ***Expenses***

Subject to specified conditions and limitations, we are required to pay all expenses, other than underwriting discounts and commissions and stock transfer taxes, incurred in connection with any exercise of these registration rights.

### ***Indemnification***

The IRA contains customary cross-indemnification provisions, pursuant to which we are obligated to indemnify the selling holders of registrable securities in the event of either material misstatements or omissions in the applicable registration statement attributable to us or our violation of the Securities Act, and the selling stockholders are obligated to indemnify us for material misstatements or omissions in the registration statement attributable to them, subject to certain limitations.

### ***Termination***

The registration rights terminate upon the earliest of: (i) such date after the completion of this offering on which all shares of registrable securities may be sold during any 90 day period pursuant to Rule 144 of the Securities Act, (ii) the fifth anniversary of the completion of this offering, (iii) the occurrence of a deemed liquidation event or (iv) the date that no registrable securities remain outstanding that have not previously been sold to the public pursuant to a registration or in reliance on Rule 144 of the Securities Act.

### **Northgate Right of Participation**

As part of the Exclusive License Agreement, Northgate has the right to participate in future financings by the company (including the Potential Concurrent Private Placement) in a proportion equal to its percentage ownership of the company as of immediately prior to each such financing on a fully diluted basis, subject to various exclusions, including exclusions for the issuance of shares of common stock to employees and consultants or in a firmly underwritten public offering (including this offering) and for specified strategic transaction purposes.

### **Anti-Takeover Effects of our Certificate of Incorporation and our Bylaws**

#### ***Election and Removal of Directors***

Immediately upon the completion of this offering, our board of directors will consist of seven directors. The exact number of directors will be fixed from time to time by resolution of the board. No director may be removed except for cause, and directors may be removed for cause by an affirmative vote of shares representing a majority of the shares then entitled to vote at an election of directors. Any vacancy occurring on the board of directors and any newly created directorship may be filled only by a majority of the remaining directors in office.

#### ***Staggered Board***

Upon the closing of this offering, our board of directors will be divided into three classes serving staggered three-year terms. Class I, Class II and Class III directors will serve until our annual meetings of stockholders in 2020, 2021 and 2022, respectively. At each annual meeting of stockholders, directors will be elected to succeed the class of directors whose terms have expired. This classification of our board of directors could have the effect of increasing the length of time necessary to change the composition of a majority of the board of directors. In general, at least two annual meetings of stockholders will be necessary for stockholders to effect a change in a majority of the members of the board of directors.

#### ***Limits on Written Consents***

Our amended and restated certificate of incorporation and our amended and restated bylaws provide that holders of our common stock will not be able to act by written consent without a meeting, unless such consent is unanimous.

### ***Stockholder Meetings***

Our amended and restated certificate of incorporation and our amended and restated bylaws provide that special meetings of our stockholders may be called only by the chairman of our board of directors or a majority of the directors. Our amended and restated certificate of incorporation and bylaws will specifically deny any power of any other person to call a special meeting.

### ***Amendment of Certificate of Incorporation***

The provisions of our amended and restated certificate of incorporation described under “Election and Removal of Directors,” “Stockholder Meetings” and “Limits on Written Consents” may be amended only by the affirmative vote of holders of at least 75% of the voting power of our outstanding shares of voting stock, voting together as a single class. The affirmative vote of holders of at least a majority of the voting power of our outstanding shares of stock will generally be required to amend other provisions of our amended and restated certificate of incorporation.

### ***Amendment of Bylaws***

Our amended and restated bylaws may generally be altered, amended or repealed, and new bylaws may be adopted, with:

- the affirmative vote of a majority of directors present at any regular or special meeting of the board of directors called for that purpose, provided that any alteration, amendment or repeal of, or adoption of any bylaw inconsistent with, specified provisions of the bylaws, including those related to special and annual meetings of stockholders, action of stockholders by written consent, classification of the board of directors, nomination of directors, special meetings of directors, removal of directors, committees of the board of directors and indemnification of directors and officers, requires the affirmative vote of at least 75% of all directors in office at a meeting called for that purpose; or
- the affirmative vote of holders of 75% of the voting power of our outstanding shares of voting stock, voting together as a single class.

### ***Other Limitations on Stockholder Actions***

Our amended and restated bylaws will also impose some procedural requirements on stockholders who wish to:

- make nominations in the election of directors;
- propose that a director be removed;
- propose any repeal or change in our bylaws; or
- propose any other business to be brought before an annual or special meeting of stockholders.

Under these procedural requirements, in order to bring a proposal before a meeting of stockholders, a stockholder must deliver timely notice of a proposal pertaining to a proper subject for presentation at the meeting to our corporate secretary along with the following:

- a description of the business or nomination to be brought before the meeting and the reasons for conducting such business at the meeting;
- the stockholder’s name and address;
- any material interest of the stockholder in the proposal;
- the number of shares beneficially owned by the stockholder and evidence of such ownership; and

- the names and addresses of all persons with whom the stockholder is acting in concert and a description of all arrangements and understandings with those persons, and the number of shares such persons beneficially own.

To be timely, a stockholder must generally deliver notice:

- in connection with an annual meeting of stockholders, not less than 120 nor more than 180 days prior to the date on which the annual meeting of stockholders was held in the immediately preceding year, but in the event that the date of the annual meeting is more than 30 days before or more than 60 days after the anniversary date of the preceding annual meeting of stockholders, a stockholder notice will be timely if received by us not later than the close of business on the later of (1) the 120th day prior to the annual meeting and (2) the 10th day following the day on which we first publicly announce the date of the annual meeting; or
- in connection with the election of a director at a special meeting of stockholders, not less than 40 nor more than 60 days prior to the date of the special meeting, but in the event that less than 55 days' notice or prior public disclosure of the date of the special meeting of the stockholders is given or made to the stockholders, a stockholder notice will be timely if received by us not later than the close of business on the 10th day following the day on which a notice of the date of the special meeting was mailed to the stockholders or the public disclosure of that date was made.

In order to submit a nomination for our board of directors, a stockholder must also submit any information with respect to the nominee that we would be required to include in a proxy statement, as well as some other information. If a stockholder fails to follow the required procedures, the stockholder's proposal or nominee will be ineligible and will not be voted on by our stockholders.

#### ***Limitation of Liability of Directors and Officers***

Our amended and restated certificate of incorporation to be in effect upon the completion of this offering will provide that we may indemnify our directors and officers, in each case to the fullest extent permitted by Delaware law. For information regarding the limitation of liability of our directors and officers, please refer to the section titled "Management—Limitations on Liability and Indemnification of Directors and Officers."

#### ***Forum Selection***

The Court of Chancery of the State of Delaware will be the sole and exclusive forum for (i) any derivative action or proceeding brought on behalf of the company, (ii) any action asserting a claim of breach of fiduciary duty owed by any director, officer or other employee of the company to the company or the company's stockholders, (iii) any action asserting a claim arising pursuant to any provision of the Delaware General Corporation Law or (iv) any action asserting a claim governed by the internal affairs doctrine. Any person or entity purchasing or otherwise acquiring any interest in shares of capital stock of the company shall be deemed to have notice of and consented to the foregoing forum selection provisions. The provision would not apply to suits brought to enforce a duty or liability created by the Exchange Act. In addition, our amended and restated bylaws will also provide that unless we consent in writing to the selection of an alternative forum, the federal district courts of the United States shall be the exclusive forum for the resolution of any complaint asserting a cause of action arising under the Securities Act.

#### ***Delaware Business Combination Statute***

We will elect to be subject to Section 203 of the Delaware General Corporation Law, which regulates corporate acquisitions. Section 203 prevents an "interested stockholder," which is defined generally as a person owning 15% or more of a corporation's voting stock, or any affiliate or associate of that person, from engaging in

a broad range of “business combinations” with the corporation for three years after becoming an interested stockholder unless:

- the board of directors of the corporation had previously approved either the business combination or the transaction that resulted in the stockholder’s becoming an interested stockholder;
- upon completion of the transaction that resulted in the stockholder’s becoming an interested stockholder, that person owned at least 85% of the voting stock of the corporation outstanding at the time the transaction commenced, other than statutorily excluded shares; or
- following the transaction in which that person became an interested stockholder, the business combination is approved by the board of directors of the corporation and holders of at least two-thirds of the outstanding voting stock not owned by the interested stockholder.

Under Section 203, the restrictions described above also do not apply to specific business combinations proposed by an interested stockholder following the announcement or notification of designated extraordinary transactions involving the corporation and a person who had not been an interested stockholder during the previous three years or who became an interested stockholder with the approval of a majority of the corporation’s directors, if such extraordinary transaction is approved or not opposed by a majority of the directors who were directors prior to any person becoming an interested stockholder during the previous three years or were recommended for election or elected to succeed such directors by a majority of such directors.

Section 203 may make it more difficult for a person who would be an interested stockholder to effect various business combinations with a corporation for a three-year period. Section 203 also may have the effect of preventing changes in our management and could make it more difficult to accomplish transactions that our stockholders may otherwise deem to be in their best interests.

#### ***Anti-Takeover Effects of Some Provisions***

Some provisions of our amended and restated certificate of incorporation and bylaws could make the following more difficult:

- acquisition of control of us by means of a proxy contest or otherwise, or
- removal of our incumbent officers and directors.

These provisions, as well as our ability to issue preferred stock, are designed to discourage coercive takeover practices and inadequate takeover bids. These provisions are also designed to encourage persons seeking to acquire control of us to first negotiate with our board of directors. We believe that the benefits of increased protection give us the potential ability to negotiate with the proponent of an unfriendly or unsolicited proposal to acquire or restructure us, and that the benefits of this increased protection outweigh the disadvantages of discouraging those proposals, because negotiation of those proposals could result in an improvement of their terms.

#### **Listing**

We have applied to list our common stock on the Nasdaq Global Market under the symbol “SWAV.”

#### **Transfer Agent and Registrar**

The transfer agent and registrar for the common stock is Computershare Trust Company, N.A. The transfer agent and registrar’s address is 250 Royall St., Canton, Massachusetts 02021.

## MATERIAL U.S. FEDERAL INCOME AND ESTATE TAX CONSEQUENCES FOR NON-U.S. HOLDERS OF COMMON STOCK

The following are the material U.S. federal income and estate tax consequences of the ownership and disposition of our common stock acquired in this offering by a “Non-U.S. Holder” that does not own, and has not owned, actually or constructively, more than 5% of our common stock. You are a Non-U.S. Holder if for U.S. federal income tax purposes you are a beneficial owner of our common stock that is:

- a nonresident alien individual;
- a foreign corporation; or
- a foreign estate or trust.

You are not a Non-U.S. Holder if you are a nonresident alien individual present in the United States for 183 days or more in the taxable year of disposition, or if you are a former citizen or former resident of the United States for U.S. federal income tax purposes. If you are such a person, you should consult your tax adviser regarding the U.S. federal income tax consequences of the ownership and disposition of our common stock.

If you are a partnership for U.S. federal income tax purposes, the U.S. federal income tax treatment of a partner will generally depend on the status of the partner and your activities.

This discussion is based on the Internal Revenue Code of 1986, as amended to the date hereof (the “Code”), administrative pronouncements, judicial decisions and final, temporary and proposed Treasury regulations, changes to any of which subsequent to the date of this prospectus may affect the tax consequences described herein, possibly with retroactive effect. This discussion does not describe all of the tax consequences that may be relevant to you in light of your particular circumstances, including alternative minimum tax and Medicare contribution tax consequences and does not address any aspect of state, local or non-U.S. taxation, or any taxes other than income and estate taxes. You should consult your tax adviser with regard to the application of the U.S. federal tax laws to your particular situation, as well as any tax consequences arising under the laws of any state, local or non-U.S. taxing jurisdiction.

### Dividends

As discussed under “Dividend Policy” above, we do not currently expect to make distributions on our common stock. In the event that we do make distributions of cash or other property, those distributions will constitute dividends for U.S. federal income tax purposes to the extent paid from our current or accumulated earnings and profits, as determined under U.S. federal income tax principles. To the extent those distributions exceed our current and accumulated earnings and profits, they will constitute a return of capital, which will first reduce your basis in our common stock, but not below zero, and then will be treated as gain from the sale of our common stock, as described below under “—Gain on Disposition of Our Common Stock.”

Dividends paid to you generally will be subject to withholding tax at a 30% rate or a reduced rate specified by an applicable income tax treaty. In order to obtain a reduced rate of withholding (subject to the discussion below under “—FATCA”), you will be required to provide a properly executed applicable Internal Revenue Service (“IRS”) Form W-8 certifying your entitlement to benefits under a treaty.

If dividends paid to you are effectively connected with your conduct of a trade or business in the United States (and, if required by an applicable income tax treaty, are attributable to a permanent establishment or fixed base maintained by you in the United States), you will generally be taxed on the dividends in the same manner as a U.S. person. In this case, you will be exempt from the withholding tax discussed in the preceding paragraph, although you will be required to provide a properly executed IRS Form W-8ECI in order to claim an exemption from withholding. You should consult your tax adviser with respect to other U.S. tax consequences of the ownership and disposition of our common stock, including the possible imposition of a branch profits tax at a rate of 30% (or a lower treaty rate) if you are a corporation.

### **Gain on Disposition of Our Common Stock**

Subject to the discussions below under “—Information Reporting and Backup Withholding” and “—FATCA,” you generally will not be subject to U.S. federal income or withholding tax on gain realized on a sale or other taxable disposition of our common stock unless:

- the gain is effectively connected with your conduct of a trade or business in the United States (and, if required by an applicable income tax treaty, is attributable to a permanent establishment or fixed base maintained by you in the United States), or
- we are or have been a “United States real property holding corporation,” as defined in the Code, at any time within the five-year period preceding the disposition or your holding period, whichever period is shorter, and our common stock has ceased to be regularly traded on an established securities market prior to the beginning of the calendar year in which the sale or disposition occurs.

We believe that we are not, and do not anticipate becoming, a United States real property holding corporation.

If you recognize gain on a sale or other disposition of our common stock that is effectively connected with your conduct of a trade or business in the United States (and if required by an applicable income tax treaty, is attributable to a permanent establishment or fixed base maintained by you in the United States), you will generally be taxed on such gain in the same manner as a U.S. person. You should consult your tax adviser with respect to other U.S. tax consequences of the ownership and disposition of our common stock, including the possible imposition of a branch profits tax at a rate of 30% (or a lower treaty rate) if you are a corporation.

### **Information Reporting and Backup Withholding**

Information returns are required to be filed with the IRS in connection with payments of dividends on our common stock. Unless you comply with certification procedures to establish that you are not a U.S. person, information returns may also be filed with the IRS in connection with the proceeds from a sale or other disposition of our common stock. You may be subject to backup withholding on payments on our common stock or on the proceeds from a sale or other disposition of our common stock unless you comply with certification procedures to establish that you are not a U.S. person or otherwise establish an exemption. Your provision of a properly executed applicable IRS Form W-8 certifying your non-U.S. status will permit you to avoid backup withholding. Amounts withheld under the backup withholding rules are not additional taxes and may be refunded or credited against your U.S. federal income tax liability, provided the required information is timely furnished to the IRS.

### **FATCA**

Provisions of the Code commonly referred to as “FATCA” require withholding of 30% on payments of dividends on our common stock, as well as, subject to the discussion of certain proposed U.S. Treasury regulations below, of gross proceeds of dispositions occurring after December 31, 2018 of our common stock, to “foreign financial institutions” (which is broadly defined for this purpose and in general includes investment vehicles) and certain other non-U.S. entities unless various U.S. information reporting and due diligence requirements (generally relating to ownership by U.S. persons of interests in or accounts with those entities) have been satisfied, or an exemption applies. An intergovernmental agreement between the United States and an applicable foreign country may modify these requirements. If FATCA withholding is imposed, a beneficial owner that is not a foreign financial institution generally may obtain a refund of any amounts withheld by filing a U.S. federal income tax return (which may entail significant administrative burden). The U.S. Treasury recently released proposed regulations which, if finalized in their present form, would eliminate the federal withholding tax of 30% applicable to the gross proceeds of a sale or other disposition of our common stock. In its preamble to such proposed regulations, the U.S. Treasury stated that taxpayers may generally rely on the proposed regulations

until final regulations are issued. You should consult your tax adviser regarding the effects of FATCA on your investment in our common stock, and the possible impact of these rules on the entities through which you hold our common stock, including, without limitation, the process and deadlines for meeting the applicable requirements to prevent the imposition of this 30% withholding tax.

**Federal Estate Tax**

Individual Non-U.S. Holders and entities the property of which is potentially includible in such an individual's gross estate for U.S. federal estate tax purposes (for example, a trust funded by such an individual and with respect to which the individual has retained certain interests or powers), should note that, absent an applicable treaty exemption, our common stock will be treated as U.S.-situs property subject to U.S. federal estate tax.



## SHARES ELIGIBLE FOR FUTURE SALE

Prior to this offering, there has been no market for our common stock. Future sales of substantial amounts of our common stock in the public market could adversely affect market prices prevailing from time to time. Furthermore, because only a limited number of shares will be available for sale shortly after this offering due to existing contractual and legal restrictions on resale as described below, there may be sales of substantial amounts of our common stock in the public market after the restrictions lapse. This may adversely affect the prevailing market price and our ability to raise equity capital in the future.

Upon completion of this offering, we will have 25,616,085 shares of common stock outstanding assuming the conversion of all outstanding shares of preferred stock and no exercise of any options and warrants outstanding as of December 31, 2018 (other than the assumed net exercise of certain of our common stock warrants into shares of our common stock that would otherwise expire upon completion of this offering), or 26,366,085 shares assuming the exercise of the underwriters' over-allotment option. Of these shares, 5,000,000 shares, or 5,750,000 shares if the underwriters exercise their option in full, sold in this offering will be freely transferable without restriction or registration under the Securities Act, except for any shares purchased by one of our existing "affiliates," as that term is defined in Rule 144 under the Securities Act. The remaining 20,616,085 shares of common stock existing are "restricted shares" as defined in Rule 144. Restricted shares may be sold in the public market only if registered or if they qualify for an exemption from registration under Rules 144 or 701 of the Securities Act. As a result of the contractual 180-day lock-up period described below and the provisions of Rules 144 and 701, these shares will be available for sale in the public market as follows:

<u>Number of Shares</u>	<u>Date</u>
0	On the date of this prospectus.
20,616,085	At various times after 180 days from the date of this prospectus (subject, in some cases, to volume limitations).

### Rule 144

In general, a person who has beneficially owned restricted shares of our common stock for at least six months would be entitled to sell such securities, provided that (i) such person is not deemed to have been one of our affiliates at the time of, or at any time during the 90 days preceding, a sale and (ii) we are subject to the Exchange Act periodic reporting requirements for at least 90 days before the sale. Persons who have beneficially owned restricted shares of our common stock for at least six months but who are our affiliates at the time of, or any time during the 90 days preceding, a sale, would be subject to additional restrictions, by which such person would be entitled to sell within any three month period only a number of securities that does not exceed the greater of either of the following:

- 1% of the number of shares of our common stock then outstanding, which will equal approximately—shares immediately after this offering, assuming no exercise of the underwriters' over-allotment option; or
- the average weekly trading volume of our common stock on the Nasdaq Global Market during the four calendar weeks preceding the filing of a notice on Form 144 with respect to the sale;

provided, in each case, that we are subject to the Exchange Act periodic reporting requirements for at least 90 days before the sale. Such sales both by affiliates and by non-affiliates must also comply with the manner of sale, current public information and notice provisions of Rule 144 to the extent applicable.

### Rule 701

In general, under Rule 701, any of our employees, directors, officers, consultants or advisors who purchases shares from us in connection with a compensatory stock or option plan or other written agreement before the

effective date of this offering is entitled to resell such shares 90 days after the effective date of this offering in reliance on Rule 144, without having to comply with the holding period requirements or other restrictions contained in Rule 701.

The SEC has indicated that Rule 701 will apply to typical stock options granted by an issuer before it becomes subject to the reporting requirements of the Exchange Act, along with the shares acquired upon exercise of such options, including exercises after the date of this prospectus. Securities issued in reliance on Rule 701 are restricted securities and, subject to the contractual restrictions described above, beginning 90 days after the date of this prospectus, may be sold by persons other than “affiliates,” as defined in Rule 144, subject only to the manner of sale provisions of Rule 144 and by “affiliates” under Rule 144 without compliance with its one-year minimum holding period requirement.

### **Registration Rights**

Upon completion of this offering, the holders of 18,670,259 shares of common stock will be entitled to various rights with respect to the registration of these shares under the Securities Act. Registration of these shares under the Securities Act would result in these shares becoming freely tradable without restriction under the Securities Act immediately upon the effectiveness of the registration, except for shares purchased by affiliates.

### **Warrants**

As of December 31, 2018, warrants to purchase an aggregate of 176,217 shares of our common stock with a weighted-average exercise price of \$2.55 per share were outstanding. See the section of this prospectus titled “Description of Capital Stock—Warrants” for additional information. Such shares issued upon exercise of the warrants may be able to be sold after the expiration of the lock-up period described above subject to the requirements of Rule 144 described above.

### **Stock Options**

As of December 31, 2018, options to purchase a total of 3,636,224 shares of common stock were outstanding. All of the shares subject to options are subject to lock-up agreements. All of the shares subject to options are subject to lock-up agreements. An additional 392,299 shares of common stock were available for future grants under our stock plans. As of the effective date of the registration statement of which this prospectus forms a part, these shares will cease to be available for issue. Shares have been reserved under our 2019 Plan for stock options and other equity awards granted after this date.

Upon completion of this offering, we intend to file a registration statement under the Securities Act covering all shares of common stock subject to outstanding options or issuable pursuant to our 2019 Plan. Subject to Rule 144 volume limitations applicable to affiliates, shares registered under any registration statements will be available for sale in the open market, beginning 90 days after the date of the prospectus, except to the extent that the shares are subject to vesting restrictions with us or the contractual restrictions described below.

### **Lock-up Agreements**

All of our directors, executive officers and substantially all of the other holders of our equity securities have agreed, subject to certain exceptions, not to offer, pledge, sell, contract to sell, sell any option or contract to purchase, purchase any option or contract to sell, grant any option, right or warrant to purchase, or otherwise transfer or dispose of, directly or indirectly, or enter into any swap or other arrangement that transfers to another, in whole or in part, any of the economic consequences of ownership of any shares of common stock or any securities convertible into or exercisable or exchangeable for shares of common stock for a period of 180 days after the date of this prospectus, without the prior written consent of the representatives of the underwriters. See the section titled “Underwriting” for more information.

## UNDERWRITING

Under the terms and subject to the conditions in an underwriting agreement dated the date of this prospectus, the underwriters named below, for whom Morgan Stanley & Co. LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated are acting as representatives, have severally agreed to purchase, and we have agreed to sell to them, severally, the number of shares indicated below:

<u>Name</u>	<u>Number of Shares</u>
Morgan Stanley & Co. LLC	
Merrill Lynch, Pierce, Fenner & Smith Incorporated	
Wells Fargo Securities, LLC	
Canaccord Genuity LLC	
Total:	<u>5,000,000</u>

The underwriters and the representatives are collectively referred to as the “underwriters” and the “representatives,” respectively. The underwriters are offering the shares of common stock subject to their acceptance of the shares from us and subject to prior sale. The underwriting agreement provides that the obligations of the several underwriters to pay for and accept delivery of the shares of common stock offered by this prospectus are subject to the approval of certain legal matters by their counsel and to certain other conditions. The underwriters are obligated to take and pay for all of the shares of common stock offered by this prospectus if any such shares are taken. However, the underwriters are not required to take or pay for the shares covered by the underwriters’ over-allotment option described below. The offering of the shares of common stock by the underwriters is subject to receipt and acceptance and subject to the underwriters’ right to reject any order in whole or in part.

The underwriters initially propose to offer part of the shares of common stock directly to the public at the offering price listed on the cover page of this prospectus and part to certain dealers. After the initial offering of the shares of common stock, the offering price and other selling terms may from time to time be varied by the representatives.

We have granted to the underwriters an option, exercisable for 30 days from the date of this prospectus, to purchase up to 750,000 additional shares of common stock at the public offering price listed on the cover page of this prospectus, less underwriting discounts and commissions. The underwriters may exercise this option solely for the purpose of covering over-allotments, if any, made in connection with the offering of the shares of common stock offered by this prospectus. To the extent the option is exercised, each underwriter will become obligated, subject to certain conditions, to purchase about the same percentage of the additional shares of common stock as the number listed next to the underwriter’s name in the preceding table bears to the total number of shares of common stock listed next to the names of all underwriters in the preceding table.

At our request, the underwriters have reserved for sale, at the initial public offering price, up to approximately 3% of the shares offered hereby for our directors, officers and certain employees and other persons with whom we have a relationship who have expressed an interest in purchasing common stock in the offering. The number of shares available for sale to the general public in the offering will be reduced to the extent these persons purchase the reserved shares. Any reserved shares not so purchased will be offered by the underwriters to the general public on the same terms as the other shares. Shares offered in the directed share program will not be subject to lock-up agreements, with the exception of the shares to be issued to directors, officers and certain existing stockholders who are already subject to lock-up agreements, as described below.

[Table of Contents](#)[Index to Financial Statements](#)

The following table shows the per share and total public offering price, underwriting discounts and commissions, and proceeds before expenses to us. These amounts are shown assuming both no exercise and full exercise of the underwriters' over-allotment option.

	Per Share	Total	
		No Exercise	Full Exercise
Public offering price	\$	\$	\$
Underwriting discounts and commissions to be paid by us	\$	\$	\$
Proceeds, before expenses, to us	\$	\$	\$

Perella Weinberg Partners LP ("Perella Weinberg"), a Financial Industry Regulatory Association, Inc. ("FINRA") member, is acting as our financial advisor in connection with the offering. We expect to pay Perella Weinberg, upon the successful completion of this offering, a fee of up to \$735,000 for its services. The services provided to us by Perella Weinberg include, among other things, an independent financial valuation analysis; assisting in drafting our positioning and investment thesis; assisting us in our interactions with the underwriters; and assisting us in crafting an appropriate aftermarket trading and investor relations strategy. Apart from Perella Weinberg's role as financial advisor in connection with this offering, Perella Weinberg has had no other relationships with the company. Perella Weinberg will not sell or offer to sell any securities in this offering and will not identify, solicit or engage directly with potential investors in this offering. In addition, Perella Weinberg will not purchase any of the offered shares of common stock.

The estimated offering expenses payable by us, including the fees of Perella Weinberg but exclusive of the underwriting discounts and commissions, are approximately \$3.9 million. We have also agreed to reimburse the underwriters for expense relating to clearance of this offering with FINRA up to \$40,000. The underwriters have agreed to reimburse us for certain expenses we incur in connection with this offering up to \$735,000.

The underwriters have informed us that they do not intend sales to discretionary accounts to exceed 5% of the total number of shares of common stock offered by them.

We have applied to list our common stock on the Nasdaq Global Market under the symbol "SWAV."

We and all of our directors and officers and the holders of all of our outstanding securities have agreed that, without the prior written consent of Morgan Stanley & Co. LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated on behalf of the underwriters, we and they will not, during the period ending 180 days after the date of this prospectus (the "restricted period"):

- offer, pledge, sell, contract to sell, sell any option or contract to purchase, purchase any option or contract to sell, grant any option, right or warrant to purchase, lend or otherwise transfer or dispose of, directly or indirectly, any shares of common stock or any securities convertible into or exercisable or exchangeable for shares of common stock;
- file any registration statement with the SEC relating to the offering of any shares of common stock or any securities convertible into or exercisable or exchangeable for common stock; or
- enter into any swap or other arrangement that transfers to another, in whole or in part, any of the economic consequences of ownership of the common stock;

whether any such transaction described above is to be settled by delivery of common stock or such other securities, in cash or otherwise. In addition, we and each such person have agreed that, without the prior written consent of Morgan Stanley & Co. LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated on behalf of the underwriters, we or such other person will not, during the restricted period, make any demand for, or exercise any right with respect to, the registration of any shares of common stock or any security convertible into or exercisable or exchangeable for common stock.

The restrictions described in the immediately preceding paragraph do not apply to our directors, officers and securityholders with respect to, among other things:

- (a) transactions relating to shares of common stock or other securities acquired in open market transactions after the completion of this offering, provided that no filing under Section 16(a) of the Exchange Act or other public announcement shall be required or shall be voluntarily made in connection with subsequent sales of common stock or other securities acquired in such open market transactions during the restricted period;
- (b) transfers of securities to us in connection with the conversion of our outstanding preferred stock or warrants into shares of common stock or warrants to acquire shares of common stock in connection with the consummation of this offering, which conversion is described in this prospectus, it being understood that any such shares of common stock or warrants received by the securityholder upon such conversion shall be subject to the restrictions on transfer set forth in the lock-up agreement;
- (c) transfers of shares of common stock or any security convertible into common stock (i) as a bona fide gift, (ii) to an immediate family member or a trust for the direct or indirect benefit of the securityholder or such immediate family member of the securityholder, (iii) if the securityholder is a trust, to a trustor or beneficiary of the trust or to the estate of a beneficiary of such trust, (iv) if the securityholder is a corporation, partnership, limited liability company, investment fund or other entity, distributions of shares of common stock or any security convertible into shares of common stock to stockholders, limited partners, members or affiliates or to any other entity that is controlled or managed by, or under common control or management with, the securityholder or (v) by will, other testamentary document or intestate succession to the legal representative, heir, beneficiary or a member of the immediate family of the securityholder; provided that in the case of any transfer or distribution pursuant to this clause, (i) each donee or distributee shall sign and deliver a lock-up agreement, (ii) no filing under Section 16(a) of the Exchange Act or other public announcement, reporting a reduction in beneficial ownership of shares of common stock, shall be required or shall be voluntarily made during the restricted period and (iii) such transfer shall not involve a disposition for value;
- (d) transfers of shares of common stock or any securities convertible into or exercisable or exchangeable for common stock that occur by operation of law pursuant to a qualified domestic order or in connection with a divorce settlement, provided that (i) each transferee shall sign and deliver a lock-up agreement, (ii) any public report or filing required to be made under Section 16(a) of the Exchange Act shall clearly indicate in the footnotes thereto that such transfer is pursuant to a qualified domestic order or in connection with a divorce settlement and (iii) such transfer shall not involve a disposition for value, and provided, further that no other public announcement shall be required or shall be made voluntarily in connection with such transfer;
- (e) transfers of shares of common stock or any securities convertible into or exercisable or exchangeable for common stock to us pursuant to agreements entered into pursuant to a stock incentive plan disclosed in this prospectus and in effect on the date of this prospectus under which we have the option to repurchase such shares or securities upon termination of service of the securityholder, provided that no public report or filing required to be made under Section 16(a) of the Exchange Act or other public filing, report or announcement shall be required or shall be voluntarily made during the period beginning on the date hereof and continuing to and including the date that is 30 days after the date of this prospectus (the "30 Day Period"), and after such 30<sup>th</sup> day, if the securityholder is required to file a report under Section 16(a) of the Exchange Act during the restricted period, the securityholder shall clearly indicate in the footnotes thereto that such transfer is pursuant to the circumstances described in this clause, and provided, further that no other public announcement shall be made voluntarily in connection with such transfer;
- (f) the exercise of outstanding warrants by the securityholder described in this prospectus or any stock option by the securityholder that was granted under a stock incentive plan or stock purchase plan described in this prospectus, provided that the shares received upon exercise shall continue to be

subject to the restrictions on transfer set forth in the lock-up agreement and provided, further that no public report or filing required to be made under Section 16(a) of the Exchange Act or other public filing, report or announcement shall be required or shall be voluntarily made during the 30 Day Period, and after the 30 Day Period, if the securityholder is required to file a report under Section 16(a) of the Exchange Act during the restricted period, the securityholder shall clearly indicate in the footnotes thereto that the filing relates to the exercise of a stock option or warrant, that no shares were sold by the reporting person and that the shares received upon exercise of the stock option or warrant are subject to a lock-up agreement, and provided, further that no other public announcement shall be made voluntarily in connection with such exercise;

- (g) the transfer of shares of common stock or any security convertible into common stock to us upon the exercise of options or warrants to purchase our securities outstanding or pursuant to a stock incentive plan or stock purchase plan described in this prospectus, on a “cashless” or “net exercise” basis, provided that the shares received upon exercise shall continue to be subject to the restrictions on transfer set forth in the lock-up agreement and provided, further that no public report or filing required to be made under Section 16(a) of the Exchange Act or other public filing, report or announcement shall be required or shall be voluntarily made during the period beginning on the date of the lock-up agreement and continuing to and including the 30 Day Period, and after the 30 Day Period, if the securityholder is required to file a report under Section 16(a) of the Exchange Act during the restricted period, the securityholder shall clearly indicate in the footnotes thereto that the filing relates to the “cashless” or “net” exercise of a stock option or warrant, that no shares were sold by the reporting person and that the shares received upon exercise of the stock option or warrant are subject to a lock-up agreement, and provided, further that no other public announcement shall be made voluntarily in connection with such transfer;
- (h) the transfer of shares of common stock or any security convertible into common stock to us, or the withholding of shares of common stock by us, in connection with a vesting event of our securities granted pursuant to a stock incentive plan or stock purchase plan described in this prospectus, to cover tax withholding obligations or the payment of taxes due in connection with the vesting event, provided that no public report or filing required to be made under Section 16(a) of the Exchange Act or other public filing, report or announcement shall be required or shall be voluntarily made during the period beginning on the date of the lock-up agreement and continuing to and including the 30 Day Period, and after the 30 Day Period, if the securityholder is required to file a report under Section 16(a) of the Exchange Act during the restricted period, the securityholder shall clearly indicate in the footnotes thereto that the purpose of such transfer is to cover such tax withholding obligations or the payment of taxes due in connection with the vesting event, and provided, further that no other public announcement shall be made voluntarily in connection with such transfer;
- (i) a merger, consolidation or other similar transaction involving a change of control of our company after the closing of this offering and approved by our board of directors, provided that in the event that such change of control is not completed, the securityholder’s shares shall remain subject to the restrictions contained in the lock-up agreement and title to the securityholder’s shares shall remain with the securityholder; and
- (j) the establishment of a trading plan pursuant to Rule 10b5-1 under the Exchange Act for the transfer of shares of common stock, provided that (i) such plan does not provide for the transfer of common stock during the restricted period and (ii) to the extent a public announcement or filing under the Exchange Act, if any, is required of or voluntarily made by or on behalf of the securityholder or us regarding the establishment of such plan, such announcement or filing shall include a statement to the effect that no transfer of Common Stock may be made under such plan during the restricted period.

In our case, such restrictions shall not apply to:

- (a) the shares of our common stock to be sold in this offering;

- (b) any shares of our common stock issued upon the exercise of options or warrants or the conversion of a security outstanding on the date of the underwriting agreement of which Morgan Stanley & Co. LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated have been advised in writing;
- (c) the grant of options or the issuance of shares of common stock by us to our employees, officers, directors, advisors or consultants pursuant to employee benefit plans in effect on the date of the underwriting agreement and as described herein;
- (d) the filing by us of a registration statement with the SEC on Form S-8 in respect of any shares issued under or the grant of any award pursuant to an employee benefit plan described herein;
- (e) shares of common stock to be sold in the Potential Concurrent Private Placement, if any; or
- (f) the sale or issuance of or entry into an agreement to sell or issue shares of our common stock or securities convertible into or exercisable or exchangeable for our common stock in connection with any (1) mergers, (2) acquisition of securities, businesses, property or other assets, (3) joint ventures, (4) strategic alliances, (5) partnerships with experts or other talent to develop or provide content, (6) equipment leasing arrangements or (7) debt financing, provided that the aggregate number of shares of our common stock or securities convertible into or exercisable for common stock (on an as-converted or as-exercised basis, as the case may be) that we may sell or issue or agree to sell or issue as described in this bullet point shall not exceed 5% of the total number of shares of our common stock issued and outstanding immediately following the completion of this offering, and provided, further, that each recipient of shares of our common stock or securities convertible into or exercisable for our common stock pursuant to this bullet point shall execute and deliver to Morgan Stanley & Co. LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated a lock-up agreement.

Morgan Stanley & Co. LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated, in their sole discretion, may release the common stock and other securities subject to the lock-up agreements described above in whole or in part at any time.

In order to facilitate the offering of the common stock, the underwriters may engage in transactions that stabilize, maintain or otherwise affect the price of the common stock. Specifically, the underwriters may sell more shares than they are obligated to purchase under the underwriting agreement, creating a short position. A short sale is covered if the short position is no greater than the number of shares available for purchase by the underwriters under the over-allotment option. The underwriters can close out a covered short sale by exercising the over-allotment option or purchasing shares in the open market. In determining the source of shares to close out a covered short sale, the underwriters will consider, among other things, the open market price of shares compared to the price available under the over-allotment option. The underwriters may also sell shares in excess of the over-allotment option, creating a naked short position. The underwriters must close out any naked short position by purchasing shares in the open market. A naked short position is more likely to be created if the underwriters are concerned that there may be downward pressure on the price of the common stock in the open market after pricing that could adversely affect investors who purchase in this offering. As an additional means of facilitating this offering, the underwriters may bid for, and purchase, shares of common stock in the open market to stabilize the price of the common stock. These activities may raise or maintain the market price of the common stock above independent market levels or prevent or retard a decline in the market price of the common stock. The underwriters are not required to engage in these activities and may end any of these activities at any time.

We and the underwriters have agreed to indemnify each other against certain liabilities, including liabilities under the Securities Act.

A prospectus in electronic format may be made available on websites maintained by one or more underwriters, or selling group members, if any, participating in this offering. The representatives may agree to allocate a number of shares of common stock to underwriters for sale to their online brokerage account holders. Internet distributions will be allocated by the representatives to underwriters that may make Internet distributions on the same basis as other allocations.

## **Other Relationships**

The underwriters and their respective affiliates are full service financial institutions engaged in various activities, which may include securities trading, commercial and investment banking, financial advisory, investment management, investment research, principal investment, hedging, financing and brokerage activities. Certain of the underwriters and their respective affiliates may in the future perform, various financial advisory and investment banking services for us, for which they will receive customary fees and expenses.

In addition, in the ordinary course of their various business activities, the underwriters and their respective affiliates may make or hold a broad array of investments and actively trade debt and equity securities (or related derivative securities) and financial instruments (including bank loans) for their own account and for the accounts of their customers and may at any time hold long and short positions in such securities and instruments. Such investment and securities activities may involve our securities and instruments. The underwriters and their respective affiliates may also make investment recommendations or publish or express independent research views in respect of such securities or instruments and may at any time hold, or recommend to clients that they acquire, long or short positions in such securities and instruments.

## **Pricing of the Offering**

Prior to this offering, there has been no public market for our common stock. The initial public offering price was determined by negotiations between us and the representatives. Among the factors considered in determining the initial public offering price were our future prospects and those of our industry in general, our sales, earnings and certain other financial and operating information in recent periods, and the price-earnings ratios, price-sales ratios, market prices of securities, and certain financial and operating information of companies engaged in activities similar to ours.

## **Selling Restrictions**

### ***European Economic Area***

In relation to each Member State of the European Economic Area which has implemented the Prospectus Directive (each, a “Relevant Member State”) an offer to the public of any shares of our common stock may not be made in that Relevant Member State, except that an offer to the public in that Relevant Member State of any shares of our common stock may be made at any time under the following exemptions under the Prospectus Directive:

- (a) to any legal entity which is a qualified investor as defined in the Prospectus Directive;
- (b) to fewer than 150 natural or legal persons (other than qualified investors as defined in the Prospectus Directive), subject to obtaining the prior consent of Morgan Stanley & Co. LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated for any such offer; or
- (c) in any other circumstances falling within Article 3(2) of the Prospectus Directive, provided that no such offer of shares of our common stock shall result in a requirement for the publication by us or any underwriter of a prospectus pursuant to Article 3 of the Prospectus Directive.

For the purposes of this provision, the expression an “offer to the public” in relation to any shares of our common stock in any Relevant Member State means the communication in any form and by any means of sufficient information on the terms of the offer and any shares of our common stock to be offered so as to enable an investor to decide to purchase any shares of our common stock, as the same may be varied in that Member State by any measure implementing the Prospectus Directive in that Member State, the expression “Prospectus Directive” means Directive 2003/71/EC (as amended), including by Directive 2010/73/EU, and includes any relevant implementing measure in the Relevant Member State.



This European Economic Area selling restriction is in addition to any other selling restrictions set out below.

***United Kingdom***

Each underwriter has represented and agreed that:

- (a) it has only communicated or caused to be communicated and will only communicate or cause to be communicated an invitation or inducement to engage in investment activity (within the meaning of Section 21 of the Financial Services and Markets Act 2000 or the “FSMA” received by it in connection with the issue or sale of the shares of our common stock in circumstances in which Section 21(1) of the FSMA does not apply to us; and
- (b) it has complied and will comply with all applicable provisions of the FSMA with respect to anything done by it in relation to the shares of our common stock in, from or otherwise involving the United Kingdom.

***Canada***

The shares may be sold only to purchasers purchasing, or deemed to be purchasing, as principal that are accredited investors, as defined in National Instrument 45-106 Prospectus Exemptions or subsection 73.3(1) of the Securities Act (Ontario), and are permitted clients, as defined in National Instrument 31-103 Registration Requirements, Exemptions and Ongoing Registrant Obligations. Any resale of the shares must be made in accordance with an exemption from, or in a transaction not subject to, the prospectus requirements of applicable securities laws.

Securities legislation in certain provinces or territories of Canada may provide a purchaser with remedies for rescission or damages if this prospectus supplement or the accompanying prospectus (including any amendment thereto) contains a misrepresentation, provided that the remedies for rescission or damages are exercised by the purchaser within the time limit prescribed by the securities legislation of the purchaser’s province or territory. The purchaser should refer to any applicable provisions of the securities legislation of the purchaser’s province or territory for particulars of these rights or consult with a legal advisor.

Pursuant to section 3A.3 (or, in the case of securities issued or guaranteed by the government of a non-Canadian jurisdiction, section 3A.4) of National Instrument 33-105 Underwriting Conflicts (NI 33-105), the underwriters are not required to comply with the disclosure requirements of NI 33-105 regarding underwriter conflicts of interest in connection with this offering.

***Russia***

Under Russian law, shares of common stock may be considered securities of a foreign issuer. Neither we, nor this prospectus, nor shares of our common stock have been, or are intended to be, registered with the Central Bank of the Russian Federation under the Federal Law No. 39-FZ “On Securities Market” dated April 22, 1996 (as amended, the “Russian Securities Law”), and none of the shares of our common stock are intended to be, or may be offered, sold or delivered, directly or indirectly, or offered or sold to any person for reoffering or re-sale, directly or indirectly, in the territory of the Russian Federation or to any resident of the Russian Federation, except pursuant to the applicable laws and regulations of the Russian Federation.

The information provided in this prospectus does not constitute any representation with respect to the eligibility of any recipients of this prospectus to acquire shares of our common stock under the laws of the Russian Federation, including, without limitation, the Russian Securities Law and other applicable legislation.

This prospectus is not to be distributed or reproduced (in whole or in part) in the Russian Federation by the recipients of this prospectus. Recipients of this prospectus undertake not to offer, sell or deliver, directly or

indirectly, or offer or sell to any person for reoffering or re-sale, directly or indirectly, shares of our common stock in the territory of the Russian Federation or to any resident of the Russian Federation, except pursuant to the applicable laws and regulations of the Russian Federation.

Recipients of this prospectus understand that respective receipt/acquisition of shares of our common stock is subject to restrictions and regulations applicable from the Russian law perspective.

#### ***Switzerland***

The shares of common stock may not be publicly offered in Switzerland and will not be listed on the SIX Swiss Exchange, or SIX, or on any other stock exchange or regulated trading facility in Switzerland. This document has been prepared without regard to the disclosure standards for issuance prospectuses under art. 652a or art. 1156 of the Swiss Code of Obligations or the disclosure standards for listing prospectuses under art. 27 ff. of the SIX Listing Rules or the listing rules of any other stock exchange or regulated trading facility in Switzerland. Neither this document nor any other offering or marketing material relating to the shares or the offering may be publicly distributed or otherwise made publicly available in Switzerland. Neither this document nor any other offering or marketing material relating to the offering, us, or the shares have been or will be filed with or approved by any Swiss regulatory authority. In particular, this document will not be filed with, and the offer of shares will not be supervised by, the Swiss Financial Market Supervisory Authority FINMA, or FINMA, and the offer of shares has not been and will not be authorized under the Swiss Federal Act on Collective Investment Schemes, or CISA. The investor protection afforded to acquirers of interests in collective investment schemes under the CISA does not extend to acquirers of shares.

#### ***Dubai International Financial Centre***

This prospectus relates to an Exempt Offer in accordance with the Offered Securities Rules of the Dubai Financial Services Authority, or DFSA. This prospectus is intended for distribution only to persons of a type specified in the Offered Securities Rules of the DFSA. It must not be delivered to, or relied on by, any other person. The DFSA has no responsibility for reviewing or verifying any documents in connection with Exempt Offers. The DFSA has not approved this prospectus nor taken steps to verify the information set forth herein and has no responsibility for the prospectus. The shares to which this prospectus relates may be illiquid and/or subject to restrictions on their resale. Prospective purchasers of the shares offered should conduct their own due diligence on the shares. If you do not understand the contents of this prospectus you should consult an authorized financial advisor.

#### ***Australia***

No placement document, prospectus, product disclosure statement or other disclosure document has been lodged with the Australian Securities and Investments Commission, or ASIC, in relation to the offering. This prospectus does not constitute a prospectus, product disclosure statement or other disclosure document under the Corporations Act 2001, or the Corporations Act, and does not purport to include the information required for a prospectus, product disclosure statement or other disclosure document under the Corporations Act.

Any offer in Australia of the shares may only be made to persons, or the Exempt Investors, who are “sophisticated investors” (within the meaning of section 708(8) of the Corporations Act), “professional investors” (within the meaning of section 708(11) of the Corporations Act) or otherwise pursuant to one or more exemptions contained in section 708 of the Corporations Act so that it is lawful to offer the shares without disclosure to investors under Chapter 6D of the Corporations Act.

The shares applied for by Exempt Investors in Australia must not be offered for sale in Australia in the period of 12 months after the date of allotment under the offering, except in circumstances where disclosure to investors under Chapter 6D of the Corporations Act would not be required pursuant to an exemption under

section 708 of the Corporations Act or otherwise or where the offer is pursuant to a disclosure document which complies with Chapter 6D of the Corporations Act. Any person acquiring shares must observe such Australian on-sale restrictions.

This prospectus contains general information only and does not take into account the investment objectives, financial situation or particular needs of any particular person. It does not contain any securities recommendations or financial product advice. Before making an investment decision, investors need to consider whether the information in this prospectus is appropriate for their needs, objectives and circumstances, and, if necessary, seek expert advice on those matters.

#### ***New Zealand***

The shares of common stock offered hereby have not been offered or sold, and will not be offered or sold, directly or indirectly in New Zealand and no offering materials or advertisements have been or will be distributed in relation to any offer of shares in New Zealand, in each case other than:

- (a) to persons whose principal business is the investment of money or who, in the course of and for the purposes of their business, habitually invest money; or
- (b) to persons who in all the circumstances can properly be regarded as having been selected otherwise than as members of the public; or
- (c) to persons who are each required to pay a minimum subscription price of at least NZ\$500,000 for the shares before the allotment of those shares (disregarding any amounts payable, or paid, out of money lent by the issuer or any associated person of the issuer); or
- (d) in other circumstances where there is no contravention of the Securities Act 1978 of New Zealand (or any statutory modification or re-enactment of, or statutory substitution for, the Securities Act 1978 of New Zealand).

#### ***Hong Kong***

The shares of common stock have not been offered or sold and will not be offered or sold in Hong Kong, by means of any document, other than (i) to “professional investors” as defined in the Securities and Futures Ordinance (Cap. 571) of Hong Kong and any rules made under that Ordinance; or (ii) in other circumstances which do not result in the document being a “prospectus” as defined in the Companies (Winding Up and Miscellaneous Provisions) Ordinance (Cap. 32) of Hong Kong or which do not constitute an offer to the public within the meaning of that Ordinance. No advertisement, invitation or document relating to the shares of common stock has been or may be issued or has been or may be in the possession of any person for the purposes of issuance, whether in Hong Kong or elsewhere, which is directed at, or the contents of which are likely to be accessed or read by, the public of Hong Kong (except if permitted to do so under the securities laws of Hong Kong) other than with respect to shares of common stock which are or are intended to be disposed of only to persons outside Hong Kong or only to “professional investors” as defined in the Securities and Futures Ordinance and any rules made under that Ordinance.

#### ***Japan***

No registration pursuant to Article 4, paragraph 1 of the Financial Instruments and Exchange Law of Japan (Law No. 25 of 1948, as amended), or the FIEL, has been made or will be made with respect to the solicitation of the application for the acquisition of the shares of common stock.

Accordingly, the shares of common stock have not been, directly or indirectly, offered or sold and will not be, directly or indirectly, offered or sold in Japan or to, or for the benefit of, any resident of Japan (which term as used herein means any person resident in Japan, including any corporation or other entity organized under the

laws of Japan) or to others for re-offering or re-sale, directly or indirectly, in Japan or to, or for the benefit of, any resident of Japan except pursuant to an exemption from the registration requirements, and otherwise in compliance with, the FIEL and the other applicable laws and regulations of Japan.

*For Qualified Institutional Investors, or QII*

Please note that the solicitation for newly-issued or secondary securities (each as described in Paragraph 2, Article 4 of the FIEL) in relation to the shares of common stock constitutes either a “QII only private placement” or a “QII only secondary distribution” (each as described in Paragraph 1, Article 23-13 of the FIEL). Disclosure regarding any such solicitation, as is otherwise prescribed in Paragraph 1, Article 4 of the FIEL, has not been made in relation to the shares of common stock. The shares of common stock may only be transferred to QIIs.

*For Non-QII Investors*

Please note that the solicitation for newly-issued or secondary securities (each as described in Paragraph 2, Article 4 of the FIEL) in relation to the shares of common stock constitutes either a “small number private placement” or a “small number private secondary distribution” (each as is described in Paragraph 4, Article 23-13 of the FIEL). Disclosure regarding any such solicitation, as is otherwise prescribed in Paragraph 1, Article 4 of the FIEL, has not been made in relation to the shares of common stock. The shares of common stock may only be transferred en bloc without subdivision to a single investor.

**Singapore**

This prospectus has not been registered as a prospectus with the Monetary Authority of Singapore. Accordingly, the shares of common stock were not offered or sold or caused to be made the subject of an invitation for subscription or purchase and will not be offered or sold or caused to be made the subject of an invitation for subscription or purchase, and has not circulated or distributed, nor will it circulate or distribute, this prospectus or any other document or material in connection with the offer or sale, or invitation for subscription or purchase, of the shares of common stock, whether directly or indirectly, to any person in Singapore other than (i) to an institutional investor (as defined in Section 4A of the Securities and Futures Act (Chapter 289) of Singapore, as modified or amended from time to time (the “SFA”)) pursuant to Section 274 of the SFA, (ii) to a relevant person (as defined in Section 275(2) of the SFA) pursuant to Section 275(1) of the SFA, or any person pursuant to Section 275(1A) of the SFA, and in accordance with the conditions specified in Section 275 of the SFA, or (iii) otherwise pursuant to, and in accordance with the conditions of, any other applicable provision of the SFA.

Where the shares of common stock are subscribed or purchased under Section 275 of the SFA by a relevant person which is:

- (a) a corporation (which is not an accredited investor (as defined in Section 4A of the SFA)) the sole business of which is to hold investments and the entire share capital of which is owned by one or more individuals, each of whom is an accredited investor; or
- (a) a trust (where the trustee is not an accredited investor) whose sole purpose is to hold investments and each beneficiary of the trust is an individual who is an accredited investor,

securities or securities-based derivatives contracts (each term as defined in Section 2(1) of the SFA) of that corporation or the beneficiaries’ rights and interest (howsoever described) in that trust shall not be transferred within six months after that corporation or that trust has acquired the shares of common stock pursuant to an offer made under Section 275 of the SFA except:

- (a) to an institutional investor or to a relevant person, or to any person arising from an offer referred to in Section 275(1A) or Section 276(4)(i) (B) of the SFA;
- (b) where no consideration is or will be given for the transfer;

[Table of Contents](#)

[Index to Financial Statements](#)

- (c) where the transfer is by operation of law; or
- (d) as specified in Section 276(7) of the SFA.

In connection with Section 309B of the SFA and the Capital Markets Products (the “CMP”) Regulations 2018, the shares of common stock are prescribed capital markets products (as defined in the CMP Regulations 2018) and Excluded Investment Products (as defined in Monetary Authority of Singapore Notice SFA 04-N12: Notice on the Sale of Investment Products and Monetary Authority of Singapore Notice FAA-N16: Notice on Recommendations on Investment Products).

## LEGAL MATTERS

The validity of the issuance of the shares of common stock offered hereby will be passed upon for us by Davis Polk & Wardwell LLP, Menlo Park, California. Cooley LLP, San Diego, California, is representing the underwriters.

## EXPERTS

The consolidated financial statements of ShockWave Medical, Inc. (the “Company”) as of December 31, 2017 and 2018, and for the years then ended, included in this Prospectus and Registration Statement have been audited by Ernst & Young LLP, independent registered public accounting firm, as set forth in their report thereon (which contains an explanatory paragraph describing conditions that raise substantial doubt about the Company’s ability to continue as a going concern as described in Note 1 to the consolidated financial statements) appearing elsewhere herein, and are included in reliance upon such report given on the authority of such firm as experts in accounting and auditing.

## WHERE YOU CAN FIND MORE INFORMATION

We have filed with the SEC a registration statement on Form S-1 under the Securities Act with respect to the common stock offered hereby. This prospectus does not contain all of the information set forth in the registration statement and the exhibits and schedules thereto. For further information with respect to the company and its common stock, reference is made to the registration statement and the exhibits and any schedules filed therewith. Statements contained in this prospectus as to the contents of any contract or other document referred to are not necessarily complete and in each instance, if such contract or document is filed as an exhibit, reference is made to the copy of such contract or other document filed as an exhibit to the registration statement, each statement being qualified in all respects by such reference. A copy of the registration statement, including the exhibits and schedules thereto, may be read and copied at the SEC’s Public Reference Room at 100 F Street, N.E., Washington, D.C. 20549. Information on the operation of the Public Reference Room may be obtained by calling the SEC at 1-800-SEC-0330. In addition, the SEC maintains an Internet site at [www.sec.gov](http://www.sec.gov), from which interested persons can electronically access the registration statement, including the exhibits and any schedules thereto.

As a result of the offering, we will be required to file periodic reports and other information with the SEC. We also maintain an Internet site at [www.Shockwavemedical.com](http://www.Shockwavemedical.com). Our website and the information contained therein or accessible therefrom shall not be deemed to be incorporated into this prospectus or the registration statement of which it forms a part.

[Table of Contents](#)

[Index to Financial Statements](#)

**SHOCKWAVE MEDICAL, INC.**  
**INDEX TO CONSOLIDATED FINANCIAL STATEMENTS**  
**Years Ended December 31, 2017 and 2018**

[Report of Independent Registered Public Accounting Firm](#)

Financial Statements:

[Consolidated Balance Sheets](#)

[Consolidated Statements of Operations and Comprehensive Loss](#)

[Consolidated Statements of Convertible Preferred Stock and Stockholders' Deficit](#)

[Consolidated Statements of Cash Flows](#)

[Notes to Consolidated Financial Statements](#)

**Page**

F-2

F-3

F-4

F-5

F-6

F-7

F-1

## Report of Independent Registered Public Accounting Firm

To the Stockholders and the Board of Directors of ShockWave Medical, Inc.

### Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of ShockWave Medical, Inc. (the “Company”) as of December 31, 2017 and 2018, the related consolidated statements of operations and comprehensive loss, stockholders’ deficit and cash flows for the years then ended, and the related notes (collectively referred to as the “consolidated financial statements”). In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Company at December 31, 2017 and 2018, and the results of its operations and its cash flows for the years then ended, in conformity with U.S. generally accepted accounting principles.

### The Company’s Ability to Continue as a Going Concern

The accompanying consolidated financial statements have been prepared assuming that the Company will continue as a going concern. As discussed in Note 1 to the consolidated financial statements, the Company has incurred significant losses and has negative cash flows from operations, and has stated that substantial doubt exists about the Company’s ability to continue as a going concern. Management’s evaluation of the events and conditions and management’s plans regarding these matters are also described in Note 1. The consolidated financial statements do not include any adjustments that might result from the outcome of this uncertainty.

### Basis for Opinion

These consolidated financial statements are the responsibility of the Company’s management. Our responsibility is to express an opinion on the Company’s consolidated financial statements based on our 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. The Company is not required to have, nor were we engaged to perform, an audit of its internal control over financial reporting. As part of our audits we are required to obtain an understanding of internal control over financial reporting but not for the purpose of expressing an opinion on the effectiveness of the Company’s internal control over financial reporting. Accordingly, we express no such opinion.

Our audits included performing procedures to assess the risks of material misstatement of the 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. We believe that our audits provide a reasonable basis for our opinion.

/s/ Ernst & Young LLP

We have served as the Company’s auditor since 2016.

San Jose, California  
February 8, 2019,  
except for Note 14, as to which the date is  
February 22, 2019



**SHOCKWAVE MEDICAL, INC.**  
**Consolidated Balance Sheets**  
(in thousands, except share and per share data)

	December 31,		Pro Forma December 31, 2018 (unaudited)
	2017	2018	
<b>ASSETS</b>			
<b>CURRENT ASSETS:</b>			
Cash and cash equivalents	\$ 51,923	\$ 39,643	
Short-term investments	1,806	—	
Accounts receivable, net	639	2,850	
Inventory	2,523	5,131	
Prepaid expenses and other current assets	968	1,112	
Total current assets	57,859	48,736	
Property and equipment, net	1,372	2,619	
Other assets	73	2,066	
<b>TOTAL ASSETS</b>	<b>\$ 59,304</b>	<b>\$ 53,421</b>	
<b>LIABILITIES, CONVERTIBLE PREFERRED STOCK AND STOCKHOLDERS' EQUITY (DEFICIT)</b>			
<b>CURRENT LIABILITIES:</b>			
Accounts payable	\$ 1,148	\$ 1,487	
Term notes, current portion	—	1,667	
Accrued liabilities	3,393	6,217	
Total current liabilities	4,541	9,371	
Term notes, noncurrent portion	—	13,383	
Convertible preferred stock warrant liability	577	313	\$ —
Other liabilities	9	136	
<b>TOTAL LIABILITIES</b>	<b>5,127</b>	<b>23,203</b>	
Commitments and contingencies (Note 6)			
Convertible preferred stock, \$0.001 par value; 216,079,811 and 229,098,987 shares authorized as of December 31, 2017 and 2018; 17,510,045 and 18,670,328 shares issued and outstanding as of December 31, 2017 and 2018, actual; aggregate liquidation preference of \$152.5 million as of December 31, 2018; no shares issued and outstanding, as of December 31, 2018, pro forma (unaudited)	137,469	152,806	—
<b>STOCKHOLDERS' EQUITY (DEFICIT):</b>			
Common stock, \$0.001 par value; 325,000,000 shares authorized as of December 31, 2017 and 2018; 1,627,032 and 1,824,852 shares as of December 31, 2017 and 2018 issued and outstanding; 20,616,085 shares issued and outstanding as of December 31, 2018, pro forma (unaudited)	2	2	21
Additional paid-in capital	2,470	4,275	157,375
Accumulated other comprehensive loss	(1)	—	—
Accumulated deficit	(85,763)	(126,865)	(126,865)
<b>TOTAL STOCKHOLDERS' EQUITY (DEFICIT)</b>	<b>(83,292)</b>	<b>(122,588)</b>	<b>\$ 30,531</b>
<b>TOTAL LIABILITIES, CONVERTIBLE PREFERRED STOCK AND STOCKHOLDERS' EQUITY (DEFICIT)</b>	<b>\$ 59,304</b>	<b>\$ 53,421</b>	

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

**SHOCKWAVE MEDICAL, INC.**  
**Consolidated Statements of Operations and Comprehensive Loss**  
**(in thousands, except share and per share data)**

	Year Ended December 31,	
	2017	2018
Revenue:		
Product revenue	\$ 1,719	\$ 12,263
Operating expenses:		
Cost of product revenue	2,836	7,250
Research and development	17,963	22,698
Sales and marketing	6,363	17,536
General and administrative	5,422	5,979
Total operating expenses	<u>32,584</u>	<u>53,463</u>
Loss from operations	(30,865)	(41,200)
Interest expense	(58)	(401)
Change in fair value of warrant liability	(32)	(52)
Other income, net	366	589
Net loss before taxes	(30,589)	(41,064)
Income tax provision	26	38
Net loss	<u>\$ (30,615)</u>	<u>\$ (41,102)</u>
Unrealized (loss) gain on available-for-sale securities	(1)	1
Total comprehensive loss	<u>\$ (30,616)</u>	<u>\$ (41,101)</u>
Net loss per share, basic and diluted	<u>\$ (19.71)</u>	<u>\$ (23.39)</u>
Shares used in computing net loss per share, basic and diluted	<u>1,553,365</u>	<u>1,757,102</u>
Pro forma net loss per share, basic and diluted (unaudited)		<u>\$ (2.10)</u>
Shares used in computing pro forma net loss per share, basic and diluted (unaudited)		<u>19,525,816</u>

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

**SHOCKWAVE MEDICAL, INC.**  
**Consolidated Statements of Convertible Preferred Stock and Stockholders' Deficit**  
(in thousands, except share data)

	Convertible Preferred Stock		Common Stock		Additional Paid-In Capital	Accumulated Other Comprehensive Income (Loss)	Accumulated Deficit	Total Stockholders' Deficit
	Shares	Amount	Shares	Amount				
Balance—December 31, 2016	14,605,589	\$ 102,180	1,555,510	\$ 2	\$ 1,315	\$ —	\$ (55,148)	\$ (53,831)
Issuance of Series C convertible preferred stock, net of issuance costs of \$93	2,840,504	34,907	—	—	—	—	—	—
Exercise of Series A-1 warrants	63,952	382	—	—	—	—	—	—
Exercise of stock options	—	—	71,522	—	139	—	—	139
Unrealized loss on available-for-sale securities	—	—	—	—	—	(1)	—	(1)
Vesting of early exercised options	—	—	—	—	51	—	—	51
Stock-based compensation	—	—	—	—	965	—	—	965
Net loss	—	—	—	—	—	—	(30,615)	(30,615)
Balance—December 31, 2017	17,510,045	137,469	1,627,032	2	2,470	(1)	(85,763)	(83,292)
Issuance of Series D convertible preferred stock, net of issuance costs of \$80	1,090,608	14,920	—	—	—	—	—	—
Exercise of Series A-1 warrants	69,675	417	—	—	—	—	—	—
Issuance of common stock warrants	—	—	—	—	104	—	—	104
Exercise of stock options	—	—	197,820	—	326	—	—	326
Unrealized gain on available-for-sale securities	—	—	—	—	—	1	—	1
Vesting of early exercised options	—	—	—	—	78	—	—	78
Stock-based compensation	—	—	—	—	1,297	—	—	1,297
Net loss	—	—	—	—	—	—	(41,102)	(41,102)
Balance—December 31, 2018	18,670,328	\$ 152,806	1,824,852	\$ 2	\$ 4,275	\$ —	\$ (126,865)	\$ (122,588)

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

**SHOCKWAVE MEDICAL, INC.**  
**Consolidated Statements of Cash Flows**  
**(in thousands)**

	<b>Year Ended December 31,</b>	
	<b>2017</b>	<b>2018</b>
<b>CASH FLOWS FROM OPERATING ACTIVITIES:</b>		
Net loss	\$(30,615)	\$(41,102)
Adjustments to reconcile net loss to net cash used in operating activities:		
Depreciation and amortization	468	700
Stock-based compensation	965	1,297
Loss on write down of fixed assets	38	31
Change in fair value of warrant liability	32	52
Amortization of debt issuance costs	18	206
Changes in operating assets and liabilities:		
Accounts receivable	(594)	(2,211)
Inventory	(1,863)	(2,608)
Prepaid expenses and other current assets	(373)	(144)
Other assets	—	(917)
Accounts payable	249	360
Accrued and other current liabilities	1,328	2,773
Other liabilities	—	98
Net cash used in operating activities	<u>(30,347)</u>	<u>(41,465)</u>
<b>CASH FLOWS FROM INVESTING ACTIVITIES:</b>		
Purchase of available-for-sale securities	(17,707)	—
Proceeds from maturities of available-for-sale securities	15,900	1,807
Purchase of property and equipment	(425)	(1,981)
Net cash used in investing activities	<u>(2,232)</u>	<u>(174)</u>
<b>CASH FLOWS FROM FINANCING ACTIVITIES:</b>		
Proceeds from issuance of convertible preferred stock, net of issuance costs	34,907	14,920
Proceeds from term notes	—	14,988
Payments of deferred offering costs	—	(626)
Proceeds from stock option exercises including early exercised options	139	426
Proceeds from warrant exercises	198	101
Principal payment of term loan	(1,557)	—
Net cash provided by financing activities	<u>33,687</u>	<u>29,809</u>
Net increase (decrease) in cash, cash equivalents and restricted cash	1,108	(11,830)
Cash, cash equivalents and restricted cash at beginning of period	50,815	51,923
Cash, cash equivalents and restricted cash equivalents at end of period	<u>\$ 51,923</u>	<u>\$ 40,093</u>
<b>SUPPLEMENTAL DISCLOSURES OF CASH FLOW INFORMATION:</b>		
Interest paid	<u>\$ 40</u>	<u>\$ 156</u>
Income tax paid	<u>\$ —</u>	<u>\$ 5</u>
<b>NON-CASH FINANCING ACTIVITIES:</b>		
Property and equipment purchases included in accounts payable	<u>\$ 58</u>	<u>\$ 55</u>
Issuance of common stock warrants in connection with debt financing	<u>\$ —</u>	<u>\$ 104</u>
Deferred offering costs included in accounts payable and accrued liabilities	<u>\$ —</u>	<u>\$ 893</u>
Issuance of Series A-1 convertible preferred stock on net exercise of warrants	<u>\$ —</u>	<u>\$ 316</u>

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

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

**1. Organization and Basis of Presentation**

ShockWave Medical, Inc. (the “Company”) was incorporated on June 17, 2009. The Company is primarily engaged in the development of Intravascular Lithotripsy (“IVL”) Technology for the treatment of calcified plaque in patients with peripheral vascular, coronary vascular and heart valve disease. Built on a balloon catheter platform, the IVL technology uses lithotripsy to disrupt both superficial and deep vascular calcium, while minimizing soft tissue injury, and an integrated angioplasty balloon to dilate blockages at low pressures, restoring blood flow.

In 2016, the Company began commercial and manufacturing operations, and began selling catheters based on the IVL Technology. The Company’s headquarters are in Santa Clara, California. The Company is located and operates primarily in the United States and has a subsidiary in Germany.

***Going Concern***

The Company has incurred significant losses and has negative cash flows from operations. As of December 31, 2018, the Company had an accumulated deficit of \$126.9 million. Management expects to continue to incur additional substantial losses in the foreseeable future.

As of December 31, 2018, the Company had cash and cash equivalents of \$39.6 million, which are available to fund future operations. The Company will need to raise additional capital to support the commercialization of its products and research and development activities. The Company’s activities are subject to significant risks and uncertainties, including the market acceptance of the Company’s products and the timing and extent of spending on research and development.

The Company believes that its cash and cash equivalents as of December 31, 2018, together with available borrowings under a revolving line of credit, will not be sufficient for the Company to continue as a going concern for at least one year from the issuance date of its consolidated financial statements. The Company believes that this raises substantial doubt about its ability to continue as a going concern. As a result, the Company will be required to raise additional capital from the sale of common stock or convertible preferred stock or the issuance of debt. However, no assurance can be given as to whether additional needed financing will be available on terms acceptable to the Company, if at all. If sufficient funds on acceptable terms are not available when needed, the Company may be required to curtail planned activities to significantly reduce its operating expenses. Failure to manage discretionary spending or raise additional financing, as needed, may adversely impact the Company’s ability to achieve its intended business objectives and have an adverse effect on its results of operations and future prospects.

The accompanying consolidated financial statements have been prepared assuming that the Company will continue as a going concern, which contemplates the realization of assets and the settlement of liabilities and commitments in the normal course of business. The accompanying consolidated financial statements do not reflect any adjustments relating to the recoverability and reclassifications of assets and liabilities that might be necessary if the Company is unable to continue as a going concern.

**2. Summary of Significant Accounting Policies**

***Principles of Consolidation***

The accompanying consolidated financial statements include the accounts of the Company and its wholly owned subsidiary. All intercompany balances and transactions have been eliminated in consolidation.

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

***Use of Estimates***

The preparation of consolidated financial statements in conformity with accounting principles generally accepted in the United States of America (“U.S. GAAP”) requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the consolidated financial statements and the reported amounts of expense during the reporting period. Significant estimates and assumptions made in the accompanying consolidated financial statements include, but are not limited to the valuation of inventory, the fair value of common stock, the fair value of preferred stock warrant liabilities, the fair value of stock options, recoverability of the Company’s net deferred tax assets, and related valuation allowance and certain accruals. The Company evaluates its estimates and assumptions on an ongoing basis using historical experience and other factors and adjusts those estimates and assumptions when facts and circumstances dictate. Actual results could materially differ from those estimates.

***Unaudited Pro Forma Financial Information***

The unaudited pro forma consolidated balance sheet information as of December 31, 2018 reflects: (i) the automatic conversion of all outstanding shares of the Company’s convertible preferred stock into an aggregate of 18,670,328 shares of common stock immediately prior to the completion of the Company’s planned initial public offering (“IPO”); (ii) the reclassification of the convertible preferred stock warrant liability to additional paid-in capital due to the warrants converting to warrants to purchase common stock; and (iii) the net exercise of certain outstanding common stock warrants that would otherwise expire upon completion of an IPO into 121,019 shares of common stock, based on an assumed IPO price of \$15.00 per share. The shares of common stock issuable and the proceeds expected to be received in the IPO are excluded from such pro forma financial information.

Pro forma basic and diluted net loss per share has been computed to give effect to the conversion of all outstanding convertible preferred stock into shares of common stock and the net exercise of certain stock warrants. Also, the numerator in the pro forma basic and diluted net loss per share calculation has been adjusted to remove gains or losses resulting from the remeasurement of the convertible preferred stock warrant liability. The unaudited pro forma net loss per share does not include the shares expected to be sold and related proceeds to be received from the IPO. The unaudited pro forma net loss per share for the year ended December 31, 2018 was computed using the weighted-average number of shares of common stock outstanding, including the pro forma effect of the conversion of all outstanding shares of convertible preferred stock into shares of common stock and the net exercise of certain convertible preferred stock warrants and common stock warrants, as if such conversion or net exercise had occurred at the beginning of the period, or their issuance dates if later.

***Cash, Cash Equivalents and Restricted Cash***

The Company considers all highly liquid investments purchased with original maturities of three months or less from the purchase date to be cash equivalents. Cash equivalents consist primarily of amounts invested in money market accounts.

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

The following table provides a reconciliation of cash, cash equivalents and restricted cash reported within the consolidated balance sheets that sum to the total of the same amounts shown in the consolidated statements of cash flows:

	<u>December 31,</u>	
	<u>2017</u>	<u>2018</u>
	<u>(in thousands)</u>	
Cash and cash equivalents	\$51,923	\$39,643
Restricted cash	—	450
Total cash, cash equivalents, and restricted cash	<u>\$51,923</u>	<u>\$40,093</u>

Restricted cash as of December 31, 2018 relates to a letter of credit established for a lease entered into in May 2018 and is recorded as other assets on the consolidated balance sheets.

#### ***Short-Term Investments***

Short-term investments have been classified as available-for-sale and are carried at estimated fair value as determined based upon quoted market prices or pricing models for similar securities. The Company determines the appropriate classification of its investments in debt securities at the time of purchase. Available-for-sale securities with original maturities beyond three months at the date of purchase are classified as current based on their availability for use in current operations.

Unrealized gains and losses are excluded from earnings and are reported as a component of comprehensive loss. The Company periodically evaluates whether declines in fair values of its marketable securities below their book value are other-than-temporary. This evaluation consists of several qualitative and quantitative factors regarding the severity and duration of the unrealized loss as well as the Company's ability and intent to hold the marketable security until a forecasted recovery occurs. Additionally, the Company assesses whether it has plans to sell the security or it is more likely than not it will be required to sell any marketable securities before recovery of its amortized cost basis. Realized gains and losses and declines in fair value judged to be other than temporary, if any, on marketable securities are included in other income, net. The cost of investments sold is based on the specific-identification method. Interest on marketable securities is included in other income, net.

#### ***Concentration of Credit Risk***

Financial instruments that potentially subject the Company to significant concentrations of credit risk consist primarily of cash, cash equivalents, restricted cash, investments and trade receivables. Risks associated with cash, cash equivalents and restricted cash are mitigated by banking with creditworthy institutions and the Company's investments have investment grade ratings when purchased. The Company performs ongoing evaluations of its customers and generally does not require collateral.

#### ***Concentration of Customers***

For the year ended December 31, 2017, one customer accounted for 19% of the Company's revenue. For the year ended December 31, 2018, there were no customers which accounted for more than 10% of the Company's revenue. There were no customers which accounted for more than 10% of the Company's accounts receivable as of December 31, 2017 and 2018.

#### ***Fair Value of Financial Instruments***

The Company's cash and cash equivalents, restricted cash, short-term investments, accounts receivable, accounts payable and accrued liabilities approximate their fair value due to their short maturities. Management

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

believes that its term notes bear interest at the prevailing market rates for instruments with similar characteristics; accordingly, the carrying value of this instrument approximates its fair value.

The Company utilizes valuation techniques that maximize the use of observable inputs and minimize the use of unobservable inputs to the extent possible. The Company determines the fair value of its financial instruments based on assumptions that market participants would use in pricing an asset or liability in the principal or most advantageous market. When considering market participant assumptions in fair value measurements, the following fair value hierarchy distinguishes between observable and unobservable inputs, which are categorized in one of the following levels:

*Level 1* – Inputs are unadjusted, quoted prices in active markets for identical assets or liabilities at the measurement date;

*Level 2* – Inputs are observable, unadjusted quoted prices in active markets for similar assets or liabilities, unadjusted quoted prices for identical or similar assets or liabilities in markets that are not active or other inputs that are observable or can be corroborated by observable market data for substantially the full term of the related assets or liabilities; and

*Level 3* – Unobservable inputs that are significant to the measurement of the fair value of the assets or liabilities that are supported by little or no market data.

***Accounts Receivable and Allowance for Doubtful Accounts***

Accounts receivable are recorded at invoice value, net of any allowance for doubtful accounts. Estimates of the allowance for doubtful accounts are determined based on existing contractual payment terms, historical payment patterns of customers and individual customer circumstances. The allowance for doubtful accounts was \$76,000 as of December 31, 2018 and the Company recognized accounts receivable write-offs in the amount of \$1,000 for the year ended December 31, 2018. There was no allowance for doubtful accounts recorded and no accounts receivable write-offs recognized as of and for the year ended December 31, 2017.

***Inventory***

Inventory is stated at the lower of standard cost (which approximates actual cost on a first-in, first-out basis) and net realizable value. Inventory costs include direct materials, direct labor and normal manufacturing overhead. Prior to achieving normal capacity, excess capacity costs are expensed in cost of product revenue as period costs. Finished goods that are used for research and development are expensed as consumed. Provisions for slow-moving, excess or 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 or quality issues.

***Property and Equipment***

Property and equipment are stated at cost, net of accumulated depreciation and amortization. Depreciation and amortization is computed using the straight-line method over the estimated useful lives of the respective assets, generally three to five years. Leasehold improvements are amortized over the lesser of their useful life or the remaining life of the lease. When assets are retired or otherwise disposed of, the cost and related accumulated depreciation and amortization are removed from the balance sheet and any resulting gain or loss is reflected in operations in the period realized. Maintenance and repairs are charged to operations as incurred.

***Impairment of Long-Lived Assets***

The Company reviews long-lived assets for impairment whenever events or changes in circumstances indicate that the carrying amount of an asset may not be recoverable. Recoverability is measured by comparing



**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

the carrying amount to the future net undiscounted cash flows which the assets are expected to generate. If such assets are considered to be impaired, the impairment to be recognized is measured by the amount by which the carrying amount of the assets exceeds the projected discounted future net cash flows arising from the asset. The Company has not identified any such impairment losses to date.

***Convertible Preferred Stock Warrant Liability***

The Company has accounted for its freestanding warrants to purchase shares of the Company's convertible preferred stock as liabilities at fair value upon issuance primarily because the shares underlying the warrants contain contingent redemption features outside the control of the Company. The warrants are subject to re-measurement at each balance sheet date and any change in fair value is recognized as the change in fair value of warrant liability. The carrying value of the warrants will continue to be adjusted until such time as these instruments are exercised, expire or convert into warrants to purchase shares of the Company's common stock. At that time, the liabilities will be reclassified to additional paid-in capital, a component of stockholders' equity (deficit).

***Revenue***

The Company adopted Accounting Standards Codification ("ASC") 606, *Revenue from Contracts with Customers*, effective January 1, 2018 using the modified retrospective method. Results for reporting periods beginning after January 1, 2018 are presented under ASC 606, while prior period amounts are not adjusted and continue to be reported in accordance with our historic accounting under ASC 605, *Revenue Recognition*. The adoption of this standard did not have a cumulative effect on opening accumulated deficit as of January 1, 2018, as the timing and measurement of revenue recognition is materially the same under ASC 606 as it was under the prior guidance.

The Company records product revenue primarily from the sale of its IVL catheters. The Company sells its products to hospitals, primarily through direct sales representatives, as well as through distributors in selected international markets. Additionally, a significant portion of the Company's revenue is generated through a consignment model under which inventory is maintained at hospitals.

Under ASC 605, revenue is recognized when persuasive evidence of an arrangement exists, delivery has occurred or services have been rendered, the price to the customer is fixed or determinable, and collectability is reasonably assured. For products sold through direct sales representatives, revenue is recognized upon delivery to customers. For products sold to distributors, revenue is recognized upon transfer of title and risk of loss to the distributor. For consignment inventory, revenue is recognized at the time the catheters are consumed in a procedure.

Under ASC 606, revenue is recognized when a customer obtains control of promised goods or services, in an amount that reflects the consideration which the entity expects to receive in exchange for those goods or services. To determine revenue recognition for arrangements that an entity determines are within the scope of ASC 606, the Company performs the following five steps: (i) identify the contract(s) with a customer; (ii) identify the performance obligations in the contract; (iii) determine the transaction price; (iv) allocate the transaction price to the performance obligations in the contract; and (v) recognize revenue when (or as) the entity satisfies a performance obligation.

For products sold through direct sales representatives, control is transferred upon delivery to customers. For products sold to distributors internationally and certain customers that purchase stocking orders in the United States, control is transferred upon shipment or delivery to the customer's named location, based on the

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

contractual shipping terms. For consignment inventory, control is transferred at the time the catheters are consumed in a procedure.

The Company generally provides for the use of an IVL generator and connector cable under an agreement to customers at no charge to facilitate use of the IVL catheters. These agreements do not contain contractually enforceable minimum commitments and are generally cancellable by either party with 30 days' notice.

***Research and Development Costs***

Research and development costs, including new product development, regulatory compliance, and clinical research are expensed as incurred.

***Accrued Research and Development Costs***

The Company accrues liabilities for estimated costs of research and development activities conducted by its third-party service providers, which include the conduct of preclinical and clinical studies. The estimated costs of research and development activities are recorded based upon the estimated amount of services provided but not yet invoiced, and these costs are included in accrued liabilities on the consolidated balance sheets and within research and development expense on the consolidated statements of operations and comprehensive loss.

These costs are accrued for based on factors such as estimates of the work completed and budget provided and in accordance with agreements established with third-party service providers. Significant judgments and estimates are made in determining the accrued liabilities balance in each reporting period. Accrued liabilities are adjusted as actual costs become known. There have not been any material differences between accrued costs and actual costs incurred since the Company's inception.

***Stock-Based Compensation***

The Company accounts for share-based payments at fair value. The fair value of stock options is measured using the Black-Scholes option-pricing model. For share-based awards that vest subject to the satisfaction of a service requirement, the fair value measurement date for stock-based compensation awards is the date of grant and the expense is recognized on a straight-line basis, over the vesting period. The Company accounts for forfeitures as they occur.

***Deferred Offering Costs***

Offering costs, consisting of legal, accounting, printer and filing fees related to the IPO, are deferred and will be offset against proceeds from the IPO upon the effectiveness of the offering. In the event the offering is terminated, all deferred offering costs will be expensed. As of December 31, 2018, \$1.5 million of deferred offering costs were recorded as other assets on the consolidated balance sheet. There were no deferred offering costs recorded as of December 31, 2017.

***Defined Contribution Plan***

The Company has a defined contribution retirement savings plan under Section 401(k) of the Internal Revenue Code. This plan allows eligible employees to defer a portion of their annual compensation on a pre-tax basis. The Company is authorized to make matching contributions but has not made such contributions for the years ended December 31, 2017 and 2018.

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

***Comprehensive Loss***

Comprehensive loss is comprised of net loss and changes in unrealized gains and losses on the Company's available-for-sale investments.

***Foreign Currency***

The functional currency of the Company's foreign subsidiary is the U.S. Dollar. Accordingly, all monetary assets and liabilities of the subsidiary are remeasured at the current exchange rate at the end of the period, nonmonetary assets and liabilities are remeasured at historical rates, and revenue and expenses are remeasured at average exchange rates during the period. There were net foreign currency transaction gains of \$36,000 for the year ended December 31, 2017 and net foreign currency transaction losses of \$46,000 for the year ended December 31, 2018.

***Net Loss Per Share***

Basic net loss per share is calculated by dividing net loss by the weighted-average number of shares of common stock outstanding for the period, without consideration of potential dilutive shares of common stock. The unvested portion of early exercised stock options are excluded from the computation of weighted-average shares as the continuing vesting of such shares is contingent on the holders' continued service to the Company. Since the Company was in a loss position for the period presented, basic net loss per share is the same as diluted net loss per share since the effects of potentially dilutive securities are antidilutive.

***Income Taxes***

The Company uses the asset and liability method of accounting for income taxes. Under this method, deferred tax assets and liabilities are determined based on the differences between the financial reporting and the tax bases of assets and liabilities and are measured using the enacted tax rates and laws that will be in effect when the differences are expected to reverse. Management makes an assessment of the likelihood that the resulting deferred tax assets will be realized. A valuation allowance is provided when it is more likely than not that some portion or all of a deferred tax asset will not be realized. Due to the Company's historical operating performance and the recorded cumulative net losses in prior fiscal periods, the net deferred tax assets have been fully offset by a valuation allowance.

The Company recognizes uncertain income tax positions at the largest amount that is more likely than not to be sustained upon audit by the relevant taxing authority. An uncertain income tax position will not be recognized if it has less than a 50% likelihood of being sustained. Changes in recognition or measurement are reflected in the period in which judgment occurs. The Company's policy is to recognize interest and penalties related to the underpayment of income taxes as a component of provision for income taxes.

***Segment Reporting***

Operating segments are defined as components of an entity for which separate financial information is available and that is regularly reviewed by the Chief Operating Decision Maker ("CODM") in deciding how to allocate resources to an individual segment and in assessing performance. The Company's CODM is its Chief Executive Officer. The Company has determined it operates in one segment.

***Recently Issued and Adopted Accounting Pronouncements***

In June 2018, the Financial Accounting Standards Board ("FASB") issued Accounting Standards Update ("ASU") No. 2018-07, *Improvements to Nonemployee Share-Based Payment Accounting*. ASU 2018-07

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

simplifies the accounting for share-based payments to nonemployees by aligning it with the accounting for share-based payments to employees, with certain exceptions. The Company early adopted this guidance as of January 1, 2018. Adoption of this guidance did not have a material impact on the Company's consolidated financial statements.

In November 2016, the FASB issued ASU No. 2016-18, *Restricted Cash*, which amends the classification and presentation of changes in restricted cash or restricted cash equivalents in the consolidated statements of cash flows. The Company adopted this guidance as of January 1, 2018. Adoption of this guidance did not have a material impact on the Company's consolidated financial statements.

**Recent Accounting Pronouncements**

In February 2016, the FASB issued ASU No. 2016-02, *Leases*. This new standard requires lessees to apply a dual approach, classifying leases as either finance or operating leases based on the principle of whether or not the lease is effectively a financed purchase by the lessee. This classification will determine whether lease expense is recognized based on an effective interest method or on a straight-line basis over the term of the lease. A lessee is also required to record a right-of-use asset and a lease liability for all leases with a term of greater than 12 months regardless of their classification. Leases with a term of 12 months or less will be accounted for similar to existing guidance for operating leases. The Company plans to adopt this accounting standard as of January 1, 2019 using the adoption method defined in ASU No. 2018-11, *Leases (Topic 842): Targeted Improvements*, in which the new leases standard is not applied in comparative periods presented in the year of adoption. The Company plans to apply a practical expedient to combine lease and non-lease components. The Company is currently in the process of evaluating the impact of the adoption of this new standard on the Company's consolidated financial statements. We expect that the adoption of this standard will result in the recognition of a right-of-use asset for leased facilities and recognition of a liability for the lease payments remaining on the lease. These changes will be reflected on the consolidated balance sheets.

**3. Financial Instruments and Fair Value Measurements**

The following tables summarize the Company's financial assets and liabilities measured at fair value on a recurring basis by level within the fair value hierarchy:

	December 31, 2017			Total
	Level 1	Level 2	Level 3	
(in thousands)				
<b>Assets:</b>				
Money market funds	\$26,379	\$ —	\$ —	\$26,379
U.S. treasury note	1,806	—	—	1,806
Total assets	<u>\$28,185</u>	<u>\$ —</u>	<u>\$ —</u>	<u>\$28,185</u>
<b>Liabilities:</b>				
Convertible preferred stock warrant liability	\$ —	\$ —	\$ 577	\$ 577
Total liabilities	<u>\$ —</u>	<u>\$ —</u>	<u>\$ 577</u>	<u>\$ 577</u>

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

	December 31, 2018			Total
	Level 1	Level 2	Level 3	
	(in thousands)			
<b>Assets:</b>				
Money market funds	\$21,680	\$ —	\$ —	\$21,680
Total assets	<u>\$21,680</u>	<u>\$ —</u>	<u>\$ —</u>	<u>\$21,680</u>
<b>Liabilities:</b>				
Convertible preferred stock warrant liability	\$ —	\$ —	\$ 313	\$ 313
Total liabilities	<u>\$ —</u>	<u>\$ —</u>	<u>\$ 313</u>	<u>\$ 313</u>

The change in the fair value of the warrant liability is summarized below:

	Year Ended December 31,	
	2017	2018
	(in thousands)	
Beginning balance	\$ 729	\$ 577
Exercise of warrants	(184)	(316)
Expiration of warrants, included in change in fair value of warrant liability	—	(133)
Change in fair value of warrant liability	32	185
Ending balance	<u>\$ 577</u>	<u>\$ 313</u>

The valuation of the Company's convertible preferred stock warrant liability contains unobservable inputs that reflect the Company's own assumptions for which there is little, if any, market activity for at the measurement date. Accordingly, the Company's convertible preferred stock warrant liability is measured at fair value on a recurring basis using unobservable inputs and are classified as Level 3 inputs, and any change in fair value is recognized as change in fair value of warrant liability in the consolidated statements of operations and comprehensive loss. Refer to Note 9 for the valuation technique and assumptions used in estimating the fair value of the warrants.

There were no transfers between Levels 1, 2 or 3 for the periods presented.

#### 4. Cash Equivalents and Short-Term Investments

The following is a summary of the Company's cash equivalents and short-term investments:

	December 31, 2017			Fair Value
	Amortized Cost Basis	Unrealized Gains	Unrealized Losses	
	(in thousands)			
Money market funds	\$ 26,379	\$ —	\$ —	\$ 26,379
U.S. treasury note	1,807	—	(1)	1,806
Total	<u>\$ 28,186</u>	<u>\$ —</u>	<u>\$ (1)</u>	<u>\$ 28,185</u>
Reported as:				
Cash equivalents				\$ 26,379
Short-term investments				1,806
Total				<u>\$ 28,185</u>

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

	December 31, 2018			Fair Value
	Amortized Cost Basis	Unrealized Gains	Unrealized Losses	
	(in thousands)			
Money market funds	\$ 21,680	\$ —	\$ —	\$ 21,680
Total	<u>\$ 21,680</u>	<u>\$ —</u>	<u>\$ —</u>	<u>\$ 21,680</u>
Reported as:				
Cash equivalents				\$ 21,680
Total				<u>\$ 21,680</u>

For the years ended December 31, 2017 and 2018, the Company recognized no material realized gains or losses on cash equivalents and short-term investments.

### 5. Balance Sheet Components

#### *Inventory*

Inventory consists of the following:

	December 31,	
	2017	2018
	(in thousands)	
Raw material	\$ 478	\$1,084
Work in progress	198	634
Finished goods	1,041	2,313
Consigned inventory	806	1,100
Total inventory	<u>\$2,523</u>	<u>\$5,131</u>

#### *Property and Equipment, Net*

Property and equipment, net consists of the following:

	December 31,	
	2017	2018
	(in thousands)	
Equipment	\$1,298	\$ 2,321
Equipment on loan to customers	263	786
Office furniture	68	90
Software	76	76
Leasehold improvements	366	764
Construction in progress	258	236
Property and equipment, gross	<u>2,329</u>	<u>4,273</u>
Less accumulated depreciation and amortization	(957)	(1,654)
Total property and equipment, net	<u>\$1,372</u>	<u>\$ 2,619</u>

Depreciation and amortization expense was \$0.5 million and \$0.7 million for the years ended December 31, 2017 and 2018, respectively.

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

**Other Assets**

Other assets consist of the following:

	<b>December 31,</b>	
	<b>2017</b>	<b>2018</b>
<b>(in thousands)</b>		
Deferred offering costs	\$—	\$1,519
Restricted cash	—	450
Other	73	97
Total other assets	<u>\$73</u>	<u>\$2,066</u>

**Accrued Liabilities**

Accrued liabilities consist of the following:

	<b>December 31,</b>	
	<b>2017</b>	<b>2018</b>
<b>(in thousands)</b>		
Accrued employee compensation	\$2,072	\$3,135
Accrued research and development costs	507	1,115
Accrued professional services	348	1,391
Other	466	576
Total accrued liabilities	<u>\$3,393</u>	<u>\$6,217</u>

**6. Commitments and Contingencies****Operating Leases**

In August 2012, the Company entered into a lease for office space located in Fremont, California. In October 2018, the Company extended the term of the lease to June 30, 2019. The Company is using the facility for office, manufacturing and research and development purposes.

In May 2018, the Company entered into a new lease agreement for office and laboratory space which consist of approximately 35,000 square feet located in Santa Clara, California. The lease term commenced in September 2018 and ends in August 2022. In connection with the lease, the Company maintains a letter of credit for the benefit of the landlord in the amount of \$0.5 million, which is secured by restricted cash recorded as other assets on the consolidated balance sheets.

The following are minimum future rental payments owed under these agreements:

<b>Year ending December 31:</b>	<b>(in thousands)</b>
2019	\$ 940
2020	830
2021	855
2022	582
Total	<u>\$ 3,207</u>

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

Rent expense for the years ended December 31, 2017 and 2018 was \$0.4 million and \$0.8 million, respectively.

**7. Term Notes**

***2014 Loan and Security Agreement***

In June 2014, the Company entered into a Loan and Security Agreement with Silicon Valley Bank (the “2014 Loan and Security Agreement”), under which a total of \$4.0 million was borrowed. The Company made monthly payments of principal and interest through the maturity date of October 1, 2017, and a one-time payment of \$0.2 million on the maturity date of the loan. All the borrowings under the 2014 Loan and Security Agreement were fully repaid as of December 31, 2017.

In connection with the 2014 Loan and Security Agreement, the Company issued warrants to purchase shares of the Company’s Series A-1 convertible preferred stock. Upon issuance, the fair value of the warrants was recorded as a debt discount. The debt discount was amortized to interest expense, net over the repayment period of the loan. During the year ended December 31, 2017, amortization of debt discount was \$0.1 million.

***2018 Loan and Security Agreement***

In February 2018, the Company entered into a Loan and Security Agreement with Silicon Valley Bank (the “2018 Loan and Security Agreement”). The terms of the 2018 Loan and Security Agreement include a term loan of \$15.0 million and a revolving line of credit of \$2.0 million. The term loan was available in two tranches, of which the first tranche of \$10.0 million was funded in June 2018 and the second tranche of \$5.0 million was funded in December 2018. The Company has not drawn down on its revolving line of credit as of December 31, 2018.

The term loan matures in December 2021, with interest-only monthly payments until September 2019. The interest-only period will extend through December 2019 if certain financing milestones are met. The term loan accrues interest at a floating per annum rate equal to the greater of the Wall Street Journal prime rate minus 1.75% and 2.75% (3.75% as of December 31, 2018). There is a final payment equal to 6.75% of the original aggregate principal amount, or \$1.0 million, of the term loan advances, which will be accrued over the term of the loan using the effective-interest method.

The line of credit matures in February 2021 and accrues interest at the Wall Street Journal prime rate.

In connection with the execution of the 2018 Loan and Security Agreement, the Company issued warrants to purchase 34,440 shares of the Company’s common stock. Upon issuance, the fair value of the warrants of \$0.1 million was recorded as a debt issuance cost. The debt issuance cost will be amortized to interest expense, net over the repayment period of the loan.

During the year ended December 31, 2018, the Company recorded interest expense related to the 2018 Loan and Security Agreement and amortization of debt discount of \$0.2 million and \$0.2 million, respectively.

The term loan is secured by all of the Company’s assets, excluding intellectual property and certain other assets. The loan contains customary affirmative and restrictive covenants, including with respect to the Company’s ability to enter into fundamental transactions, incur additional indebtedness, grant liens, pay any dividend or make any distributions to its holders, make investments, merge or consolidate with any other person or engage in transactions with the Company’s affiliates, but does not include any financial covenants.



**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

Long-term debt and net premium balances are as follows:

	<b>December 31, 2018</b>
	<b>(in thousands)</b>
Face value of term note	\$ 15,000
Net premium associated with accretion of final payment, issuance of common stock warrants, and other debt issuance costs	50
Term note, current and noncurrent	15,050
Less term note, current portion	(1,667)
Term note, noncurrent portion	<u>\$ 13,383</u>

Future minimum payments of principal and estimated payments of interest on the Company's outstanding variable rate borrowings as of December 31, 2018 are as follows:

<b>Year ending December 31:</b>	<b>(in thousands)</b>
2019	\$ 2,243
2020	7,079
2021	7,816
Total future payments	17,138
Less amounts representing interest	(1,125)
Less final payment	(1,013)
Total principal amount of term note payments	<u>\$ 15,000</u>

#### **8. Convertible Preferred Stock**

In September 2017, the Company issued 2,840,504 shares of its Series C convertible preferred stock at a price per share of \$12.32176 for net proceeds of \$34.9 million.

In December 2018, the Company issued 1,090,608 shares of its Series D convertible preferred stock at a price per share of \$13.75379 for gross proceeds of \$15.0 million. The Series D investor has the option to purchase up to \$10.0 million in common stock in a concurrent private placement at a price per share equal to the price per share of the common stock to the public in an initial public offering.

During 2018, the Company issued 69,675 shares of its Series A-1 convertible preferred stock at the fair value of \$5.978 per share, of which 32,498 shares were issued for gross cash proceeds of \$0.1 million in connection with the cash exercise of Series A-1 warrants and 37,177 shares were issued in connection with the net exercise of 49,655 shares of Series A-1 warrants.

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

Convertible preferred stock consists of the following:

	December 31, 2017			
	Shares Authorized	Shares Issued and Outstanding	Net Carrying Value	Aggregate Liquidation Preference
		(in thousands, except share amounts)		
Series A	19,280,722	1,580,387	\$ 4,226	\$ 4,473
Series A-1	52,589,632	4,127,463	13,637	12,780
Series B	65,000,000	5,309,617	39,877	40,000
Series C	79,209,457	6,492,578	79,729	80,000
	<u>216,079,811</u>	<u>17,510,045</u>	<u>\$ 137,469</u>	<u>\$ 137,253</u>

	December 31, 2018			
	Shares Authorized	Shares Issued and Outstanding	Net Carrying Value	Aggregate Liquidation Preference
		(in thousands, except share amounts)		
Series A	19,280,722	1,580,387	\$ 4,226	\$ 4,473
Series A-1	51,874,893	4,197,138	14,054	12,996
Series B	64,777,331	5,309,617	39,877	40,000
Series C	79,209,457	6,492,578	79,729	80,000
Series D	13,956,584	1,090,608	14,920	15,000
	<u>229,098,987</u>	<u>18,670,328</u>	<u>\$ 152,806</u>	<u>\$ 152,469</u>

The Company recorded its convertible preferred stock at fair value on the dates of issuance, net of issuance costs. As of December 31, 2017 and 2018, the Company classified its Series A, Series A-1, Series B, Series C, and Series D convertible preferred stock outside of stockholders' deficit in temporary equity because, in the event of certain "liquidation events" that are not solely within the control of the Company (including liquidation, sale or transfer of control of the Company), the shares would become redeemable at the option of the holders. As of December 31, 2017 and 2018, the Company did not adjust the carrying values of the Series A, Series A-1, Series B, Series C and Series D convertible preferred stock to the deemed liquidation values of such shares since a liquidation event was not probable at the consolidated balance sheet dates. Subsequent adjustments to increase or decrease the carrying values to the ultimate liquidation values will be made if and when it becomes probable that such a liquidation event will occur.

The holders of the Convertible Preferred Stock have the following rights, privileges and preferences:

**Optional Conversion Rights**

Each share of Series A, Series A-1, Series B, Series C and Series D convertible preferred stock is convertible at the option of the holder into the number of shares of common stock determined by dividing the original issue price by the applicable conversion price. The original issue price per share and initial conversion price per share is \$2.8304 for Series A, \$3.09636 for Series A-1, \$7.5335 for Series B, \$12.32176 for Series C and \$13.75379 for Series D convertible preferred stock. As of December 31, 2018, at the current conversion ratios, each share of Series A, Series A-1, Series B, Series C and Series D convertible preferred stock will convert on a one-for-one basis into common stock. The conversion price per share for the convertible preferred stock shall be adjusted for certain recapitalizations, splits, combinations, common stock dividends or as set forth in the Company's amended and restated certificate of incorporation. At December 31, 2017 and 2018, none of

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

the Series A, Series A-1, Series B, Series C and Series D convertible preferred stock has been converted to common stock.

***Automatic Conversion Rights***

Each share of convertible preferred stock shall automatically be converted into shares of common stock at the then effective conversion rate for such share (i) immediately prior to the closing of a firm commitment underwritten initial public offering pursuant to an effective registration statement filed under the Securities Act of 1933, as amended (the "Securities Act"), covering the offer and sale of the Company's common stock, provided that the offering price per share is not less than \$15.067 (as adjusted for recapitalizations) and the aggregate gross proceeds to the Company are not less than \$30.0 million, or (ii) upon the receipt by the Company of a written request for such conversion from the preferred requisite majority, or, if later, the effective date for conversion specified in such requests. The conversion prices and rates for each series of convertible preferred stock are the same in the event of an automatic conversion as they would be in the event of an optional conversion.

***Voting Rights***

Each share of convertible preferred stock has a number of votes equal to the number of shares of common stock into which it is convertible. The holders of the Series A, Series A-1 and Series B convertible preferred stock, voting as separate classes, each have the right to elect one director to the Company's board of directors (the "Board"). The holders of the Series C and Series D convertible preferred stock, voting together as a separate class, have the right to elect one director to the Company's Board. The holders of the common stock, voting as a separate class, have the right to elect two members to the Board. Any other members of the Company's Board shall be elected by both (i) the holders of convertible preferred stock, voting as a separate class and on an as-converted basis, and (ii) the holders of common stock, voting as a separate class.

***Liquidation Rights***

In the event of any liquidation, dissolution or winding-up of the Company, the holders of the Series A, Series A-1, Series B, Series C and Series D convertible preferred stock are entitled to liquidation preferences in the amount of \$2.8304 per share for the Series A, \$3.09636 per share for the Series A-1, \$7.5335 per share for the Series B, \$12.32176 per share for the Series C and \$13.75379 for the Series D convertible preferred stock (each subject to adjustment for recapitalizations), plus all declared but unpaid dividends. After the payment or setting aside for payment to the holders of the Series A, Series A-1, Series B, Series C and Series D convertible preferred stock of their full liquidation preference amounts, the entire remaining assets of the Company legally available for distribution shall be distributed pro rata to the holders of common stock in proportion to the number of shares of common stock held by them.

If upon the liquidation, dissolution or winding up of the Company the assets of the Company legally available for distribution to the holders of the Series A, Series A-1, Series B, Series C and Series D convertible preferred stock are insufficient to permit the payment to such holders of the full liquidation preferences to which they are entitled, then the holders of the Company's common stock will receive nothing in respect of their equity holdings in the Company. Upon such an event, the assets of the Company legally available for distribution shall satisfy the respective liquidation preferences in the order of: first, the Series D and C convertible preferred stock, which would be treated with equal priority, then the Series B convertible preferred stock, then the Series A-1 convertible preferred stock and then, finally, the Series A convertible preferred stock.

A Liquidation Event is defined as including (i) the acquisition of the corporation by another entity by means of any transaction or series of related transactions to which the corporation is party other than a transaction or

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

series of transactions in which the holders of the voting securities of the corporation outstanding immediately prior to such transaction retain, immediately after such transaction or series of transactions, as a result of shares in the corporation held by such holders prior to such transaction, at least a majority of the total voting power represented by the outstanding voting securities of the corporation or such other surviving or resulting entity; (ii) a sale, lease or other disposition (excluding by exclusive license) of all or substantially all of the assets of the corporation; or (iii) any liquidation, dissolution or winding up of the corporation whether voluntary or involuntary.

***Dividend Rights***

The convertible preferred stockholders are entitled to receive dividends at an annual rate of \$0.22643 per share of Series A, \$0.24766 per share of Series A-1, \$0.60268 per share of Series B, \$0.98576 per share of Series C and \$1.10044 per share of Series D (each adjusted to reflect recapitalizations). Such dividends are payable out of funds legally available, are payable only when and if declared by the Board and are noncumulative. No dividends may be paid on the common stock during any fiscal year until the Series A, Series A-1, Series B, Series C and Series D convertible preferred stockholders have received their dividend preference for that fiscal year. After the payment of these dividends, any dividends declared by the Company's Board out of funds legally available shall be shared equally among all outstanding shares on an as-converted basis. No dividends have been declared to date.

***Redemption Rights***

There are no redemption rights afforded to the holders of convertible preferred stock. Upon certain change in control events that are outside of the Company's control, including liquidation, sale or transfer of control of the Company, the convertible preferred stock is contingently redeemable.

**9. Warrant Liability**

The key terms of the outstanding convertible preferred stock warrants are summarized in the following table:

	<b>Warrants Outstanding</b>			
	<b>Warrants Outstanding December 31, 2017</b>	<b>Warrants Outstanding December 31, 2018</b>	<b>Exercise Price</b>	<b>Expiration</b>
Series A-1 convertible preferred stock warrants	128,259	—	\$ 3.09636	Various dates in 2018
Series A-1 convertible preferred stock warrants	54,903	54,903	\$ 3.09636	June 2024
Total convertible preferred stock warrants	<u>183,162</u>	<u>54,903</u>		

As discussed in Note 8, during 2018, the Company issued 69,675 shares of its Series A-1 convertible preferred stock at the fair value of \$5.978 per share upon the exercise of its warrants; 12,478 warrants were cancelled as payment for the net exercise of warrants pursuant to these issuances. During the year ended December 31, 2018, 46,106 Series A-1 convertible preferred stock warrants expired unexercised.

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

The fair value of the warrants was determined using the Black-Scholes option pricing model and the following assumptions:

	December 31,	
	2017	2018
Expected term (in years)	0-6.5	5.5
Expected volatility	19.8%-42.3%	42.8%
Risk-free interest rate	1.1%-1.8%	2.9%
Expected dividend yield	0%	0%

#### 10. Stock-Based Compensation

Total stock-based compensation was as follows:

	Year Ended December 31,	
	2017	2018
	(in thousands)	
Cost of product revenue	\$ 46	\$ 67
Research and development	185	235
Sales and marketing	130	294
General and administrative	604	701
Total stock-based compensation	<u>\$965</u>	<u>\$1,297</u>

#### *Determination of Fair Value*

The estimated grant-date fair value of all the Company's stock-based awards was calculated using the Black-Scholes option pricing model, based on the following assumptions:

	December 31,	
	2017	2018
Expected term (in years)	6.08	6.08
Expected volatility	45.6%	40.8%-41.9%
Risk-free interest rate	1.9%-2.2%	2.5%-3.1%
Expected dividend yield	0%	0%

The fair value of each stock option grant was determined by the Company using the methods and assumptions discussed below. Each of these inputs is subjective and generally requires significant judgment and estimation by management.

*Expected Term*—The expected term represents the period that stock-based awards are expected to be outstanding. The Company's historical share option exercise information is limited due to a lack of sufficient data points, and did not provide a reasonable basis upon which to estimate an expected term. The expected term for option grants is therefore determined using the simplified method. The simplified method deems the expected term to be the midpoint between the vesting date and the contractual life of the stock-based awards.

*Expected Volatility*—The expected volatility was derived from the historical stock volatilities of comparable peer public companies within the Company's industry that are considered to be comparable to the Company's business over a period equivalent to the expected term of the stock-based awards since there has been no trading history of the Company's common stock.

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

*Risk-Free Interest Rate*—The risk-free interest rate is based on the U.S. Treasury yield curve in effect at the date of grant for zero-coupon U.S. Treasury notes with maturities approximately equal to the stock-based awards' expected term.

*Expected Dividend Yield*—The expected dividend yield is zero as the Company has not paid nor does it anticipate paying any dividends on its common stock in the foreseeable future.

The Company has elected to recognize forfeitures of share-based payment awards as they occur.

**Equity Incentive Plan**

On June 17, 2009, the Company adopted the 2009 Equity Incentive Plan (the "Plan") under which the Board may issue stock options to employees, directors and consultants. The Board has the authority to determine to whom options will be granted, the number of shares, the term and the exercise price. If an individual owns stock representing 10% or more of the outstanding shares, the price of each share shall be at least 110% of the fair market value, as determined by the Board. Options granted under the Plan have a term of up to 10 years and generally vest over a 4 year period with a straight-line vesting and a 25% one year cliff. As of December 31, 2018, the Company had reserved 5,057,744 shares of common stock for issuance under the Plan.

Activity under the 2009 Plan is set forth below:

	Shares Available for Grant	Number of Shares	Weighted- Average Exercise Price Per Share	Weighted- Average Remaining Term (in years)	Aggregate Intrinsic Value (in thousands)
Balance, December 31, 2016	887,885	1,365,934	\$ 1.95		\$ 2,011
Awards authorized	1,352,677	—			
Options granted	(1,974,589)	1,974,589	3.42		
Options exercised	—	(71,522)	1.95		
Options cancelled	160,397	(160,397)	2.44		
Balance, December 31, 2017	426,370	3,108,604	\$ 2.81	8.03	\$ 3,647
Awards authorized	691,503	—			
Options granted	(1,015,963)	1,015,963	5.25		
Options exercised	—	(197,820)	2.20		
Options cancelled	290,389	(290,389)	3.42		
Balance, December 31, 2018	<u>392,299</u>	<u>3,636,358</u>	\$ 3.54	7.79	\$ 11,267
Vested and exercisable, December 31, 2018		<u>1,585,273</u>	\$ 2.68	6.50	\$ 6,249
Vested and expected to vest, December 31, 2018		<u>3,636,358</u>	\$ 3.54	7.79	\$ 11,267

The weighted-average grant date fair value of options granted during the years ended December 31, 2017 and 2018 was \$1.59 and \$2.56 per share, respectively. The total grant date fair value of options vested was \$0.9 million and \$1.6 million for the years ended December 31, 2017 and 2018, respectively.

The aggregate intrinsic values of options outstanding, vested and exercisable, and vested and expected to vest were calculated as the difference between the exercise price of the options and the estimated fair value of the Company's common stock, as determined by the Board, as of December 31, 2018. The aggregate intrinsic value

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

of options exercised was \$0.1 million and \$0.5 million for the years ended December 31, 2017 and 2018, respectively.

As of December 31, 2018, total unrecognized stock-based compensation related to unvested stock options was \$3.8 million, which the Company expects to recognize over a remaining weighted-average period of 2.72 years.

**Early Exercise of Options**

Certain stock options granted under the Company's stock option Plan provide option holders the right to elect to exercise unvested options in exchange for restricted common stock. A summary of the restricted stock shares issued under the Company's Plan is as follows:

	Number of Shares	Weighted- Average Exercise Price
Outstanding and unvested at December 31, 2016	94,610	\$ 0.61
Vested	83,007	\$ 0.61
Outstanding and unvested at December 31, 2017	11,603	\$ 0.61
Exercised	45,287	\$ 2.20
Vested	(43,468)	\$ 1.83
Outstanding and unvested at December 31, 2018	<u>13,422</u>	\$ 2.20

Terms of the Plan permit certain option holders to exercise options before their options are vested, subject to certain limitations. Upon early exercise, the awards become subject to a restricted stock agreement. The shares of restricted stock granted upon early exercise of the options are subject to the same vesting provisions in the original stock option awards. Common stock outstanding in these consolidated financial statements includes restricted stock subject to repurchase. Shares issued as a result of early exercise that have not vested are subject to repurchase by the Company upon termination of the purchaser's employment, at the price paid by the purchaser, and are not deemed to be issued for accounting purposes until those related shares vest. The liability is reclassified into common stock and additional paid-in capital as the shares vest and the repurchase right lapses. Accordingly, the Company has recorded the unvested portion of the exercise proceeds of \$7,000 and \$29,000 as a liability as of December 31, 2017 and 2018, from the early exercise in the accompanying consolidated balance sheets.

**Stock-Based Awards Granted Outside of Equity Incentive Plans**

**Common Stock Warrants**

In May 2015, the Company issued warrants to purchase shares of its common stock to the three founders of the Company. In February 2018, in connection with the execution of the 2018 Loan and Security Agreement, the Company issued warrants to purchase shares of the Company's common stock. The key terms of the outstanding common stock warrants are summarized in the following table:

	Warrants Outstanding			
	Warrants Outstanding December 31, 2017	Warrants Outstanding December 31, 2018	Exercise Price	Expiration
Related party common stock warrants	141,778	141,778	\$ 2.196	May 2025
Common stock warrants issued in connection with the 2018 Loan and Security Agreement	—	34,440	\$ 4.026	February 2028
Total common stock warrants	<u>141,778</u>	<u>176,218</u>		

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

**11. Income Taxes**

Current income tax provision consists of the following:

	December 31,	
	2017	2018
	(in thousands)	
Domestic	\$ 1	\$ 3
Foreign	25	35
Total current income tax provision	<u>\$ 26</u>	<u>\$ 38</u>

The components of the deferred tax assets are as follows:

	December 31,	
	2017	2018
	(in thousands)	
<b>Deferred tax assets:</b>		
Net operating loss carryovers	\$ 19,251	\$ 28,834
Fixed and intangible assets	664	837
Accruals and reserves	465	761
Stock-based compensation	31	132
Research and development credits	1,858	1,716
Contributions	13	14
Total deferred tax assets	22,282	32,294
Less valuation allowance	(22,282)	(32,294)
Total net deferred tax assets	<u>\$ —</u>	<u>\$ —</u>

Reconciliation of the statutory federal income tax to the Company's effective tax is as follows:

	December 31,	
	2017	2018
	(in thousands)	
Income tax benefit at federal statutory rate	\$(10,404)	\$(8,624)
State and local income taxes net of federal tax benefit	1	3
Foreign tax rate differential	(3)	11
Change in valuation allowance	(522)	8,497
Stock-based compensation	309	123
R&D tax credits	(222)	(313)
Other	109	341
Federal rate change (pursuant to the Tax Cuts and Jobs Act of 2017)	10,758	—
Total current income tax provision	<u>\$ 26</u>	<u>\$ 38</u>

Due to the uncertainties surrounding the realization of deferred assets through future taxable income, the Company has provided a full valuation allowance and, therefore, no benefit has been recognized for the net operating loss and other deferred tax assets. The valuation allowance increased by \$0.6 million and \$10.0 million during the years ended December 31, 2017 and 2018, respectively.

As of December 31, 2018, the Company had net operating loss carryforwards available to reduce future federal, California and other state income of \$119.5 million, \$37.2 million and \$19.5 million, respectively. The



**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

federal net operating loss carryforwards begin expiring in 2030, the California net operating loss carryforwards begin expiring in 2031 and other state net operating loss carryforwards begin expiring in various years, starting in 2029. The net operating loss related deferred tax assets do not include excess tax benefits from employee stock option exercises.

As of December 31, 2018, the Company had research and development credit carryforwards of \$1.0 million for federal income tax purposes and \$0.9 million for California state income tax purposes available to reduce future taxable income, if any. The federal research and development credit carryforwards expire beginning 2032 and California credits can be carried forward indefinitely.

Utilization of the net operating loss carryforward may be subject to an annual limitation due to the ownership percentage change limitations provided by the Internal Revenue Code of 1986, as amended, and similar state provisions. The annual limitation may result in the expiration of the net operating loss before utilization.

The Tax Cuts and Jobs Act (“TCJA”) was enacted on December 22, 2017. The TCJA reduces the top U.S. federal corporate tax rate from 35% to 21%, requires companies to pay a one-time transition tax on earnings of certain foreign subsidiaries that were previously tax deferred, changes the rules related to uses and limitations of net operating loss carryforwards created in tax years beginning after December 31, 2017, allows for immediate expensing of fixed asset additions beginning after September 27, 2017, and creates new taxes on certain foreign sourced earnings. In 2017, the Company was not subject to a one-time transition tax as no foreign accumulated earnings and profits existed. As a result of the signing of the TCJA, the Company recorded a \$10.1 million reduction as of December 31, 2017, due to remeasurement of its deferred tax assets along with a corresponding reduction of its valuation allowance.

Subsequent to the enactment of the TCJA, the SEC staff issued Staff Accounting Bulletin No. 118 (“SAB 118”), which allowed companies to record provisional amounts related to the effects of the TCJA during a measurement period not to extend beyond one year of the enactment date. The accounting for the tax effects of the TCJA has been completed as of December 31, 2018 and was not material to income tax expense for the year then ended.

The Company has adopted the approach of recording the consequences of the global intangible low-taxed income (“GILTI”) provisions of the TCJA as period costs when incurred effective for periods beginning after December 31, 2017.

***Uncertain Tax Positions***

The activity related to the gross amount of unrecognized tax benefits is as follows:

	<b>December 31,</b>	
	<b>2017</b>	<b>2018</b>
	<b>(in thousands)</b>	
Beginning balance	\$ 688	\$ 893
Additions based on tax positions related to prior years	—	394
Additions based on tax positions related to current years	205	609
Balance at end of year	<u>\$ 893</u>	<u>\$ 1,896</u>

If recognized, gross unrecognized tax benefits would not have an impact on the Company’s effective tax rate due to the Company’s full valuation allowance position. While it is often difficult to predict the final outcome of any particular uncertain tax position, the Company does not believe that the amount of gross

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

unrecognized tax benefits will change significantly in the next twelve months. The Company is subject to taxation in the United States and in Germany. The Company files federal, California, and various other state income tax returns. The Company is not currently under examination by any income tax authorities. The federal and California statute of limitations remains open for three and four years, respectively, from the date of utilization of any net operating loss or credits.

It is the Company's policy to include penalties and interest expense related to income taxes as a component of the income tax provision as necessary. The Company determined that no accrual for interest and penalties was required as of December 31, 2018.

**12. Net Loss Per Share**

The following outstanding potentially dilutive common stock equivalents have been excluded from the calculation of diluted net loss per share for the period presented due to their anti-dilutive effect:

	Year Ended December 31,	
	2017	2018
	(in thousands)	
Convertible preferred stock	17,510,045	18,670,328
Common stock options issued and outstanding	3,108,604	3,636,358
Early exercised options subject to future vesting	11,603	13,422
Convertible preferred stock warrants	183,162	54,903
Common stock warrants	141,778	176,218
Total	<u>20,955,192</u>	<u>22,551,229</u>

**Unaudited Pro Forma Net Loss Per Share**

The following table sets forth the computation of unaudited pro forma basic and diluted net loss per share:

	Year Ended December 31, 2018 (unaudited) (in thousands, except share and per share data)
<b>Numerator:</b>	
Net loss	\$ (41,102)
Change in fair value of warrant liability	52
Pro forma net loss, basic and diluted	<u>\$ (41,050)</u>
<b>Denominator:</b>	
Shares of common stock used in computing net loss per share, basic and diluted	1,757,102
Pro forma adjustment to reflect assumed conversion of convertible preferred stock	17,647,695
Pro forma adjustment to reflect assumed exercise of certain common stock warrants	121,019
Pro forma shares of common stock, basic and diluted	<u>19,525,816</u>
Pro forma net loss per share, basic and diluted	<u>\$ (2.10)</u>

**ShockWave Medical, Inc.**  
**Notes to Consolidated Financial Statements**

**13. Segment and Geographic Information**

The following table represents the Company's product revenue based on the location to which the product is shipped:

	December 31,	
	2017	2018
	(in thousands)	
United States	\$ 969	\$ 7,022
Germany	597	1,393
Rest of Europe	143	3,516
All other countries	10	332
Product revenue	<u>\$1,719</u>	<u>\$12,263</u>

As of December 31, 2017 and 2018, the Company's long-lived assets are all held in the United States with exception of certain equipment on loan to customers held internationally, which was not material as of each period end.

**14. Subsequent Events**

Except as noted below, subsequent events have been evaluated through February 8, 2019, which is the date that the consolidated financial statements were available to be issued.

***Reverse Stock Split***

The Company's board of directors approved a reverse split of shares of the Company's common stock and convertible preferred stock on a 12.2-for-one basis (the "Reverse Stock Split"), which was effected on February 22, 2019. The par value and the number of authorized shares of the convertible preferred stock and common stock were not adjusted in connection with the Reverse Stock Split. All references to common stock, convertible preferred stock, warrants to purchase common stock, warrants to purchase convertible preferred stock, options to purchase common stock, early exercised options, share data, per share data and related information contained in the financial statements have been retrospectively adjusted to reflect the effect of the Reverse Stock Split for all periods presented. The number of shares of the Company's common stock contained in the financial statements includes fractional shares resulting from the Reverse Stock Split, aggregating to 45 whole shares of common stock and 69 whole shares of preferred stock for the period presented, which fractional shares will be settled in cash in fiscal 2019.

**5,000,000 Shares**



**Common Stock**

**Prospectus**

**Morgan Stanley**

**Wells Fargo Securities**

**BofA Merrill Lynch**

**Canaccord Genuity**

**, 2019**

**PART II****INFORMATION NOT REQUIRED IN PROSPECTUS****Item 13. Other Expenses of Issuance and Distribution**

The following table sets forth all expenses to be paid by us, other than underwriting discounts and commissions, upon completion of this offering. All amounts shown are estimates except for the SEC registration fee, the FINRA filing fee and the Nasdaq Global Market, or Nasdaq, listing fee.

	<b>Amount to Be† Paid</b>
SEC registration fee	\$ 11,150
FINRA filing fee	14,300
Nasdaq Listing fee	150,000
Advisory fees payable to Perella Weinberg Partners LP	735,000
Transfer agent and registrar's fees	10,000
Printing and engraving expenses	350,000
Legal fees and expenses	1,600,000
Accounting fees and expenses	900,000
Blue Sky fees and expenses	—
Miscellaneous expenses	150,000
Total	<u>\$ 3,920,450</u>

† The underwriters have agreed to reimburse us for certain expenses we incur in connection with this offering up to \$735,000.

**Item 14. Indemnification of Directors and Officers**

Section 145 of the Delaware General Corporation Law provides that a corporation may indemnify directors and officers as well as other employees and individuals against expenses (including attorneys' fees), judgments, fines and amounts paid in settlement actually and reasonably incurred by such person in connection with any threatened, pending or completed actions, suits or proceedings in which such person is made a party by reason of such person being or having been a director, officer, employee or agent to the registrant. The Delaware General Corporation Law provides that Section 145 is not exclusive of other rights to which those seeking indemnification may be entitled under any bylaw, agreement, vote of stockholders or disinterested directors or otherwise. The registrant's Bylaws provides for indemnification by the registrant of its directors, officers and employees to the fullest extent permitted by the Delaware General Corporation Law. The registrant has entered into indemnification agreements with each of its current directors and executive officers to provide these directors and executive officers additional contractual assurances regarding the scope of the indemnification set forth in the registrant's amended and restated certificate of incorporation and amended and restated bylaws and to provide additional procedural protections. There is no pending litigation or proceeding involving a director or executive officer of the registrant for which indemnification is sought.

Section 102(b)(7) of the Delaware General Corporation Law permits a corporation to provide in its certificate of incorporation that a director of the corporation shall not be personally liable to the corporation or its stockholders for monetary damages for breach of fiduciary duty as a director, except for liability (i) for any breach of the director's duty of loyalty to the corporation or its stockholders, (ii) for acts or omissions not in good faith or which involve intentional misconduct or a knowing violation of law, (iii) for unlawful payments of dividends or unlawful stock repurchases, redemptions or other distributions, or (iv) for any transaction from which the director derived an improper personal benefit. The registrant's amended and restated certificate of incorporation provides for such limitation of liability.

The registrant maintains standard policies of insurance under which coverage is provided (a) to its directors and officers against loss rising from claims made by reason of breach of duty or other wrongful act, and (b) to the registrant with respect to payments which may be made by the registrant to such officers and directors pursuant to the above indemnification provision or otherwise as a matter of law.

The proposed form of underwriting agreement filed as Exhibit 1.1 to this registration statement provides for indemnification of directors and officers of the registrant by the underwriters against certain liabilities.

#### **Item 15. Recent Sales of Unregistered Securities**

Since January 1, 2016, the registrant has sold the following securities without registration under the Securities Act of 1933:

1. In November 2016 and September 2017, the registrant issued an aggregate of 6,492,564 shares of its Series C convertible preferred stock at \$12.32176 per share, for an aggregate consideration of approximately \$80.0 million. All shares of its Series C convertible preferred stock will convert into shares of its common stock immediately prior to the closing of this offering in accordance with its certificate of incorporation.
2. In February 2018, the registrant issued a ten-year common stock warrant to purchase up to 34,440 shares of its common stock with an exercise price of \$4.026 per share.
3. In December 2018, the registrant issued an aggregate of 1,090,608 shares of its Series D convertible preferred stock at \$13.75379 per share, for an aggregate consideration of approximately \$15.0 million. All shares of its Series D convertible preferred stock will convert into shares of its common stock immediately prior to the closing of this offering in accordance with its certificate of incorporation.
4. In February 2019, the registrant issued 50,331 shares of its common stock upon the exercise of a warrant at \$2.196 per share, for cash consideration of approximately \$0.1 million.
5. Since January 1, 2016, the registrant has granted stock options to purchase an aggregate of 3,352,030 shares of its common stock at a weighted-average exercise price of \$3.98 per share, to certain of our employees, consultants and directors in connection with services provided to the registrant by such persons.
6. Since January 1, 2016, the registrant has issued an aggregate of 372,157 shares of its common stock to its employees, consultants and directors upon their exercise of stock options, for aggregate cash consideration of approximately \$0.8 million.
7. Since January 1, 2016, the registrant has issued an aggregate of 155,829 shares of its Series A-1 convertible preferred stock for aggregate cash consideration of approximately \$0.3 million. All shares of its Series A-1 convertible preferred stock will convert into shares of its common stock immediately prior to the closing of this offering in accordance with its certificate of incorporation.

No underwriters were involved in the foregoing sales of securities. The securities described in this Item 15 were issued to investors in reliance upon the exemption from the registration requirements of the Securities Act, as set forth in Section 4(2) under the Securities Act and Regulation D promulgated thereunder relative to transactions by an issuer not involving any public offering, to the extent an exemption from such registration was required. All purchasers of shares of convertible preferred stock described above represented to us in connection with their purchase that they were accredited investors and were acquiring the shares for their own account for investment purposes only and not with a view to, or for sale in connection with, any distribution thereof and that they could bear the risks of the investment and could hold the securities for an indefinite period of time. The purchasers received written disclosures that the securities had not been registered under the Securities Act and that any resale must be made pursuant to a registration statement or an available exemption from such registration.

## [Table of Contents](#)

## [Index to Financial Statements](#)

The issuances of stock options and the shares of common stock issuable upon the exercise of the options described in paragraphs 6 and 7 above were issued pursuant to written compensatory plans or arrangements with our employees, directors and consultants, in reliance on the exemption provided by Rule 701 promulgated under the Securities Act, or pursuant to Section 4(a)(2) under the Securities Act, relative to transactions by an issuer not involving any public offering, to the extent an exemption from such registration was required.

All of the foregoing securities are deemed restricted securities for purposes of the Securities Act. All certificates representing the issued shares of capital stock described in this Item 15 included appropriate legends setting forth that the securities have not been registered and the applicable restrictions on transfer.

### **Item 16. Exhibits and Financial Statement Schedules**

(a) The following exhibits are filed as part of this registration statement:

<b>Exhibit Number</b>	<b>Description</b>
1.1	<a href="#">Form of Underwriting Agreement</a>
3.1*	<a href="#">Amended and Restated Certificate of Incorporation, as currently in effect</a>
3.2	<a href="#">Form of Amended and Restated Certificate of Incorporation, to become effective immediately upon the completion of this offering</a>
3.3*	<a href="#">Amended and Restated Bylaws, as currently in effect</a>
3.4	<a href="#">Form of Amended and Restated Bylaws, to become effective immediately upon the completion of this offering</a>
3.5	<a href="#">Form of Certificate of Retirement of Preferred Stock of the Registrant, to be effective immediately upon the completion of this offering</a>
4.1*	<a href="#">Form of Common Stock Certificate</a>
4.2*	<a href="#">Amended and Restated Investors' Rights Agreement, between the Registrant and the investors listed on Exhibit A thereto</a>
4.3*	<a href="#">Common Stock Warrant</a>
4.4*	<a href="#">Series A-1 Convertible Preferred Stock Warrant</a>
5.1	<a href="#">Opinion of Davis Polk &amp; Wardwell LLP</a>
10.1*	<a href="#">Sublease Agreement by and between the Registrant and Benvenue Medical, Inc. for facilities at 5403 Betsy Ross Drive, Santa Clara, California, dated May 7, 2018</a>
10.2*	<a href="#">Lease by and between the Registrant and Hines VAF No Cal Properties, L.P. for facilities at 48531 Warm Springs Boulevard, Fremont, California, dated August 10, 2012 and amended on August 30, 2013, October 3, 2014, July 29, 2015, September 30, 2016 and October 18, 2018</a>
10.3†*	<a href="#">2009 Equity Incentive Plan, and forms of Stock Option Agreement and Early Exercise Stock Option Agreement</a>
10.4†	<a href="#">2019 Equity Incentive Plan and form of Stock Option Agreement</a>
10.5†	<a href="#">Employee Stock Purchase Plan</a>
10.6†*	<a href="#">Form of Indemnification Agreement by and between the Registrant and each of its directors and executive officers</a>
10.7†*	<a href="#">Offer Letter with Douglas Godshall</a>
10.8†*	<a href="#">Offer Letter with Dan Puckett</a>
10.9†*	<a href="#">Offer Letter with Isaac Zacharias</a>

<u>Exhibit Number</u>	<u>Description</u>
10.10*	<a href="#">Loan and Security Agreement by and between the Registrant and Silicon Valley Bank, dated February 26, 2018</a>
10.11†	<a href="#">Non-Employee Director Compensation Policy</a>
21.1*	<a href="#">Subsidiaries of the Registrant</a>
23.1	<a href="#">Consent of Independent Registered Public Accounting Firm</a>
23.2	<a href="#">Consent of Davis Polk &amp; Wardwell LLP (included in Exhibit 5.1)</a>
24.1*	<a href="#">Power of Attorney (included on signature pages of this registration statement)</a>

\* Previously filed.

† Indicates management contract or compensatory plan.

#### **Item 17. Undertakings**

The undersigned registrant hereby undertakes:

(a) The undersigned registrant hereby undertakes to provide to the underwriter at the closing specified in the underwriting agreement certificates in such denominations and registered in such names as required by the underwriter to permit prompt delivery to each purchaser.

(b) Insofar as indemnification for liabilities arising under the Securities Act of 1933 may be permitted to directors, officers and controlling persons of the registrant pursuant to the foregoing provisions, or otherwise, the registrant has been advised that in the opinion of the Securities and Exchange Commission such indemnification is against public policy as expressed in the Act and is, therefore, unenforceable. In the event that a claim for indemnification against such liabilities (other than the payment by the registrant of expenses incurred or paid by a director, officer, or controlling person of the registrant in the successful defense of any action, suit or proceeding) is asserted by such director, officer or controlling person in connection with the securities being registered, the registrant will, unless in the opinion of its counsel the matter has been settled by controlling precedent, submit to a court of appropriate jurisdiction the question of whether such indemnification by it is against public policy as expressed in the Act and will be governed by the final adjudication of such issue.

(c) The undersigned registrant hereby undertakes that:

(1) For purposes of determining any liability under the Securities Act of 1933, the information omitted from the form of prospectus filed as part of this registration statement in reliance upon Rule 430A and contained in a form of prospectus filed by the registrant pursuant to Rule 424(b)(1) or (4) or 497(h) under the Securities Act shall be deemed to be part of this registration statement as of the time it was declared effective.

(2) For the purpose of determining any liability under the Securities Act of 1933, each post-effective amendment that contains a form of prospectus shall be deemed to be a new registration statement relating to the securities offered therein, and the offering of such securities at that time shall be deemed to be the initial bona fide offering thereof.



**SIGNATURES**

Pursuant to the requirements of the Securities Act of 1933, the registrant has duly caused this registration statement to be signed on its behalf by the undersigned, thereunto duly authorized, in the City of Santa Clara, State of California, on the 25th day of February, 2019.

SHOCKWAVE MEDICAL, INC.

By: /s/ Douglas Godshall

Name: Douglas Godshall

Title: President, Chief Executive Officer & Director

**SIGNATURES**

Pursuant to the requirements of the Securities Act of 1933, this registration statement has been signed by the following persons in the capacities and on the dates indicated.

<u>Signature</u>	<u>Title</u>	<u>Date</u>
<u>/s/ Douglas Godshall</u> Douglas Godshall	President, Chief Executive Officer & Director (principal executive officer)	February 25, 2019
<u>/s/ Dan Puckett</u> Dan Puckett	Chief Financial Officer & Secretary (principal financial and accounting officer)	February 25, 2019
<u>*</u> C. Raymond Larkin, Jr.	Chairman & Director	February 25, 2019
<u>*</u> F.T. "Jay" Watkins	Director	February 25, 2019
<u>*</u> Antoine Papiernik	Director	February 25, 2019
<u>*</u> Colin Cahill	Director	February 25, 2019
<u>*</u> Frederic Moll, M.D.	Director	February 25, 2019
<u>*</u> Marc-Andre Marcotte	Director	February 25, 2019
<u>*</u> Laura Francis	Director	February 25, 2019

\*By: /s/ Douglas Godshall  
Douglas Godshall  
Attorney-in-fact

[•] Shares

SHOCKWAVE MEDICAL, INC.

COMMON STOCK, PAR VALUE \$0.001 PER SHARE

UNDERWRITING AGREEMENT

[•], 2019

Morgan Stanley & Co. LLC  
Merrill Lynch, Pierce, Fenner & Smith  
Incorporated

c/o Morgan Stanley & Co. LLC  
1585 Broadway  
New York, New York 10036

c/o Merrill Lynch, Pierce, Fenner & Smith  
Incorporated  
One Bryant Park  
New York, New York 10036

Ladies and Gentlemen:

ShockWave Medical, Inc., a Delaware corporation (the “**Company**”), proposes to issue and sell to the several Underwriters named in Schedule I hereto (the “**Underwriters**”), for whom Morgan Stanley & Co. LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated are acting as representatives (the “**Representatives**”), [•] shares of its common stock, par value \$0.001 per share (the “**Firm Shares**”). The Company also proposes to issue and sell to the several Underwriters not more than an additional [•] shares of its common stock, par value \$0.001 per share (the “**Additional Shares**”), if and to the extent that the Representatives shall have determined to exercise, on behalf of the Underwriters, the right to purchase such shares of common stock granted to the Underwriters in Section 2 hereof. The Firm Shares and the Additional Shares are hereinafter collectively referred to as the “**Shares**.” The shares of common stock, par value \$0.001 per share, of the Company to be outstanding after giving effect to the sales contemplated hereby are hereinafter referred to as the “**Common Stock**.” In the event that the Company has only one subsidiary, then all references herein to “subsidiaries” of the Company shall be deemed to refer to such single subsidiary, mutatis mutandis.

The Company has filed with the Securities and Exchange Commission (the “**Commission**”) a registration statement on Form S-1 (File No. 333-229590), including a prospectus, relating to the Shares. The registration statement as amended at the time it becomes effective, including the information (if any) deemed to be part of the registration statement at the time of effectiveness pursuant to Rule 430A under the Securities Act of 1933, as amended (the “**Securities Act**”), is hereinafter referred to as the “**Registration Statement**”; the prospectus in the form first used to confirm sales of the Shares (or in the form first made available to the Underwriters by the Company to meet requests of purchasers pursuant to Rule 173 under the Securities Act) is hereinafter referred to as the “**Prospectus**.” If the Company has filed an abbreviated registration statement to register additional shares of Common Stock pursuant to Rule 462(b) under the Securities Act (the “**Rule 462 Registration Statement**”), then any reference herein to the term “**Registration Statement**” shall be deemed to include such Rule 462 Registration Statement.

For purposes of this Underwriting Agreement (the “**Agreement**”), “**free writing prospectus**” has the meaning set forth in Rule 405 under the Securities Act, “**Time of Sale Prospectus**” means the preliminary prospectus contained in the Registration Statement at the time of its effectiveness together with the documents and pricing information set forth in Schedule II hereto, and “**broadly available road show**” means a “bona fide electronic road show” as defined in Rule 433(h)(5) under the Securities Act that has been made available without restriction to any person. As used herein, the terms “Registration Statement,” “preliminary prospectus,” “Time of Sale Prospectus” and “Prospectus” shall include the documents, if any, incorporated by reference therein as of the date hereof.

Morgan Stanley & Co. LLC (“**Morgan Stanley**”) has agreed to reserve a portion of the Shares to be purchased by it under this Agreement for sale to the Company’s directors, officers, employees and business associates and other parties related to the Company (collectively, “**Participants**”), as set forth in the Prospectus under the heading “Underwriters” (the “**Directed Share Program**”). The Shares to be sold by Morgan Stanley and its affiliates pursuant to the Directed Share Program, at the direction of the Company, are referred to hereinafter as the “**Directed Shares**”. Any Directed Shares not orally confirmed for purchase by any Participant by the end of the business day on which this Agreement is executed will be offered to the public by the Underwriters as set forth in the Prospectus.

1. *Representations and Warranties.* The Company represents and warrants to and agrees with each of the Underwriters that:

(a) The Registration Statement has become effective; no stop order suspending the effectiveness of the Registration Statement is in effect, and no proceedings for such purpose are pending before or, to the Company’s knowledge, threatened by the Commission.

(b) (i) The Registration Statement, when it became effective, did not contain and, as amended or supplemented, if applicable, will not contain, as of the date of such amendment or supplement, any untrue statement of a material fact or omit to state a material fact required to be stated therein or necessary to make the statements therein not misleading, (ii) the Registration Statement and the Prospectus comply and, as amended or supplemented, if applicable, will, as of the date of such amendment or supplement, comply in all material respects with the Securities Act and the applicable rules and regulations of the Commission thereunder, (iii) the Time of Sale Prospectus does not, and at the time of each sale of the Shares in connection with the offering when the Prospectus is not yet available to prospective purchasers and at the Closing Date (as defined in Section 4), the Time of Sale Prospectus, as then amended or supplemented by the Company, if applicable, will not, contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements therein, in the

light of the circumstances under which they were made, not misleading, (iv) each broadly available road show, if any, does not contain any information that conflicts with the information contained in the Registration Statement, the Time of Sale Prospectus or the Prospectus, and when considered together with the Time of Sale Prospectus, does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements therein, in the light of the circumstances under which they were made, not misleading and (v) the Prospectus, as of its date, does not contain and, as amended or supplemented, if applicable, will not contain, as of the date of such amendment or supplement, or as of the Closing Date and each Option Closing Date (as defined in Section 2), any untrue statement of a material fact or omit to state a material fact necessary to make the statements therein, in the light of the circumstances under which they were made, not misleading, except that the representations and warranties set forth in this paragraph do not apply to statements or omissions in the Registration Statement, the Time of Sale Prospectus or the Prospectus based upon information relating to any Underwriter furnished to the Company in writing by such Underwriter through the Representatives expressly for use therein.

(c) The Company is not an “ineligible issuer” in connection with the offering pursuant to Rules 164, 405 and 433 under the Securities Act. Any free writing prospectus that the Company is required to file pursuant to Rule 433(d) under the Securities Act has been, or will be, filed with the Commission in accordance with the requirements of the Securities Act and the applicable rules and regulations of the Commission thereunder. Each free writing prospectus that the Company has filed, or is required to file, pursuant to Rule 433(d) under the Securities Act or that was prepared by or on behalf of or used or referred to by the Company complies, or if filed after the effective date of this Agreement, will comply when filed, in all material respects with the requirements of the Securities Act and the applicable rules and regulations of the Commission thereunder. Except for the free writing prospectuses, if any, identified in Schedule II hereto, and electronic road shows, if any, each furnished to the Representatives before first use, the Company has not prepared, used or referred to, and will not, without the prior consent of the Representatives, prepare, use or refer to, any free writing prospectus.

(d) The Company has been duly incorporated, is validly existing as a corporation in good standing under the laws of the State of Delaware, has the corporate power and authority to own or lease its property and to conduct its business as described in the Time of Sale Prospectus and the Prospectus and is duly qualified to transact business and is in good standing in each jurisdiction (to the extent the concept of good standing or an equivalent concept is applicable in such jurisdiction) in which the conduct of its business or its ownership or leasing of property requires such qualification, except to the extent that the failure to be so qualified or be in good standing (to the extent the concept of good standing or an equivalent concept is applicable in such jurisdiction) would not have a material adverse effect on the Company and its subsidiaries, taken as a whole.

(e) Each subsidiary of the Company has been duly incorporated, is validly existing as a corporation in good standing under the laws of the jurisdiction of its incorporation, has the corporate power and authority to own its property and to conduct its business as described in the Time of Sale Prospectus and the Prospectus and is duly qualified to transact business and is in good standing in each jurisdiction (to the extent the concept of good standing or an equivalent concept is applicable in such jurisdiction) in which the conduct of its business or its ownership or leasing of property requires such qualification, except to the extent that the failure to be so qualified or be in good standing would not have a material adverse effect on the Company and its subsidiaries, taken as a whole; all of the issued shares of capital stock of each subsidiary of the Company have been duly and validly authorized and issued, are fully paid and non-assessable and are owned directly by the Company, free and clear of all liens, encumbrances, equities or claims.

(f) This Agreement has been duly authorized, executed and delivered by the Company.

(g) As of the Closing Date, the authorized capital stock of the Company will conform as to legal matters in all material respects to the description thereof contained in each of the Time of Sale Prospectus and the Prospectus.

(h) The shares of Common Stock outstanding prior to the issuance of the Shares have been duly authorized and are validly issued, fully paid and non-assessable.

(i) The Shares have been duly authorized and, when issued, delivered and paid for in accordance with the terms of this Agreement, will be validly issued, fully paid and non-assessable, and the issuance of such Shares will not be subject to any preemptive or similar rights.

(j) With respect to the stock options granted pursuant to the stock-based compensation plans of the Company and its subsidiaries (the “**Company Stock Plans**”), (i) each grant of a stock option was duly authorized no later than the date on which the grant of such stock option was by its terms to be effective by all necessary corporate action, including, as applicable, approval by the board of directors of the Company (or a duly constituted and authorized committee thereof) and any required stockholder approval by the necessary number of votes or written consents, and the award agreement governing such grant (if any) was duly executed and delivered by each party thereto, and (ii) each such grant was made in accordance with the terms of the Company Stock Plans, and all applicable laws and regulatory rules or requirements, including all applicable federal securities laws.

(k) The execution and delivery by the Company of, and the performance by the Company of its obligations under, this Agreement will not contravene any provision of (i) applicable law, (ii) the certificate of incorporation or by-laws of the Company or any agreement, (iii) other instrument binding upon the Company or any of its subsidiaries that is material to the Company and its subsidiaries, taken as a whole, or (iv) any judgment, order or decree of any governmental body, agency or court having jurisdiction over the Company or any subsidiary, except that in the case of clauses (i), (iii), and (iv) as would not, individually, or in the aggregate, have a material adverse effect on the Company or on the power and ability of the Company to perform its obligations under this Agreement; and no consent, approval, authorization or order of, or qualification with, any governmental body or agency is required for the performance by the Company of its obligations under this Agreement, except such as have been obtained or waived or as may be required by the securities or Blue Sky laws of the various states or foreign jurisdictions or the rules and regulations of the Financial Industry Regulatory Authority in connection with the offer and sale of the Shares.

(l) There has not occurred any material adverse effect on the Company and its subsidiaries, taken as a whole, or any development involving a prospective material adverse effect on the Company and its subsidiaries, taken as a whole, in the condition, financial or otherwise, or in the earnings, business or operations of the Company and its subsidiaries, taken as a whole, from that set forth in the Time of Sale Prospectus.

(m) Neither the Company nor any of its subsidiaries is (i) in violation of its respective certificate of incorporation or bylaws; (ii) in default, and no event has occurred that, with notice or lapse of time or both, would constitute such a default, in the due performance or observance of any term, covenant or condition contained in any indenture, mortgage, deed of trust, loan agreement or other agreement or instrument to which the Company or any of its subsidiaries is a party or by which the Company or any of its subsidiaries is bound or to which any of the property or assets of the Company or any of its subsidiaries is subject; or (iii) in violation of any law or statute or any judgment, order, rule or regulation of any court or arbitrator or governmental or regulatory authority applicable to the Company, any of its subsidiaries or their respective businesses and properties, except, in the case of clauses (ii) and (iii) above, for any such default or violation that would not, individually or in the aggregate, have a material adverse effect on the Company and its subsidiaries, taken as a whole.

(n) There are no legal or governmental proceedings pending or threatened to which the Company or any of its subsidiaries is a party or to which any of the properties of the Company or any of its subsidiaries is subject (i) other than proceedings accurately described in all material respects in the Time of Sale Prospectus and the Prospectus and proceedings that would not have a material adverse effect on the Company and its subsidiaries, taken as a whole, or a material adverse effect on the power or ability of the Company to perform its obligations under this Agreement or to consummate the transactions contemplated by the Time of Sale Prospectus and the Prospectus or (ii) that are required to be described in the Registration Statement or the Prospectus and are not so described

in all material respects; and there are no statutes, regulations, contracts or other documents that are required to be described in the Registration Statement or the Prospectus or to be filed as exhibits to the Registration Statement that are not described in all material respects or filed as required.

(o) Each preliminary prospectus filed as part of the Registration Statement as originally filed or as part of any amendment thereto, or filed pursuant to Rule 424 under the Securities Act, complied when so filed in all material respects with the Securities Act and the applicable rules and regulations of the Commission thereunder.

(p) The Company is not, and after giving effect to the offering and sale of the Shares and the application of the proceeds thereof as described in the Prospectus will not be, required to register as an “investment company” as such term is defined in the Investment Company Act of 1940, as amended.

(q) The Company and its subsidiaries (i) are in compliance with any and all applicable foreign, federal, state and local laws and regulations relating to the protection of human health and safety, the environment or hazardous or toxic substances or wastes, pollutants or contaminants (“**Environmental Laws**”), (ii) have received all permits, licenses or other approvals required of them under applicable Environmental Laws to conduct their respective businesses and (iii) are in compliance with all terms and conditions of any such permit, license or approval, except where such noncompliance with Environmental Laws, failure to receive required permits, licenses or other approvals or failure to comply with the terms and conditions of such permits, licenses or approvals would not, singly or in the aggregate, have a material adverse effect on the Company and its subsidiaries, taken as a whole.

(r) There are no costs or liabilities associated with Environmental Laws (including, without limitation, any capital or operating expenditures required for clean-up, closure of properties or compliance with Environmental Laws or any permit, license or approval, any related constraints on operating activities and any potential liabilities to third parties) which would, singly or in the aggregate, have a material adverse effect on the Company and its subsidiaries, taken as a whole.

(s) Except as otherwise have been validly waived or complied with in connection with the issuance and sale of the Shares contemplated hereby and as described in each of the Registration Statement, the Time of Sale Prospectus and the Prospectus, there are no contracts, agreements or understandings between the Company and any person granting such person the right to require the Company to file a registration statement under the Securities Act with respect to any securities of the Company or to require the Company to include such securities with the Shares registered pursuant to the Registration Statement.



(t) (i) None of the Company or its subsidiaries or affiliates, or any director, officer, or employee thereof, or, to the Company's knowledge, any agent or representative of the Company or of any of its subsidiaries or affiliates, has taken or will take any action in furtherance of an offer, payment, promise to pay, or authorization or approval of the payment, giving or receipt of money, property, gifts, benefits, or anything else of value, directly or indirectly, to any government official (including any officer or employee of a government or government-owned or controlled entity or of a public international organization, or any person acting in an official capacity for or on behalf of any of the foregoing, or any political party or party official or candidate for political office) ("**Government Official**") in order to influence official action, or to any person in violation of any applicable anti-corruption laws; (ii) the Company and its subsidiaries and affiliates have conducted their businesses in compliance with applicable anti-corruption laws and have instituted and maintained and will continue to maintain policies and procedures reasonably designed to promote and achieve compliance with such laws and with the representations and warranties contained herein; and (iii) neither the Company nor its subsidiaries will use, directly or indirectly, the proceeds of the offering in furtherance of an offer, payment, promise to pay, or authorization of the payment or giving of money, or anything else of value, to any person in violation of any applicable anti-corruption laws.

(u) The operations of the Company and its subsidiaries are and have been conducted at all times in material compliance with all applicable financial recordkeeping and reporting requirements, including those of the Bank Secrecy Act, as amended by Title III of the Uniting and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism Act of 2001 (USA PATRIOT Act), and the applicable anti-money laundering statutes of jurisdictions where the Company and its subsidiaries conduct business, the rules and regulations thereunder and any related or similar rules, regulations or guidelines, issued, administered or enforced by any governmental or regulatory agency having jurisdiction over the Company or any of its subsidiaries (collectively, the "**Anti-Money Laundering Laws**"), and no action, suit or proceeding by or before any court or governmental or regulatory agency, authority or body or any arbitrator involving the Company or any of its subsidiaries with respect to the Anti-Money Laundering Laws is pending or, to the knowledge of the Company, threatened.

(v) (i) None of the Company, any of its subsidiaries, or any director or officer thereof, or, to the Company's knowledge, any employee, any agent, affiliate or representative of the Company or any of its subsidiaries, is an individual or entity ("**Person**") that is, or is owned or controlled by one or more Persons that are:

(A) the subject of any sanctions administered or enforced by the U.S. Department of Treasury's Office of Foreign Assets Control, the United Nations Security Council, the European Union, Her Majesty's Treasury, or other relevant sanctions authority (collectively, "**Sanctions**"), or

(B) located, organized or resident in a country or territory that is the subject of Sanctions (including, without limitation, Crimea, Cuba, Iran, North Korea and Syria).

(ii) The Company will not, directly or indirectly, use the proceeds of the offering, or lend, contribute or otherwise make available such proceeds to any subsidiary, joint venture partner or other Person:

(A) to fund or facilitate any activities or business of or with any Person or in any country or territory that, at the time of such funding or facilitation, is the subject of Sanctions; or

(B) in any other manner that will result in a violation of Sanctions by any Person (including any Person participating in the offering, whether as underwriter, advisor, investor or otherwise).

(iii) For the past five years, the Company and its subsidiaries have not knowingly engaged in, are not now knowingly engaged in, and will not knowingly engage in, any dealings or transactions with any Person, or in any country or territory, that at the time of the dealing or transaction is or was the subject of Sanctions.

(w) Subsequent to the respective dates as of which information is given in each of the Registration Statement, the Time of Sale Prospectus and the Prospectus, (i) the Company and its subsidiaries have not incurred any material liability or obligation, direct or contingent, nor entered into any material transaction; (ii) the Company has not purchased any of its outstanding capital stock, other than from its employees or other service-providers in connection with the termination of their service pursuant to the terms of the equity compensation plans or agreements, as described in each of the Registration Statement, the Time of Sales Prospectus and the Prospectus, nor declared, paid or otherwise made any dividend or distribution of any kind on its capital stock other than ordinary and customary dividends; and (iii) there has not been any material change in the capital stock (other than the exercise or settlement or equity awards or grants or forfeiture of equity awards outstanding as of such respective dates as of which information is given in each of the Registration Statement, the Time of Sale Prospectus and the Prospectus, in each case granted pursuant to the equity compensation plans described in each of the Registration Statement, the Time of Sale Prospectus and the Prospectus), short-term debt or long-term debt of the Company and its subsidiaries, except in each case as described in each of the Registration Statement, the Time of Sale Prospectus and the Prospectus, respectively.

(x) The Company and its subsidiaries have good and marketable title in fee simple to all real property owned by them and good and marketable title to all personal property (other than intellectual property, which is addressed exclusively in Section 1(y)) owned by the Company and its subsidiaries, in each case free and clear of all liens, encumbrances and defects except such as are described in the Time of Sale Prospectus and the Prospectus or such as do not materially affect the value of such property and do not materially interfere with the use made and proposed to be made of such property by the Company and its subsidiaries, taken as a whole; and any real property and buildings held under lease by the Company and its subsidiaries are held by them under valid, subsisting and enforceable leases with such exceptions as are not material and do not materially interfere with the use made and proposed to be made of such property and buildings by the Company and its subsidiaries, in each case except as described in the Time of Sale Prospectus and the Prospectus.

(y) Except as disclosed in the Registration Statement, the Time of Sale Prospectus, and the Prospectus and except as would not have a material adverse effect on the Company and its subsidiaries, taken as a whole, (i) the Company and its subsidiaries own or possess the right to use all patents, patent applications, inventions, trademarks, trade names, service marks, logos, trade dress, designs, data, database rights, Internet domain names, rights of privacy, rights of publicity, copyrights, works of authorship, trade secrets, know-how and proprietary information (including unpatented and unpatentable proprietary or confidential information, inventions, systems or procedures) and other industrial property and intellectual property rights (collectively, “**Intellectual Property**”) described in the Registration Statement, the Time of Sale Prospectus, and the Prospectus as being owned or licensed by them, as well as applicable related rights, such as moral rights and the right to sue for all past, present and future infringements or misappropriation or dilution of any of the foregoing, and registrations and applications for registration of any of the foregoing, necessary for the conduct of their business as presently conducted and as presently proposed to be conducted in the future as disclosed in the Registration Statement, the Time of Sale Prospectus, and the Prospectus (the “**Company Intellectual Property**”), and the Company Intellectual Property has not been adjudged by a court of competent jurisdiction to be invalid or unenforceable, in whole or in part; (ii) to the Company’s knowledge, the conduct of the Company’s and its respective subsidiaries’ businesses as described in the Registration Statement, the Time of Sale Prospectus, and the Prospectus does not infringe, misappropriate or otherwise violate any valid and enforceable Intellectual Property of any other person; (iii) to the Company’s knowledge, there are no third parties who have rights or will be able to establish rights to any Company Intellectual Property, except for (A) customary reversionary rights of third-party licensors with respect to Intellectual Property that are disclosed in the Registration Statement, the Time of Sale Prospectus, and the Prospectus as licensed to the Company or its subsidiaries and (B) third parties who have been granted licenses by the Company; (iv) to the Company’s knowledge, there is no infringement by third parties of any Company Intellectual Property; (v) there is no pending or, to the

Company's knowledge, threatened in writing, action, suit, proceeding or claim by others: (A) challenging the Company's rights or any of its subsidiaries' rights in or to any Company Intellectual Property; (B) challenging the validity, enforceability or scope of any Company Intellectual Property, or (C) asserting that the Company or any of its subsidiaries infringes, misappropriates, or otherwise violates, or would, upon the commercialization of any product or service described in the Registration Statement, the Time of Sale Prospectus or the Prospectus as under development, infringe, misappropriate, or violate, any patent, trademark, trade name, service name, copyright, trade secret or other proprietary right of others; (vi) to the Company's knowledge, the Company and its subsidiaries have complied with the terms of each agreement to which they are a party and that is described in the Registration Statement, the Time of Sale Prospectus or the Prospectus pursuant to which Intellectual Property has been licensed to the Company, and all such agreements are in full force and effect; (vii) the Company and its subsidiaries have taken all commercially reasonable steps necessary to secure their interests in the Company Intellectual Property from their employees and contractors and to protect the confidentiality of all of their confidential information and trade secrets, including the execution of appropriate nondisclosure, confidentiality and invention assignment agreements with their employees; (viii) to the Company's knowledge, no employee of the Company is in or has been in violation of any term of any written employment contract, patent disclosure agreement, invention assignment agreement, non-competition agreement, non-solicitation agreement, nondisclosure agreement, or restrictive covenant agreement with a former employer where the basis of such violation relates to (A) such employee's employment with the Company and (B) the ownership by the Company or its subsidiaries of any Company Intellectual Property; (ix) none of the Company Intellectual Property (including information technology) has been obtained by the Company or its subsidiaries in violation of any contractual obligation binding on the Company or its subsidiaries or any of their respective officers, directors or employees; (x) the product candidates described in the Registration Statement, the Time of Sale Prospectus and the Prospectus as under development by the Company fall within the scope of the claims of one or more patents or patent applications owned by, or exclusively licensed to, the Company; and (xi) to the Company's knowledge, all employees of the Company who have a duty of candor and good faith to the United States Patent and Trademark Office during the prosecution of the Company's U.S. patents and patent applications have complied with that duty.

(z) Except as would not, individually or in the aggregate, reasonably be expected to result in a material adverse effect on the Company and its subsidiaries, taken as a whole, (A) each Plan (as defined below) has been maintained in compliance with its terms and the requirements of any applicable statutes, orders, rules and regulations, including but not limited to the Employee Retirement Income Security Act of 1974, as amended ("ERISA") and the Internal Revenue Code of 1986, as amended (the "Code"); (B) no non-exempt prohibited transaction, within the meaning of Section 406 of ERISA or Section 4975 of the Code, has occurred with respect to any Plan; (C) for each Plan, no failure to satisfy the minimum funding standards (within the meaning of Section 412 of the Code or Section 302 of ERISA), whether or not waived, has occurred or is reasonably expected to occur; (D) no "reportable event" (within the meaning of Section 4043(c) of ERISA, other than those events as to which notice is waived) has occurred or is reasonably expected to occur; and (E) neither the Company nor any member of its "Controlled Group" (defined as any organization which is a member of a controlled group of corporations within the meaning of Section 414

of the Code) has incurred, nor is reasonably expected to incur, any liability under Title IV of ERISA (other than contributions to any Plan or any Multiemployer Plan or premiums to the PBGC, in the ordinary course and without default) in respect of a Plan or a Multiemployer Plan. For purposes of this paragraph, (x) the term “Plan” means an employee benefit plan, within the meaning of Section 3(3) of ERISA, subject to Title IV of ERISA, but excluding any Multiemployer Plan, for which the Company or any member of its “Controlled Group” has any liability and (y) the term “Multiemployer Plan” means a multiemployer plan within the meaning of Section 4001(a)(3) of ERISA.

(aa) No material labor dispute with the employees of the Company or any of its subsidiaries exists, except as described in the Time of Sale Prospectus and the Prospectus, or, to the knowledge of the Company, is imminent; and the Company is not aware of any existing, threatened or imminent labor disturbance by the employees of any of its principal suppliers, manufacturers or contractors that could have a material adverse effect on the Company and its subsidiaries, taken as a whole.

(bb) The Company and each of its subsidiaries are insured by insurers of recognized financial responsibility against such losses and risks and in such amounts as the Company reasonably believes are prudent and customary in the businesses in which they are engaged, taken as a whole; neither the Company nor any of its subsidiaries has been refused any insurance coverage sought or applied for; and neither the Company nor any of its subsidiaries has any reason to believe that it will not be able to renew its existing insurance coverage as and when such coverage expires or to obtain similar coverage from similar insurers as may be necessary to continue its business at a cost that would not have a material adverse effect on the Company and its subsidiaries, taken as a whole, except as described in the Time of Sale Prospectus and the Prospectus.

(cc) The Company and its subsidiaries, taken as a whole possess all certificates, authorizations and permits issued by the appropriate federal, state or foreign regulatory authorities necessary to conduct their respective businesses, except where the failure to obtain such certificates, authorizations and permits would not, individually or in the aggregate, have a material adverse effect on the Company and its subsidiaries, taken as a whole, and neither the Company nor any of its subsidiaries has received any notice of proceedings relating to the revocation or modification of any such certificate, authorization or permit which, singly or in the aggregate, if the subject of an unfavorable decision, ruling or finding, would have a material adverse effect on the Company and its subsidiaries, taken as a whole, except as described in the Time of Sale Prospectus and the Prospectus.

(dd) The Company and each of its subsidiaries maintain a system of internal accounting controls sufficient to provide reasonable assurance that (i) transactions are executed in accordance with management’s general or specific authorizations; (ii) transactions are recorded as necessary to permit preparation of

financial statements in conformity with U.S. generally accepted accounting principles (“U.S. GAAP”) and to maintain asset accountability; (iii) access to assets is permitted only in accordance with management’s general or specific authorization; and (iv) the recorded accountability for assets is compared with the existing assets at reasonable intervals and appropriate action is taken with respect to any differences. Except as described in the Time of Sale Prospectus and the Prospectus, since the end of the Company’s most recent audited fiscal year, there has been (i) no material weakness in the Company’s internal control over financial reporting, as defined in Rule 13(a)-15(f) under the Securities Exchange Act of 1934, as amended (the “Exchange Act”) (whether or not remediated) and (ii) no change in the Company’s internal control over financial reporting that has materially and adversely affected, or is reasonably likely to materially and adversely affect, the Company’s internal control over financial reporting.

(ee) The financial statements of the Company filed with the Commission as a part of the Registration Statement and included in the Time of Sale Prospectus and the Prospectus comply as to form in all material respects with the applicable accounting requirements of the Securities Act and present fairly the financial position of the Company as of the dates indicated and the results of its operations and cash flows for the periods specified. Such financial statements have been prepared in conformity with U.S. GAAP applied on a consistent basis throughout the periods involved. The other financial information included in the Registration Statement, the Time of Sale Prospectus and the Prospectus has been derived from the accounting records of the Company and its subsidiaries and presents fairly in all material respects the information shown thereby.

(ff) Ernst & Young LLP, which has expressed its opinion with respect to certain of the financial statements of the Company and its subsidiaries filed with the Commission as part of the Registration Statement and included in each of the Time of Sale Prospectus and the Prospectus, is an independent registered public accounting firm with respect to the Company and its subsidiaries within the applicable rules and regulations adopted by the Commission and the Public Company Accounting Oversight Board (United States) and as required by the Securities Act.

(gg) The statistical, industry and market related data included in the Registration Statement, the Time of Sale Prospectus and the Prospectus are based on or derived from sources that the Company believes, after reasonable inquiry, to be reliable and accurate. To the Company’s knowledge, after reasonable investigation, it does not require the consent of any third party for the use of any such data.

(hh) To the extent required under applicable rules, the Company maintains disclosure controls and procedures that comply with the requirements of the Exchange Act; such disclosure controls and procedures have been designed to ensure that material information relating to the Company and its subsidiaries is made known to the Company’s principal executive officer and principal financial officer by others within those entities.

(ii) Except as described in the Time of Sale Prospectus and the Prospectus, the Company has not sold, issued or distributed any shares of Common Stock during the six-month period preceding the date hereof, including any sales pursuant to Rule 144A under, or Regulation D or S of, the Securities Act, other than shares issued pursuant to employee benefit plans, qualified stock option plans or other employee compensation plans or pursuant to outstanding options, rights or warrants.

(jj) The Company and each of its subsidiaries have filed all federal, state, local and foreign tax returns required to be filed through the date of this Agreement or have requested extensions thereof (except where the failure to file would not, individually or in the aggregate, have a material adverse effect on the Company and its subsidiaries, taken as a whole) and have paid all taxes required to be paid thereon (except for cases in which the failure to file or pay would not have a material adverse effect on the Company and its subsidiaries, taken as a whole, or, except as are currently being contested in good faith and for which reserves required by U.S. GAAP have been created in the financial statements of the Company), and no tax deficiency has been determined adversely to the Company or any of its subsidiaries which has had (nor does the Company nor any of its subsidiaries have any notice or knowledge of any tax deficiency which could reasonably be expected to be determined adversely to the Company or its subsidiaries and which could reasonably be expected to have) a material adverse effect on the Company and its subsidiaries, taken as a whole.

(kk) The Company has taken all necessary actions to ensure that, upon the effectiveness of the Registration Statement, it will be in compliance with all provisions of the Sarbanes-Oxley Act of 2002, as amended (the “**Sarbanes-Oxley Act**”), and all rules and regulations promulgated thereunder applicable to the Company at such time, and is taking steps designed to ensure that it will be in compliance, at all times, with the other provisions of the Sarbanes-Oxley Act when they become applicable to the Company after the effectiveness of the Registration Statement.

(ll) The Company has not taken, directly or indirectly, any action designed to or that would reasonably be expected to cause or result in any stabilization or manipulation of the price of the Shares.

(mm) From the time of initial confidential submission of the Registration Statement to the Commission (or, if earlier, the first date on which the Company engaged directly or through any person authorized to act on its behalf in any Testing-the-Waters Communication) through the date hereof, the Company has been and is an “emerging growth company,” as defined in Section 2(a) of the Securities Act (an “**Emerging Growth Company**”). “**Testing-the-Waters Communication**” means any oral or written communication with potential investors undertaken in reliance on Section 5(d) of the Securities Act.

(nn) The Company (i) has not alone engaged in any Testing-the-Waters Communication other than Testing-the-Waters Communications with the consent of the Representatives with entities that are qualified institutional buyers within the meaning of Rule 144A under the Securities Act or institutions that are accredited investors within the meaning of Rule 501 under the Securities Act and (ii) has not authorized anyone other than the Representatives to engage in Testing-the-Waters Communications. The Company reconfirms that the Representatives have been authorized to act on its behalf in undertaking Testing-the-Waters Communications. The Company has not distributed any Written Testing-the-Waters Communications other than those listed on Schedule III hereto. “**Written Testing-the-Waters Communication**” means any Testing-the-Waters Communication that is a written communication within the meaning of Rule 405 under the Securities Act.

(oo) As of the time of each sale of the Shares in connection with the offering when the Prospectus is not yet available to prospective purchasers, none of (A) the Time of Sale Prospectus, (B) any free writing prospectus, when considered together with the Time of Sale Prospectus, and (C) any individual Written Testing-the-Waters Communication, when considered together with the Time of Sale Prospectus, included, includes or will include an untrue statement of a material fact or omitted, omits or will omit to state a material fact necessary in order to make the statements therein, in the light of the circumstances under which they were made, not misleading.

(pp) The preclinical tests and clinical trials, and other studies (collectively, “**Studies**”) that are described in, or the results of which are referred to in, the Registration Statement, the Time of Sale Prospectus or the Prospectus were and, if still pending, are being conducted in all material respects in accordance with the protocols, procedures and controls designed and approved for such Studies and with standard medical and scientific research procedures; each description of the results of such Studies is accurate and complete in all material respects and fairly presents the data derived from such Studies, and the Company has no knowledge of any other Studies the results of which are inconsistent with, or otherwise call into question, the results described or referred to in the Registration Statement, the Time of Sale Prospectus or the Prospectus; the Company has made all such filings and obtained all such approvals or authorizations as may be required by the Food and Drug Administration of the U.S. Department of Health and Human Services or from any other U.S. or foreign government or drug or medical device regulatory agency, or health care facility Institutional Review Board (collectively, the “**Regulatory Agencies**”), except where the failure to make such filing or obtain such approval would not reasonably be expected to, individually or in the aggregate, result in a material adverse effect on the Company and its subsidiaries, taken as a whole; except as described in the Registration Statement, the Time of Sale Prospectus and the



Prospectus, the Company has not received any notice of, or correspondence from, any Regulatory Agency requiring the termination, suspension or material modification of any clinical trials that are described or referred to in the Registration Statement, the Time of Sale Prospectus, nor is the Company aware of any reasonable grounds for such notice or correspondence; and the Company has operated and currently is in compliance in all material respects with all applicable laws, rules, regulations and policies of the Regulatory Agencies.

(qq) The Company and its subsidiaries are, and at all times have been, in compliance with all applicable statutes, rules and regulations applicable to the Health Care Laws, as defined below, except where failure to be in compliance would not be reasonably expected to have a material adverse effect on the Company and its subsidiaries, taken as a whole. For purposes of this Agreement, “Health Care Laws” means: (i) the Federal Food, Drug, and Cosmetic Act (21 U.S.C. §§ 301 et seq.) and the regulations promulgated thereunder; (ii) all applicable federal, state, local and all applicable foreign health care related fraud and abuse laws, including, without limitation, the U.S. Anti-Kickback Statute (42 U.S.C. § 1320a-7b(b)), the U.S. False Statements Law (42 U.S.C. § 1320a-7b(a)), the Civil Monetary Penalties Law (42 U.S.C. §1320a-7a), the U.S. Civil False Claims Act (31 U.S.C. § 3729 et seq.), all criminal laws relating to health care fraud and abuse, including but not limited to 18 U.S.C. §§ 286 and 287, and the health care fraud criminal provisions under the U.S. Health Insurance Portability and Accountability Act of 1996 (“**HIPAA**”) (42 U.S.C. §§1320d et seq.), the Physician Payments Sunshine Act (42 U.S.C. § 1320a-7h), the exclusion law (42 U.S.C. § 1320a-7), the statutes, regulations and directives of applicable government funded or sponsored healthcare programs, and the regulations promulgated pursuant to such statutes, including but not limited to the coverage and payment provisions of Medicare (Title XVIII of the Social Security Act) and, Medicaid (Title XIX of the Social Security Act); (iii) the Standards for Privacy of Individually Identifiable Health Information (the “**Privacy Rule**”), the Security Standards, and the Standards for Electronic Transactions and Code Sets promulgated under HIPAA, the Health Information Technology for Economic and Clinical Health Act (“**HITECH Act**”) (42 U.S.C. §§ 17921 et seq.), and the regulations promulgated thereunder and any state or non-U.S. counterpart thereof or other law or regulation the purpose of which is to protect the privacy of individuals or prescribers; and (iv) any and all other applicable health care laws and regulations applicable to the ownership, testing, development, manufacture, packaging, processing, use, distribution, marketing, advertising, labeling, promotion, sale, offer for sale, storage, import, export or disposal of any product manufactured or distributed by the Company. Neither the Company nor its subsidiaries has received written notice of any claim, action, suit, proceeding, hearing, enforcement, investigation, arbitration or other action from any court or arbitrator or governmental or regulatory authority or third party alleging that any product operation or activity is in material violation of any Health Care Laws, and, to the Company’s knowledge, no such claim, action, suit, proceeding, hearing, enforcement, investigation, arbitration or other action is threatened. Neither the Company, its subsidiaries, nor any of their officers, directors,

employees, contractors and agents, is a party to any corporate integrity agreements, monitoring agreements, consent decrees, settlement orders, or similar agreements with or imposed by any governmental or regulatory authority. Additionally, neither the Company including any of its employees, contractors, agents, officers or directors, nor its subsidiaries including any of the subsidiary's employees, contractors, agents, officers or directors has been excluded, suspended or debarred from participation in any U.S. federal health care program or human clinical research or, to the knowledge of the Company, is subject to a governmental inquiry, investigation, proceeding, or other similar action that could reasonably be expected to result in debarment, suspension, or exclusion. The Company and its subsidiaries have filed, obtained, maintained or submitted all material reports, documents, forms, notices, applications, records, claims, submissions and supplements or amendments as required by the Health Care Laws, and all such reports, documents, forms, notices, applications, records, claims, submissions and supplements or amendments were timely, complete, accurate and not misleading on the date filed in all material respects (or were corrected or supplemented by a subsequent submission).

(rr) Except as disclosed in the Registration Statement, the Time of Sale Prospectus, and the Prospectus and except as would not have a material adverse effect on the Company and its subsidiaries, taken as a whole, (i) the Company and each of its subsidiaries is, and at all prior times was, in compliance with all applicable data privacy and security laws and regulations, including the European Union General Data Protection Regulation) (EU 2016/679), for which any non-compliance with same would be reasonably likely to create a material liability (collectively, the "**Privacy Laws**"); (ii) to ensure compliance with the Privacy Laws, the Company and its subsidiaries have in place, comply with, and take appropriate steps reasonably designed to ensure compliance with their policies and procedures relating to data privacy and security and the collection, storage, use, disclosure, handling, and analysis of personal data that is subject to the Privacy Laws (the "**Policies**"); (iii) at all times since inception, the Company has provided accurate notice of its Policies then in effect to its customers, employees, third party vendors and representatives; (iv) each of the Policies provides accurate and all required notice of the Company's then-current privacy practices relating to its subject matter and such Policies do not contain any omissions of the Company's then-current privacy practices; (v) the Company and its subsidiaries since inception have at all times made all disclosures to users or customers required by the Privacy Laws, and none of such disclosures made or contained in any of the Policies have been inaccurate, misleading, or deceptive in violation of any Privacy Laws or Policies; (vi) the execution, delivery and performance of this Agreement or any other agreement referred to in this Agreement will not result in a breach or violation of any Privacy Laws or Policies; and (vii) neither the Company nor any of its subsidiaries (A) has received written notice from any governmental authority of any actual or potential liability under or relating to, or actual or potential violation of, any of the Privacy Laws, and has no knowledge of any event or condition that would reasonably be expected to result in any such notice, (B) is currently conducting or paying for, in whole or in part, any investigation, remediation, or other corrective action pursuant to any Privacy Law, or (C) is a party to any order, decree, or agreement that imposes any obligation or liability under any Privacy Law.

(ss) Except as disclosed in the Registration Statement, the Time of Sale Prospectus, and the Prospectus and except as would not have a material adverse effect on the Company and its subsidiaries, taken as a whole, (i) the Company and its subsidiaries' information technology assets and equipment, computers, technology systems and other systems, networks, hardware, software, websites, applications, and databases (collectively, "**IT Systems**") are adequate for, and operate and perform as required in connection with the operation of the business of the Company and its subsidiaries as currently conducted; (ii) the Company and its subsidiaries have at all times implemented and maintained commercially reasonable controls, policies, procedures, and safeguards necessary to maintain and protect its confidential information and the integrity, continuous operation and security of all IT Systems (including all personal data and sensitive, confidential or regulated data (the "**Confidential Data**")) used in connection with the operation of the Company or its subsidiaries; (iii) the Company and its subsidiaries have established commercially reasonable disaster recovery and security plans, procedures and facilities consistent with industry standards and practice; and (iv) to the Company's knowledge, there have been no security breaches, violations, outages or unauthorized uses of or access to the IT Systems or the Confidential Data.

(tt) The Registration Statement, the Prospectus, the Time of Sale Prospectus and any preliminary prospectus comply, and any amendments or supplements thereto will comply, with any applicable laws or regulations of foreign jurisdictions in which the Prospectus, the Time of Sale Prospectus or any preliminary prospectus, as amended or supplemented, if applicable, are distributed in connection with the Directed Share Program.

(uu) No consent, approval, authorization or order of, or qualification with, any governmental body or agency, other than those obtained, is required in connection with the offering of the Directed Shares in any jurisdiction where the Directed Shares are being offered.

(vv) The Company has not offered, or caused Morgan Stanley or any Morgan Stanley Entity as defined in Section 9 to offer, Shares to any person pursuant to the Directed Share Program with the specific intent to unlawfully influence (i) a customer or supplier of the Company to alter the customer's or supplier's level or type of business with the Company, or (ii) a trade journalist or publication to write or publish favorable information about the Company or its products.

2. *Agreements to Sell and Purchase.* The Company hereby agrees to sell to the several Underwriters, and each Underwriter, upon the basis of the representations and warranties herein contained, but subject to the conditions hereinafter stated, agrees, severally and not jointly, to purchase from the Company the respective numbers of Firm Shares set forth in Schedule I hereto opposite its name at \$[•] a share (the "**Purchase Price**").

On the basis of the representations and warranties contained in this Agreement, and subject to its terms and conditions, the Company agrees to sell to the Underwriters the Additional Shares, and the Underwriters shall have the right to purchase, severally and not jointly, up to [•] Additional Shares at the Purchase Price, provided, however, that the amount paid by the Underwriters for any Additional Shares shall be reduced by an amount per share equal to any dividends or distribution declared by the Company and payable on the Firm Shares but not payable on such Additional Shares. The Representatives may exercise this right on behalf of the Underwriters in whole or from time to time in part by giving written notice not later than 30 days after the date of this Agreement. Any exercise notice shall specify the number of Additional Shares to be purchased by the Underwriters and the date on which such Additional Shares are to be purchased. Each purchase date must be at least one business day after the written notice is given and may not be earlier than the closing date for the Firm Shares nor later than ten business days after the date of such notice. Additional Shares may be purchased as provided in Section 4 hereof solely for the purpose of covering over-allotments made in connection with the offering of the Firm Shares. On each day, if any, that Additional Shares are to be purchased (an “**Option Closing Date**”), each Underwriter agrees, severally and not jointly, to purchase the number of Additional Shares (subject to such adjustments to eliminate fractional shares as the Representatives may determine) that bears the same proportion to the total number of Additional Shares to be purchased on such Option Closing Date as the number of Firm Shares set forth in Schedule I hereto opposite the name of such Underwriter bears to the total number of Firm Shares.

3. *Terms of Public Offering.* The Company is advised by the Representatives that the Underwriters propose to make a public offering of their respective portions of the Shares as soon after the Registration Statement and this Agreement have become effective as in the judgment of the Representatives is advisable. The Company is further advised by the Representatives that the Shares are to be offered to the public initially at \$[•] a share (the “**Public Offering Price**”) and to certain dealers selected by the Representatives at a price that represents a concession not in excess of \$[•] a share under the Public Offering Price.

4. *Payment and Delivery.* Payment for the Firm Shares shall be made to the Company in Federal or other funds immediately available in New York City against delivery of such Firm Shares for the respective accounts of the several Underwriters at 10:00 a.m., New York City time, on [•], 2019, or at such other time on the same or such other date, not later than [•], 2019, as shall be designated in writing by the Representatives. The time and date of such payment are hereinafter referred to as the “**Closing Date.**”

Payment for any Additional Shares shall be made to the Company in Federal or other funds immediately available in New York City against delivery of such Additional Shares for the respective accounts of the several Underwriters at 10:00 a.m., New York City time, on the date specified in the corresponding notice described in Section 2 or at such other time on the same or on such other date, in any event not later than [•], 2019, as shall be designated in writing by the Representatives.

The Firm Shares and Additional Shares shall be registered in such names and in such denominations as Morgan Stanley & Co. LLC shall request in writing not later than one full business day prior to the Closing Date or the applicable Option Closing Date, as the case may be. The Firm Shares and Additional Shares shall be delivered to Morgan Stanley & Co. LLC on the Closing Date or an Option Closing Date, as the case may be, for the respective accounts of the several Underwriters, with any transfer taxes payable in connection with the transfer of the Shares to the Underwriters duly paid, against payment of the Purchase Price therefor.

5. *Conditions to the Underwriters' Obligations.* The obligations of the Company to sell the Shares to the Underwriters and the several obligations of the Underwriters to purchase and pay for the Shares on the Closing Date are subject to the condition that the Registration Statement shall have become effective not later than [5:00 p.m.] (New York City time) on the date hereof.

The several obligations of the Underwriters are subject to the following further conditions:

(a) Subsequent to the execution and delivery of this Agreement and prior to the Closing Date:

(i) there shall not have occurred any downgrading, nor shall any notice have been given of any intended or potential downgrading or of any review for a possible change that does not indicate the direction of the possible change, in the rating accorded any of the securities of the Company or any of its subsidiaries by any "nationally recognized statistical rating organization," as such term is defined in Section 3(a) (62) of the Exchange Act; and

(ii) there shall not have occurred any change, or any development involving a prospective change, in the condition, financial or otherwise, or in the earnings, business or operations of the Company and its subsidiaries, taken as a whole, from that set forth in the Time of Sale Prospectus and the Prospectus that, in the judgment of the Representatives, is material and adverse and that makes it, in the judgment of the Representatives, impracticable to market the Shares on the terms and in the manner contemplated in the Time of Sale Prospectus and the Prospectus.

(b) The Underwriters shall have received on the Closing Date a certificate, dated the Closing Date and signed by an executive officer of the Company, to the effect set forth in Section 5(a)(i) above and to the effect that the representations and warranties of the Company contained in this Agreement are

true and correct as of the Closing Date and that the Company has complied with all of the agreements and satisfied all of the conditions on its part to be performed or satisfied hereunder on or before the Closing Date. The officer signing and delivering such certificate may rely upon the best of his or her knowledge as to proceedings threatened.

(c) The Underwriters shall have received on the Closing Date an opinion and negative assurance letter of Davis Polk & Wardwell LLP, outside counsel for the Company, dated the Closing Date, in form and substance reasonably satisfactory to the Representatives.

(d) The Underwriters shall have received on the Closing Date an opinion and negative assurance letter of Cooley LLP, counsel for the Underwriters, dated the Closing Date, in form and substance satisfactory to the Underwriters.

With respect to Sections 5(c) and (d) above, Davis Polk & Wardwell LLP and Cooley LLP may state that their opinions and beliefs are based upon their participation in the preparation of the Registration Statement, the Time of Sale Prospectus and the Prospectus and any amendments or supplements thereto and review and discussion of the contents thereof, but are without independent check or verification, except as specified.

The opinion and negative assurance letter of Davis Polk & Wardwell LLP described in Section 5(c) above shall be rendered to the Underwriters at the request of the Company and shall so state therein.

(e) The Underwriters shall have received on the Closing Date an opinion of Morrison & Foerster LLP, intellectual property counsel for the Underwriters, dated the Closing Date, in form and substance satisfactory to the Underwriters.

(f) The Underwriters shall have received, on each of the date hereof and the Closing Date, a letter dated the date hereof or the Closing Date, as the case may be, in form and substance satisfactory to the Underwriters, from Ernst & Young LLP, independent public accountants, containing statements and information of the type ordinarily included in accountants' "comfort letters" to underwriters with respect to the financial statements and certain financial information contained in the Registration Statement, the Time of Sale Prospectus and the Prospectus; *provided* that the letter delivered on the Closing Date shall use a "cut-off date" not earlier than the date hereof.

(g) The "lock-up" agreements, each substantially in the form of Exhibit A hereto, executed by substantially all securityholders, officers and directors of the Company relating to sales and certain other dispositions of shares of Common Stock or certain other securities, delivered to the Representatives on or before the date hereof, shall be in full force and effect on the Closing Date.

(h) The Underwriters shall have received on the Closing Date an opinion of Hogan Lovells US LLP, regulatory counsel for the Underwriters, dated the Closing Date, in form and substance satisfactory to the Underwriters.

(i) The chief financial officer of the Company shall have delivered to the Underwriters, on each of the date hereof and on the Closing Date, a certificate in a form reasonably acceptable to the Representatives.

(j) The several obligations of the Underwriters to purchase Additional Shares hereunder are subject to the delivery to the Representatives on the applicable Option Closing Date of the following:

(i) a certificate, dated the Option Closing Date and signed by an executive officer of the Company, confirming that the certificate delivered on the Closing Date pursuant to Section 5(b) hereof remains true and correct as of such Option Closing Date;

(ii) an opinion and negative assurance letter of Davis Polk & Wardwell LLP, outside counsel for the Company, dated the Option Closing Date, relating to the Additional Shares to be purchased on such Option Closing Date and otherwise to the same effect as the opinion required by Section 5(c) hereof;

(iii) an opinion and negative assurance letter of Cooley LLP, counsel for the Underwriters, dated the Option Closing Date, relating to the Additional Shares to be purchased on such Option Closing Date and otherwise to the same effect as the opinion required by Section 5(d) hereof;

(iv) a letter dated the Option Closing Date, in form and substance satisfactory to the Underwriters, from Ernst & Young LLP, independent public accountants, substantially in the same form and substance as the letter furnished to the Underwriters pursuant to Section 5(f) hereof; *provided* that the letter delivered on the Option Closing Date shall use a “cut-off date” not earlier than three business days prior to such Option Closing Date;

(v) an opinion of Hogan Lovells US LLP, regulatory counsel for the Underwriters, dated the Option Closing Date, relating to the Additional Shares to be purchased on such Option Closing Date and otherwise to the same effect as the opinion required by Section 5(h) hereof;

(vi) an opinion of Morrison & Foerster LLP, intellectual property counsel for the Underwriters, dated the Option Closing Date, relating to the Additional Shares to be purchased on such Option Closing Date and otherwise to the same effect as the opinion required by Section 5(e) hereof;

(vii) a certificate, dated the Option Closing Date and signed by the chief financial officer of the Company substantially in the same form and substance as the letter furnished to the Underwriters pursuant to Section 5(i) hereof; and

(viii) such other documents as the Representatives may reasonably request with respect to the good standing of the Company, the due authorization and issuance of the Additional Shares to be sold on such Option Closing Date and other matters related to the issuance of such Additional Shares.

6. *Covenants of the Company.* The Company covenants with each Underwriter as follows:

(a) To furnish to the Representatives, without charge, seven signed copies of the Registration Statement (including exhibits thereto) and for delivery to each other Underwriter a conformed copy of the Registration Statement (without exhibits thereto) and to furnish to the Representatives in New York City, without charge, prior to 10:00 a.m. New York City time on the business day next succeeding the date of this Agreement and during the period mentioned in Section 6(e) or 6(f) below, as many copies of the Time of Sale Prospectus, the Prospectus and any supplements and amendments thereto or to the Registration Statement as the Representatives may reasonably request.

(b) Before amending or supplementing the Registration Statement, the Time of Sale Prospectus or the Prospectus, to furnish to the Representatives a copy of each such proposed amendment or supplement and not to file any such proposed amendment or supplement to which the Representatives reasonably object, and to file with the Commission within the applicable period specified in Rule 424(b) under the Securities Act any prospectus required to be filed pursuant to such Rule.

(c) To furnish to the Representatives a copy of each proposed free writing prospectus to be prepared by or on behalf of, used by, or referred to by the Company and not to use or refer to any proposed free writing prospectus to which the Representatives reasonably object.

(d) Not to take any action that would result in an Underwriter or the Company being required to file with the Commission pursuant to Rule 433(d) under the Securities Act a free writing prospectus prepared by or on behalf of the Underwriter that the Underwriter otherwise would not have been required to file thereunder.

(e) If the Time of Sale Prospectus is being used to solicit offers to buy the Shares at a time when the Prospectus is not yet available to prospective purchasers and any event shall occur or condition exist as a result of which it is necessary to amend or supplement the Time of Sale Prospectus in order to make



the statements therein, in the light of the circumstances under which they were made, not misleading, or if any event shall occur or condition exist as a result of which the Time of Sale Prospectus conflicts with the information contained in the Registration Statement then on file, or if, in the opinion of counsel for the Underwriters, it is necessary to amend or supplement the Time of Sale Prospectus to comply with applicable law, forthwith to prepare, file with the Commission and furnish, at its own expense, to the Underwriters and to any dealer upon request, either amendments or supplements to the Time of Sale Prospectus so that the statements in the Time of Sale Prospectus as so amended or supplemented will not, in the light of the circumstances when the Time of Sale Prospectus is delivered to a prospective purchaser, be misleading or so that the Time of Sale Prospectus, as amended or supplemented, will no longer conflict with the Registration Statement, or so that the Time of Sale Prospectus, as amended or supplemented, will comply with applicable law.

(f) If, during such period after the first date of the public offering of the Shares as in the opinion of counsel for the Underwriters the Prospectus (or in lieu thereof the notice referred to in Rule 173(a) of the Securities Act) is required by law to be delivered in connection with sales by an Underwriter or dealer, any event shall occur or condition exist as a result of which it is necessary to amend or supplement the Prospectus in order to make the statements therein, in the light of the circumstances when the Prospectus (or in lieu thereof the notice referred to in Rule 173(a) of the Securities Act) is delivered to a purchaser, not misleading, or if, in the opinion of counsel for the Underwriters, it is necessary to amend or supplement the Prospectus to comply with applicable law, forthwith to prepare, file with the Commission and furnish, at its own expense, to the Underwriters and to the dealers (whose names and addresses the Representatives will furnish to the Company) to which Shares may have been sold by the Representatives on behalf of the Underwriters and to any other dealers upon request, either amendments or supplements to the Prospectus so that the statements in the Prospectus as so amended or supplemented will not, in the light of the circumstances when the Prospectus (or in lieu thereof the notice referred to in Rule 173(a) of the Securities Act) is delivered to a purchaser, be misleading or so that the Prospectus, as amended or supplemented, will comply with applicable law.

(g) To endeavor to qualify the Shares for offer and sale under the securities or Blue Sky laws of such jurisdictions as the Representatives shall reasonably request; *provided*, however, that nothing contained herein shall require the Company to qualify to do business in any jurisdiction, to execute or file a general consent to service of process in any jurisdiction or to subject itself to taxation in any jurisdiction in which it is not otherwise subject.

(h) To make generally available to the Company's security holders and to the Representatives as soon as practicable an earning statement covering a period of at least twelve months beginning with the first fiscal quarter of the Company occurring after the date of this Agreement which shall satisfy the provisions of Section 11(a) of the Securities Act and the rules and regulations of the Commission thereunder.

(i) Whether or not the transactions contemplated in this Agreement are consummated or this Agreement is terminated, to pay or cause to be paid all expenses incident to the performance of its obligations under this Agreement, including: (i) the fees, disbursements and expenses of the Company's counsel and the Company's accountants in connection with the registration and delivery of the Shares under the Securities Act and all other fees or expenses in connection with the preparation and filing of the Registration Statement, any preliminary prospectus, the Time of Sale Prospectus, the Prospectus, any free writing prospectus prepared by or on behalf of, used by, or referred to by the Company and amendments and supplements to any of the foregoing, including all printing costs associated therewith, and the mailing and delivering of copies thereof to the Underwriters and dealers, in the quantities hereinabove specified, (ii) all costs and expenses related to the transfer and delivery of the Shares to the Underwriters, including any transfer or other taxes payable thereon, (iii) the reasonable, documented cost of printing or producing any Blue Sky or Legal Investment memorandum in connection with the offer and sale of the Shares under state securities laws and all expenses in connection with the qualification of the Shares for offer and sale under state securities laws as provided in Section 6(g) hereof, including filing fees and the reasonable, documented fees and disbursements of counsel for the Underwriters in connection with such qualification and in connection with the Blue Sky or Legal Investment memorandum, (iv) all filing fees in respect of the reasonable fees and disbursements of counsel to the Underwriters incurred in connection with the review and qualification of the offering of the Shares by the Financial Industry Regulatory Authority (provided that the amount payable by the Company with respect to fees and disbursements of counsel for the Underwriters pursuant to subsections (iii) and (iv) shall not exceed \$40,000) (v) all fees and expenses in connection with the preparation and filing of the registration statement on Form 8-A relating to the Common Stock and all costs and expenses incident to listing the Shares on the Nasdaq Global Market, (vi) the cost of printing certificates representing the Shares, (vii) the costs and charges of any transfer agent, registrar or depository, (viii) the costs and expenses of the Company relating to investor presentations on any "road show" undertaken in connection with the marketing of the offering of the Shares, including, without limitation, expenses associated with the preparation or dissemination of any electronic road show, expenses associated with the production of road show slides and graphics, fees and expenses of any consultants engaged in connection with the road show presentations with the prior approval of the Company, travel and lodging expenses of the representatives and officers of the Company and any such consultants, and fifty percent (50%) of the cost of any aircraft chartered in connection with the road show to be used by both the Company and Underwriters (the remaining fifty percent (50%) of the cost of such aircraft to be paid by the Underwriters), (ix) the document production charges and expenses associated with printing this Agreement, (x) all fees and disbursements of counsel incurred by the Underwriters in connection with the Directed Share

Program and stamp duties, similar taxes or duties or other taxes, if any, incurred by the Underwriters in connection with the Directed Share Program and (xi) all other costs and expenses incident to the performance of the obligations of the Company hereunder for which provision is not otherwise made in this Section 7(i). It is understood, however, that except as provided in this Section, Section 8 entitled "Indemnity and Contribution," Section 9 entitled "Directed Share Program Indemnification" and the last paragraph of Section 11 below, the Underwriters will pay all of their costs and expenses, including fees and disbursements of their counsel, stock transfer taxes payable on resale of any of the Shares by them and any advertising expenses connected with any offers they may make and all travel and other expenses of the Underwriters or any of their employees incurred by them in connection with participation in investor presentations on any "road show" undertaken in connection with the marketing of the offering of the Shares, other than the cost of aircraft chartered in connection with the road show, for which the Underwriters agree to pay for the other fifty percent (50%) not paid for by the Company, as described above.

(j) The Company will promptly notify the Representatives if the Company ceases to be an Emerging Growth Company at any time prior to the later of (a) completion of the distribution of the Shares within the meaning of the Securities Act and (b) completion of the Restricted Period (as defined in this Section 6).

(k) If at any time following the distribution of any Written Testing-the-Waters Communication there occurred or occurs an event or development as a result of which such Written Testing-the-Waters Communication included or would include an untrue statement of a material fact or omitted or would omit to state a material fact necessary in order to make the statements therein, in the light of the circumstances existing at that subsequent time, not misleading, the Company will promptly notify the Representatives and will promptly amend or supplement, at its own expense, such Written Testing-the-Waters Communication to eliminate or correct such untrue statement or omission.

(l) The Company will deliver to each Underwriter (or its agent), on the date of execution of this Agreement, a properly completed and executed Certification Regarding Beneficial Owners of Legal Entity Customers, together with copies of identifying documentation, and the Company undertakes to provide such additional supporting documentation as each Underwriter may reasonably request in connection with the verification of the foregoing Certification.

(m) To comply with all applicable securities and other laws, rules and regulations in each jurisdiction in which the Directed Shares are offered in connection with the Directed Share Program.

The Company also covenants with each Underwriter that, without the prior written consent of the Representatives on behalf of the Underwriters, it will not, during the period ending 180 days after the date of the Prospectus (the “**Restricted Period**”), and will not publicly disclose an intention to, (1) offer, pledge, sell, contract to sell, sell any option or contract to purchase, purchase any option or contract to sell, grant any option, right or warrant to purchase, lend, or otherwise transfer or dispose of, directly or indirectly, any shares of Common Stock or any securities convertible into or exercisable or exchangeable for Common Stock or (2) enter into any swap or other arrangement that transfers to another, in whole or in part, any of the economic consequences of ownership of the Common Stock, whether any such transaction described in clause (1) or (2) above is to be settled by delivery of Common Stock or such other securities, in cash or otherwise or (3) confidentially submit any draft registration statement or file any registration statement with the Commission relating to the offering of any shares of Common Stock or any securities convertible into or exercisable or exchangeable for Common Stock.

The restrictions contained in the preceding paragraph shall not apply to (a) the Shares to be sold hereunder; (b) the issuance by the Company of shares of Common Stock issued upon the exercise of options or warrants (including net exercise) or the conversion of a security outstanding on the date hereof and described in each of the Registration Statement, the Time of Sale Prospectus and the Prospectus which the Representatives have been advised in writing; (c) the grant of options or the issuance of shares of Common Stock by the Company to its employees, officers, directors, advisors or consultants pursuant to employee benefit plans in effect on the date hereof and as described Registration Statement, provided that each recipient of such securities shall execute and deliver to the Representatives a lock-up agreement substantially in the form of Exhibit A hereto covering the remainder of the Restricted Period; (d) the filing of any registration statement on Form S-8 relating to securities granted or to be granted pursuant to any plan in effect on the date hereof and described in each of the Registration Statement, the Time of Sale Prospectus and the Prospectus or any assumed employee benefit plan contemplated by clause (c); (e) the sale or issuance of or entry into an agreement to sell or issue shares of Common Stock or securities convertible into or exercisable or exchangeable for Common Stock in connection with any (1) mergers, (2) acquisition of securities, businesses, property or other assets, (3) joint ventures, (4) strategic alliances, (5) partnerships with experts or other talent to develop or provide content or (6) equipment leasing arrangements, provided that the aggregate number of shares of Common Stock or securities convertible into or exercisable for Common Stock (on an as-converted or as-exercised basis, as the case may be) that the Company may sell or issue or agree to sell or issue as described in this clause (e) shall not exceed 5% of the total number of shares of Common Stock issued and outstanding immediately following the completion of the transactions contemplated by this Agreement, and provided, further, that each recipient of shares of Common Stock or securities convertible into or exercisable for Common Stock pursuant to this clause (e) shall execute and deliver to the Representatives a lock-up agreement substantially in the form of Exhibit A hereto covering the remainder of the Restricted Period; or (f) the issuance of shares of Common Stock by the Company pursuant to the potential concurrent private placement described in each of the Registration Statement, the Time of Sale Prospectus and the Prospectus.

If the Representatives, in their sole discretion, agree to release or waive the restrictions set forth in a lock-up letter described in Section 5(h) hereof for an officer or director of the Company and provide the Company with notice of the impending release or waiver at least three business days before the effective date of the release or waiver, the Company agrees to announce the impending release or waiver by a press release substantially in the form of Exhibit B hereto through a major news service at least two business days before the effective date of the release or waiver.

7. *Covenants of the Underwriters.* Each Underwriter severally covenants with the Company not to take any action that would result in the Company being required to file with the Commission under Rule 433(d) of the Securities Act a free writing prospectus prepared by or on behalf of such Underwriter that otherwise would not be required to be filed by the Company thereunder, but for the action of the Underwriter.

8. *Indemnity and Contribution.* (a) The Company agrees to indemnify and hold harmless each Underwriter, each person, if any, who controls any Underwriter within the meaning of either Section 15 of the Securities Act or Section 20 of the Exchange Act and each affiliate of any Underwriter within the meaning of Rule 405 under the Securities Act from and against any and all losses, claims, damages and liabilities (including, without limitation, any legal or other expenses reasonably incurred in connection with defending or investigating any such action or claim) caused by any untrue statement or alleged untrue statement of a material fact contained in the Registration Statement or any amendment thereof, any preliminary prospectus, the Time of Sale Prospectus or any amendment or supplement thereto, any issuer free writing prospectus as defined in Rule 433(h) under the Securities Act, any Company information that the Company has filed, or is required to file, pursuant to Rule 433(d) under the Securities Act, any road show as defined in Rule 433(h) under the Securities Act (a “road show”), or the Prospectus or any amendment or supplement thereto, or any Written Testing-the-Waters Communication, or caused by any omission or alleged omission to state therein, a material fact required to be stated therein or necessary to make the statements therein not misleading, except insofar as such losses, claims, damages or liabilities are caused by any such untrue statement or omission or alleged untrue statement or omission based upon information relating to any Underwriter furnished to the Company in writing by such Underwriter through the Representatives expressly for use therein. The Company agrees and confirms that references to “affiliates” of Morgan Stanley that appear in this Agreement shall be understood to include Mitsubishi UFJ Morgan Stanley Securities Co., Ltd.

(b) Each Underwriter agrees, severally and not jointly, to indemnify and hold harmless the Company, its directors, its officers who sign the Registration Statement and each person, if any, who controls the Company within the meaning of either Section 15 of the Securities Act or Section 20 of the Exchange Act to the same extent as the foregoing indemnity from the Company to such Underwriter, but only with reference to information relating to such Underwriter furnished to the Company in writing by such Underwriter through the Representatives expressly for use in the Registration Statement, any preliminary prospectus, the Time of Sale Prospectus, any issuer free writing prospectus, road show or the Prospectus or any amendment or supplement thereto.

(c) In case any proceeding (including any governmental investigation) shall be instituted involving any person in respect of which indemnity may be sought pursuant to Section 8(a) or 8(b), such person (the “**indemnified party**”) shall promptly notify the person against whom such indemnity may be sought (the “**indemnifying party**”) in writing and the indemnifying party, upon request of the indemnified party, shall retain counsel reasonably satisfactory to the indemnified party to represent the indemnified party and any others the indemnifying party may designate in such proceeding and shall pay the reasonably incurred, documented fees and disbursements of such counsel related to such proceeding. In any such proceeding, any indemnified party shall have the right to retain its own counsel, but the fees and expenses of such counsel shall be at the expense of such indemnified party unless (i) the indemnifying party and the indemnified party shall have mutually agreed in writing to the retention of such counsel, (ii) the named parties to any such proceeding (including any impleaded parties) include both the indemnifying party and the indemnified party and representation of both parties by the same counsel would be inappropriate due to actual or potential differing interests between them or (iii) the indemnified party shall have reasonably concluded that there may be legal defenses available to it that are different from or in addition to those available to the indemnifying party. It is understood that the indemnifying party shall not, in respect of the legal expenses of any indemnified party in connection with any proceeding or related proceedings in the same jurisdiction, be liable for the fees and expenses of more than one separate firm (in addition to any local counsel) for all such indemnified parties and that all such fees and expenses shall be reimbursed as they are incurred. Such firm shall be designated in writing by the Representatives, in the case of parties indemnified pursuant to Section 8(a), and by the Company, in the case of parties indemnified pursuant to Section 8(b). The indemnifying party shall not be liable for any settlement of any proceeding effected without its written consent, but if settled with such consent or if there be a final judgment for the plaintiff, the indemnifying party agrees to indemnify the indemnified party from and against any loss or liability by reason of such settlement or judgment. Notwithstanding the foregoing sentence, if at any time an indemnified party shall have requested an indemnifying party to reimburse the indemnified party for fees and expenses of counsel as contemplated by the second and third sentences of this paragraph, the indemnifying party agrees that it shall be liable for any settlement of any proceeding effected without its written consent if (i) such settlement is entered into more than 30 days after receipt by such indemnifying party of the aforesaid request and (ii) such indemnifying party shall not have reimbursed the indemnified party in accordance with such request prior to the date of such settlement. No indemnifying party shall, without the prior written consent of the indemnified party, effect any settlement of any pending or threatened proceeding in respect of which any indemnified party is or could have been a party and indemnity could have been sought hereunder by such indemnified party, unless such settlement (i) includes an unconditional release of such indemnified party from all liability on claims that are the subject matter of such proceeding and (ii) does not include a statement as to or an admission of fault culpability, or a failure to act, by or on behalf of any indemnified party.

(d) To the extent the indemnification provided for in Section 8(a) or 8(b) is unavailable to an indemnified party or insufficient in respect of any losses, claims, damages or liabilities referred to therein, then each indemnifying party under such paragraph, in lieu of indemnifying such indemnified party thereunder, shall contribute to the amount paid or payable by such indemnified party as a result of such losses, claims, damages or liabilities (i) in such proportion as is appropriate to reflect the relative benefits received by the indemnifying party or

parties on the one hand and the indemnified party or parties on the other hand from the offering of the Shares or (ii) if the allocation provided by clause 8(d)(i) above is not permitted by applicable law, in such proportion as is appropriate to reflect not only the relative benefits referred to in clause 8(d)(i) above but also the relative fault of the indemnifying party or parties on the one hand and of the indemnified party or parties on the other hand in connection with the statements or omissions that resulted in such losses, claims, damages or liabilities, as well as any other relevant equitable considerations. The relative benefits received by the indemnifying party or parties on the one hand and the indemnified party or parties on the other hand in connection with the offering of the Shares shall be deemed to be in the same respective proportions as the net proceeds from the offering of the Shares (before deducting expenses) received by the Company and the total underwriting discounts and commissions received by the Underwriters, in each case as set forth in the table on the cover of the Prospectus, bear to the aggregate Public Offering Price of the Shares. The relative fault of the indemnifying party or parties on the one hand and the indemnified party or parties on the other hand shall be determined by reference to, among other things, whether the untrue or alleged untrue statement of a material fact or the omission or alleged omission to state a material fact relates to information supplied by the Company or by the Underwriters and the parties' relative intent, knowledge, access to information and opportunity to correct or prevent such statement or omission. The Underwriters' respective obligations to contribute pursuant to this Section 8 are several in proportion to the respective number of Shares they have purchased hereunder, and not joint.

(e) The Company and the Underwriters agree that it would not be just or equitable if contribution pursuant to this Section 8 were determined by *pro rata* allocation (even if the Underwriters were treated as one entity for such purpose) or by any other method of allocation that does not take account of the equitable considerations referred to in Section 8(d). The amount paid or payable by an indemnified party as a result of the losses, claims, damages and liabilities referred to in Section 8(d) shall be deemed to include, subject to the limitations set forth above, any legal or other expenses reasonably incurred by such indemnified party in connection with investigating or defending any such action or claim. Notwithstanding the provisions of this Section 8, no Underwriter shall be required to contribute any amount in excess of the amount by which the total price at which the Shares underwritten by it and distributed to the public were offered to the public exceeds the amount of any damages that such Underwriter has otherwise been required to pay by reason of such untrue or alleged untrue statement or omission or alleged omission. No person guilty of fraudulent misrepresentation (within the meaning of Section 11(f) of the Securities Act) shall be entitled to contribution from any person who was not guilty of such fraudulent misrepresentation. The remedies provided for in this Section 8 are not exclusive and shall not limit any rights or remedies which may otherwise be available to any indemnified party at law or in equity.

(f) The indemnity and contribution provisions contained in this Section 8 and the representations, warranties and other statements of the Company contained in this Agreement shall remain operative and in full force and effect regardless of (i) any termination of this Agreement, (ii) any investigation made by or on behalf of any Underwriter, any person controlling any Underwriter or any affiliate of any Underwriter or by or on behalf of the Company, its officers or directors or any person controlling the Company and (iii) acceptance of and payment for any of the Shares.

9. *Directed Share Program Indemnification.* (a) The Company agrees to indemnify and hold harmless Morgan Stanley, each person, if any, who controls Morgan Stanley within the meaning of either Section 15 of the Securities Act or Section 20 of the Exchange Act and each affiliate of Morgan Stanley within the meaning of Rule 405 of the Securities Act (“**Morgan Stanley Entities**”) from and against any and all losses, claims, damages and liabilities (including, without limitation, any legal or other expenses reasonably incurred in connection with defending or investigating any such action or claim) (i) caused by any untrue statement or alleged untrue statement of a material fact contained in any material prepared by or with the consent of the Company for distribution to Participants in connection with the Directed Share Program or caused by any omission or alleged omission to state therein a material fact required to be stated therein or necessary to make the statements therein not misleading; (ii) caused by the failure of any Participant to pay for and accept delivery of Directed Shares that the Participant agreed to purchase; or (iii) related to, arising out of, or in connection with the Directed Share Program, other than losses, claims, damages or liabilities (or expenses relating thereto) that are finally judicially determined to have resulted from the bad faith or gross negligence of Morgan Stanley Entities.

(b) In case any proceeding (including any governmental investigation) shall be instituted involving any Morgan Stanley Entity in respect of which indemnity may be sought pursuant to Section 9(a), the Morgan Stanley Entity seeking indemnity, shall promptly notify the Company in writing and the Company, upon request of the Morgan Stanley Entity, shall retain counsel reasonably satisfactory to the Morgan Stanley Entity to represent the Morgan Stanley Entity and any others the Company may designate in such proceeding and shall pay the fees and disbursements of such counsel related to such proceeding. In any such proceeding, any Morgan Stanley Entity shall have the right to retain its own counsel, but the fees and expenses of such counsel shall be at the expense of such Morgan Stanley Entity unless (i) the Company shall have agreed to the retention of such counsel or (ii) the named parties to any such proceeding (including any impleaded parties) include both the Company and the Morgan Stanley Entity and representation of both parties by the same counsel would be inappropriate due to actual or potential differing interests between them. The Company shall not, in respect of the legal expenses of the Morgan Stanley Entities in connection with any proceeding or related proceedings in the same jurisdiction, be liable for the fees and expenses of more than one separate firm (in addition to any local counsel) for all Morgan Stanley Entities. Any such separate firm for the Morgan Stanley Entities shall be designated in writing by Morgan



Stanley. The Company shall not be liable for any settlement of any proceeding effected without its written consent, but if settled with such consent or if there be a final judgment for the plaintiff, the Company agrees to indemnify the Morgan Stanley Entities from and against any loss or liability by reason of such settlement or judgment. Notwithstanding the foregoing sentence, if at any time a Morgan Stanley Entity shall have requested the Company to reimburse it for fees and expenses of counsel as contemplated by the second and third sentences of this paragraph, the Company agrees that it shall be liable for any settlement of any proceeding effected without its written consent if (i) such settlement is entered into more than 30 days after receipt by the Company of the aforesaid request and (ii) the Company shall not have reimbursed the Morgan Stanley Entity in accordance with such request prior to the date of such settlement. The Company shall not, without the prior written consent of Morgan Stanley, effect any settlement of any pending or threatened proceeding in respect of which any Morgan Stanley Entity is or could have been a party and indemnity could have been sought hereunder by such Morgan Stanley Entity, unless such settlement includes an unconditional release of the Morgan Stanley Entities from all liability on claims that are the subject matter of such proceeding.

(c) To the extent the indemnification provided for in Section 9(a) is unavailable to a Morgan Stanley Entity or insufficient in respect of any losses, claims, damages or liabilities referred to therein, then the Company in lieu of indemnifying the Morgan Stanley Entity thereunder, shall contribute to the amount paid or payable by the Morgan Stanley Entity as a result of such losses, claims, damages or liabilities (i) in such proportion as is appropriate to reflect the relative benefits received by the Company on the one hand and the Morgan Stanley Entities on the other hand from the offering of the Directed Shares or (ii) if the allocation provided by clause 9(c)(i) above is not permitted by applicable law, in such proportion as is appropriate to reflect not only the relative benefits referred to in clause 9(c)(i) above but also the relative fault of the Company on the one hand and of the Morgan Stanley Entities on the other hand in connection with any statements or omissions that resulted in such losses, claims, damages or liabilities, as well as any other relevant equitable considerations. The relative benefits received by the Company on the one hand and the Morgan Stanley Entities on the other hand in connection with the offering of the Directed Shares shall be deemed to be in the same respective proportions as the net proceeds from the offering of the Directed Shares (before deducting expenses) and the total underwriting discounts and commissions received by the Morgan Stanley Entities for the Directed Shares, bear to the aggregate Public Offering Price of the Directed Shares. If the loss, claim, damage or liability is caused by an untrue or alleged untrue statement of a material fact or the omission or alleged omission to state a material fact, the relative fault of the Company on the one hand and the Morgan Stanley Entities on the other hand shall be determined by reference to, among other things, whether the untrue or alleged untrue statement or the omission or alleged omission relates to information supplied by the Company or by the Morgan Stanley Entities and the parties' relative intent, knowledge, access to information and opportunity to correct or prevent such statement or omission.

(d) The Company and the Morgan Stanley Entities agree that it would not be just or equitable if contribution pursuant to this Section 9 were determined by pro rata allocation (even if the Morgan Stanley Entities were treated as one entity for such purpose) or by any other method of allocation that does not take account of the equitable considerations referred to in Section 9(c). The amount paid or payable by the Morgan Stanley Entities as a result of the losses, claims, damages and liabilities referred to in the immediately preceding paragraph shall be deemed to include, subject to the limitations set forth above, any legal or other expenses reasonably incurred by the Morgan Stanley Entities in connection with investigating or defending any such action or claim. Notwithstanding the provisions of this Section 9, no Morgan Stanley Entity shall be required to contribute any amount in excess of the amount by which the total price at which the Directed Shares distributed to the public were offered to the public exceeds the amount of any damages that such Morgan Stanley Entity has otherwise been required to pay. The remedies provided for in this Section 9 are not exclusive and shall not limit any rights or remedies which may otherwise be available to any indemnified party at law or in equity.

(e) The indemnity and contribution provisions contained in this Section 9 shall remain operative and in full force and effect regardless of (i) any termination of this Agreement, (ii) any investigation made by or on behalf of any Morgan Stanley Entity or the Company, its officers or directors or any person controlling the Company and (iii) acceptance of and payment for any of the Directed Shares.

10. *Termination.* The Underwriters may terminate this Agreement by notice given by the Representatives to the Company, if after the execution and delivery of this Agreement and prior to the Closing Date (i) trading generally shall have been suspended or materially limited on, or by, as the case may be, any of the New York Stock Exchange, the NYSE MKT, the Nasdaq Global Market, the Chicago Board of Options Exchange, the Chicago Mercantile Exchange or the Chicago Board of Trade or other relevant exchanges, (ii) trading of any securities of the Company shall have been suspended on any exchange or in any over-the-counter market, (iii) a material disruption in securities settlement, payment or clearance services in the United States or other relevant jurisdiction shall have occurred, (iv) any moratorium on commercial banking activities shall have been declared by Federal or New York State authorities or (v) there shall have occurred any outbreak or escalation of hostilities, or any change in financial markets or any calamity or crisis that, in the judgment of the Representatives, is material and adverse and which, singly or together with any other event specified in this clause (v), makes it, in the judgment of the Representatives, impracticable or inadvisable to proceed with the offer, sale or delivery of the Shares on the terms and in the manner contemplated in the Time of Sale Prospectus or the Prospectus.

11. *Effectiveness; Defaulting Underwriters.* This Agreement shall become effective upon the execution and delivery hereof by the parties hereto.

If, on the Closing Date or an Option Closing Date, as the case may be, any one or more of the Underwriters shall fail or refuse to purchase Shares that it has or they have agreed to purchase hereunder on such date, and the aggregate number of Shares which such defaulting Underwriter or Underwriters agreed but failed or refused to purchase is not more than one-tenth of the aggregate number of the Shares to be purchased on such date, the other Underwriters shall be obligated severally in the proportions that the number of Firm Shares set forth opposite their respective names in Schedule I bears to the aggregate number of Firm Shares set forth opposite the names of all such non-defaulting Underwriters, or in such other proportions as the Representatives may specify, to purchase the Shares which such defaulting Underwriter or Underwriters agreed but failed or refused to purchase on such date; *provided* that in no event shall the number of Shares that any Underwriter has agreed to purchase pursuant to this Agreement be increased pursuant to this Section 11 by an amount in excess of one-ninth of such number of Shares without the written consent of such Underwriter. If, on the Closing Date, any Underwriter or Underwriters shall fail or refuse to purchase Firm Shares and the aggregate number of Firm Shares with respect to which such default occurs is more than one-tenth of the aggregate number of Firm Shares to be purchased on such date, and arrangements satisfactory to the Representatives and the Company for the purchase of such Firm Shares are not made within 36 hours after such default, this Agreement shall terminate without liability on the part of any non-defaulting Underwriter or the Company. In any such case either the Representatives or the Company shall have the right to postpone the Closing Date, but in no event for longer than seven days, in order that the required changes, if any, in the Registration Statement, in the Time of Sale Prospectus, in the Prospectus or in any other documents or arrangements may be effected. If, on an Option Closing Date, any Underwriter or Underwriters shall fail or refuse to purchase Additional Shares and the aggregate number of Additional Shares with respect to which such default occurs is more than one-tenth of the aggregate number of Additional Shares to be purchased on such Option Closing Date, the non-defaulting Underwriters shall have the option to (i) terminate their obligation hereunder to purchase the Additional Shares to be sold on such Option Closing Date or (ii) purchase not less than the number of Additional Shares that such non-defaulting Underwriters would have been obligated to purchase in the absence of such default. Any action taken under this paragraph shall not relieve any defaulting Underwriter from liability in respect of any default of such Underwriter under this Agreement.

If this Agreement shall be terminated by the Underwriters, or any of them, because of any failure or refusal on the part of the Company to comply with the terms or to fulfill any of the conditions of this Agreement, or if for any reason the Company shall be unable to perform its obligations under this Agreement, the Company will reimburse the Underwriters or such Underwriters as have so terminated this Agreement with respect to themselves, severally, for all out-of-pocket expenses (including the fees and disbursements of their counsel) reasonably incurred by such Underwriters in connection with this Agreement or the offering contemplated hereunder.

12. *Entire Agreement.* (a) This Agreement, together with any contemporaneous written agreements and any prior written agreements (to the extent not superseded by this Agreement) that relate to the offering of the Shares, represents the entire agreement between the Company and the Underwriters with respect to the preparation of any preliminary prospectus, the Time of Sale Prospectus, the Prospectus, the conduct of the offering, and the purchase and sale of the Shares.

(b) The Company acknowledges that in connection with the offering of the Shares: (i) the Underwriters have acted at arm's length, are not agents of, and owe no fiduciary duties to, the Company or any other person, (ii) the Underwriters owe the Company only those duties and obligations set forth in this Agreement and prior written agreements (to the extent not superseded by this Agreement), if any, and (iii) the Underwriters may have interests that differ from those of the Company. The Company waives to the full extent permitted by applicable law any claims it may have against the Underwriters arising from an alleged breach of fiduciary duty in connection with the offering of the Shares.

13. *Recognition of the U.S. Special Resolution Regimes.* (a) In the event that any Underwriter that is a Covered Entity becomes subject to a proceeding under a U.S. Special Resolution Regime, the transfer from such Underwriter of this Agreement, and any interest and obligation in or under this Agreement, will be effective to the same extent as the transfer would be effective under the U.S. Special Resolution Regime if this Agreement, and any such interest and obligation, were governed by the laws of the United States or a state of the United State.

(b) In the event that any Underwriter that is a Covered Entity or a BHC Act Affiliate of such Underwriter becomes subject to a proceeding under a U.S. Special Resolution Regime, Default Rights under this Agreement that may be exercised against such Underwriter are permitted to be exercised to no greater extent than such Default Rights could be exercised under the U.S. Special Resolution Regime if this Agreement were governed by the laws of the United States or a state of the United States.

For purposes of this Section a "**BHC Act Affiliate**" has the meaning assigned to the term "affiliate" in, and shall be interpreted in accordance with, 12 U.S.C. § 1841(k). "**Covered Entity**" means any of the following: (i) a "covered entity" as that term is defined in, and interpreted in accordance with, 12 C.F.R. § 252.82(b); (ii) a "covered bank" as that term is defined in, and interpreted in accordance with, 12 C.F.R. § 47.3(b); or (iii) a "covered FSI" as that term is defined in, and interpreted in accordance with, 12 C.F.R. § 382.2(b). "**Default Right**" has the meaning assigned to that term in, and shall be interpreted in accordance with, 12 C.F.R. §§ 252.81, 47.2 or 382.1, as applicable. "**U.S. Special Resolution Regime**" means each of (i) the Federal Deposit Insurance Act and the regulations promulgated thereunder and (ii) Title II of the Dodd-Frank Wall Street Reform and Consumer Protection Act and the regulations promulgated thereunder.

14. *Counterparts.* This Agreement may be signed in two or more counterparts, each of which shall be an original, with the same effect as if the signatures thereto and hereto were upon the same instrument.

15. *Applicable Law.* This Agreement shall be governed by and construed in accordance with the internal laws of the State of New York.

16. *Headings.* The headings of the sections of this Agreement have been inserted for convenience of reference only and shall not be deemed a part of this Agreement.

17. *Notices.* All communications hereunder shall be in writing and effective only upon receipt and if to the Underwriters shall be delivered, mailed or sent to the Representatives in care of Morgan Stanley & Co. LLC, 1585 Broadway, New York, New York 10036, Attention: Equity Syndicate Desk, with a copy to the Legal Department; and Merrill Lynch, Pierce, Fenner & Smith Incorporated, One Bryant Park, New York, New York 10036, Attention: Syndicate Department (facsimile: (646) 855-3073), with a copy to ECM Legal (facsimile: (212) 230-8730); and if to the Company shall be delivered, mailed or sent to ShockWave Medical, Inc., Corporate Secretary; Attn: Dan Puckett, 5403 Betsy Ross Drive, Santa Clara, California 95054.

*[Signature page follows]*

Very truly yours,

**SHOCKWAVE MEDICAL, INC.**

By: \_\_\_\_\_  
Name:  
Title:

Accepted as of the date hereof

Morgan Stanley & Co. LLC  
Merrill Lynch, Pierce, Fenner & Smith  
Incorporated  
Acting severally on behalf of themselves and  
the several Underwriters named in  
Schedule I hereto.

Morgan Stanley & Co. LLC

By: \_\_\_\_\_  
Name:  
Title:

Merrill Lynch, Pierce, Fenner & Smith  
Incorporated

By: \_\_\_\_\_  
Name:  
Title:

*[Signature page to Underwriting Agreement]*

**Underwriter**

**Number of Firm Shares  
To Be Purchased**

---

Morgan Stanley & Co. LLC  
Merrill Lynch, Pierce, Fenner & Smith  
Incorporated  
Wells Fargo Securities, LLC  
Canaccord Genuity Inc.  
Total:

---

---

**Time of Sale Prospectus**

1. Preliminary Prospectus issued [•], 2019
2. [identify all free writing prospectuses filed by the Company under Rule 433(d) of the Securities Act]
3. [free writing prospectus containing a description of terms that does not reflect final terms, if the Time of Sale Prospectus does not include a final term sheet]
4. [orally communicated pricing information such as price per share and size of offering if a Rule 134 pricing term sheet is used at the time of sale instead of a pricing term sheet filed by the Company under Rule 433(d) as a free writing prospectus]



**Written Testing-the-Waters Communications**

ShockWave - Testing-the-Waters Presentation dated January 2019

III-1

## FORM OF LOCK-UP LETTER

\_\_\_\_\_, 20[ ]

Morgan Stanley & Co. LLC  
Merrill Lynch, Pierce, Fenner & Smith  
Incorporated

c/o Morgan Stanley & Co. LLC  
1585 Broadway  
New York, NY 10036

c/o Merrill Lynch, Pierce, Fenner & Smith  
Incorporated  
One Bryant Park  
New York, New York 10036

Ladies and Gentlemen:

The undersigned understands that Morgan Stanley & Co. LLC ("**Morgan Stanley**") and Merrill Lynch, Pierce, Fenner & Smith Incorporated ("**BAML**") proposes to enter into an Underwriting Agreement (the "**Underwriting Agreement**") with Shockwave Medical, Inc., a Delaware corporation (the "**Company**"), providing for the public offering (the "**Public Offering**") by the several Underwriters, including Morgan Stanley and BAML (the "**Underwriters**"), of shares (the "**Shares**") of common stock, par value \$0.001 per share, of the Company (the "**Common Stock**").

To induce the Underwriters that may participate in the Public Offering to continue their efforts in connection with the Public Offering, the undersigned hereby agrees that, without the prior written consent of Morgan Stanley and BAML on behalf of the Underwriters, it will not, and will not publicly disclose an intention to, during the period commencing on the date hereof and ending 180 days after the date of the final prospectus (the "**Restricted Period**") relating to the Public Offering (the "**Prospectus**"), (1) offer, pledge, sell, contract to sell, sell any option or contract to purchase, purchase any option or contract to sell, grant any option, right or warrant to purchase, lend, or otherwise transfer or dispose of, directly or indirectly, any shares of Common Stock beneficially owned (as such term is used in Rule 13d-3 of the Securities Exchange Act of 1934, as amended (the "**Exchange Act**")), by the undersigned or any other securities so owned convertible into or exercisable or exchangeable for Common Stock or (2) enter into any swap or other arrangement that transfers to another, in whole or in part, any of the economic consequences of ownership of the Common Stock, whether any such transaction described in clause (1) or (2) above is to be settled by delivery of Common

Stock or such other securities, in cash or otherwise. The foregoing sentence shall not apply to:

- (a) transactions relating to shares of Common Stock or other securities acquired in open market transactions after the completion of the Public Offering, *provided* that no filing under Section 16(a) of the Exchange Act or other public announcement shall be required or shall be voluntarily made in connection with subsequent sales of Common Stock or other securities acquired in such open market transactions during the Restricted Period;
- (b) transfers of securities to the Company in connection with the conversion of the Company's outstanding preferred stock or warrants into shares of Common Stock or warrants to acquire shares of Common Stock in connection with the consummation of the Public Offering, which conversion is described in the Prospectus, it being understood that any such shares of Common Stock or warrants received by the undersigned upon such conversion shall be subject to the restrictions on transfer set forth herein;
- (c) transfers of shares of Common Stock or any security convertible into Common Stock (i) as a bona fide gift, (ii) to an immediate family member or a trust for the direct or indirect benefit of the undersigned or such immediate family member of the undersigned (for purposes of this lock-up letter, "**immediate family**" shall mean any relationship by blood, marriage or adoption, not more remote than first cousin), (iii) if the undersigned is a trust, to a trustor or beneficiary of the trust or to the estate of a beneficiary of such trust, (iv) if the undersigned is a corporation, partnership, limited liability company, investment fund or other entity, distributions of shares of Common Stock or any security convertible into shares of Common Stock to stockholders, limited partners, members or affiliates or to any other entity that is controlled or managed by, or under common control or management with, the undersigned or (v) by will, other testamentary document or intestate succession to the legal representative, heir, beneficiary or a member of the immediate family of the undersigned; *provided* that in the case of any transfer or distribution pursuant to this clause (c), (i) each donee or distributee shall sign and deliver a lock-up letter substantially in the form of this letter, (ii) no filing under Section 16(a) of the Exchange Act or other public announcement, reporting a reduction in beneficial ownership of shares of Common Stock, shall be required or shall be voluntarily made during the Restricted Period and (iii) such transfer shall not involve a disposition for value;
- (d) transfers of shares of Common Stock or any securities convertible into or exercisable or exchangeable for Common Stock that occur by operation of law pursuant to a qualified domestic order or in connection with a divorce settlement, *provided* that (i) each transferee shall sign and deliver a lock-up letter substantially in the form of this letter, (ii) any public report or filing required to be made under Section 16(a) of the Exchange Act shall clearly indicate in the footnotes thereto that such transfer is pursuant to a qualified

domestic order or in connection with a divorce settlement and (iii) such transfer shall not involve a disposition for value, and *provided, further* that no other public announcement shall be required or shall be made voluntarily in connection with such transfer;

- (e) transfers of shares of Common Stock or any securities convertible into or exercisable or exchangeable for Common Stock to the Company pursuant to agreements entered into pursuant to a stock incentive plan disclosed in the Prospectus and in effect on the date of the Prospectus under which the Company has the option to repurchase such shares or securities upon termination of service of the undersigned, *provided* that no public report or filing required to be made under Section 16(a) of the Exchange Act or other public filing, report or announcement shall be required or shall be voluntarily made during the period beginning on the date hereof and continuing to and including the date that is 30 days after the date of the Prospectus (the “**30 Day Period**”), and after such 30<sup>th</sup> day, if the undersigned is required to file a report under Section 16(a) of the Exchange Act during the Restricted Period, the undersigned shall clearly indicate in the footnotes thereto that such transfer is pursuant to the circumstances described in this clause (e), and *provided, further* that no other public announcement shall be made voluntarily in connection with such transfer;
- (f) the exercise of outstanding warrants by the undersigned described in the Prospectus or any stock option by the undersigned that was granted under a stock incentive plan or stock purchase plan described in the Prospectus, *provided* that the shares received upon exercise shall continue to be subject to the restrictions on transfer set forth in this lock-up letter and *provided, further* that no public report or filing required to be made under Section 16(a) of the Exchange Act or other public filing, report or announcement shall be required or shall be voluntarily made during the 30 Day Period, and after the 30 Day Period, if the undersigned is required to file a report under Section 16(a) of the Exchange Act during the Restricted Period, the undersigned shall clearly indicate in the footnotes thereto that the filing relates to the exercise of a stock option or warrant, that no shares were sold by the reporting person and that the shares received upon exercise of the stock option or warrant are subject to a lock-up letter agreement with the Underwriters of the Public Offering, and *provided, further* that no other public announcement shall be made voluntarily in connection with such exercise;
- (g) the transfer of shares of Common Stock or any security convertible into Common Stock to the Company upon the exercise of options or warrants to purchase the Company’s securities outstanding as of the date hereof or pursuant to a stock incentive plan or stock purchase plan described in the Prospectus, on a “cashless” or “net exercise” basis, *provided* that the shares received upon exercise shall continue to be subject to the restrictions on transfer set forth in this lock-up letter and *provided, further* that no public

report or filing required to be made under Section 16(a) of the Exchange Act or other public filing, report or announcement shall be required or shall be voluntarily made during the period beginning on the date hereof and continuing to and including the 30 Day Period, and after the 30 Day Period, if the undersigned is required to file a report under Section 16(a) of the Exchange Act during the Restricted Period, the undersigned shall clearly indicate in the footnotes thereto that the filing relates to the “cashless” or “net” exercise of a stock option or warrant, that no shares were sold by the reporting person and that the shares received upon exercise of the stock option or warrant are subject to a lock-up letter agreement with the Underwriters of the Public Offering, and *provided, further* that no other public announcement shall be made voluntarily in connection with such transfer;

- (h) the transfer of shares of Common Stock or any security convertible into Common Stock to the Company, or the withholding of shares of Common Stock by the Company, in connection with a vesting event of the Company’s securities granted pursuant to a stock incentive plan or stock purchase plan described in the Prospectus, to cover tax withholding obligations or the payment of taxes due in connection with the vesting event, *provided* that no public report or filing required to be made under Section 16(a) of the Exchange Act or other public filing, report or announcement shall be required or shall be voluntarily made during the period beginning on the date hereof and continuing to and including the 30 Day Period, and after the 30 Day Period, if the undersigned is required to file a report under Section 16(a) of the Exchange Act during the Restricted Period, the undersigned shall clearly indicate in the footnotes thereto that the purpose of such transfer is to cover such tax withholding obligations or the payment of taxes due in connection with the vesting event, and *provided, further* that no other public announcement shall be made voluntarily in connection with such transfer;
- (i) a merger, consolidation or other similar transaction involving a Change of Control (as defined below) of the Company after the closing of the Public Offering and approved by the Company’s board of directors, *provided* that in the event that such Change of Control is not completed, the undersigned’s shares shall remain subject to the restrictions contained in this lock-up letter and title to the undersigned’s shares shall remain with the undersigned; and
- (j) the establishment of a trading plan pursuant to Rule 10b5-1 under the Exchange Act for the transfer of shares of Common Stock, *provided* that (i) such plan does not provide for the transfer of Common Stock during the Restricted Period and (ii) to the extent a public announcement or filing under the Exchange Act, if any, is required of or voluntarily made by or on behalf of the undersigned or the Company regarding the establishment of such plan, such announcement or filing shall include a statement to the effect that no transfer of Common Stock may be made under such plan during the Restricted Period.

In addition, the undersigned agrees that, without the prior written consent of Morgan Stanley and BAML on behalf of the Underwriters, it will not, and will not publicly disclose an intention to, during the Restricted Period, make any demand for or exercise any right with respect to, the registration of any shares of Common Stock or any security convertible into or exercisable or exchangeable for Common Stock. "Change of Control" means the transfer (whether by tender offer, merger, consolidation or other similar transaction), in one transaction or a series of related transactions, to a person or group of affiliated persons (other than an Underwriter pursuant to the Public Offering), of the Company's voting securities if, after such transfer, such person or group of affiliated persons would hold more than a majority of the outstanding voting securities of the Company (or the surviving entity).

If the undersigned is an officer or director of the Company, the undersigned further agrees that the foregoing provisions shall be equally applicable to any issuer-directed Shares the undersigned may purchase in the Public Offering.

If the undersigned is an officer or director of the Company, (i) Morgan Stanley and BAML agree that, at least three business days before the effective date of any release or waiver of the foregoing restrictions in connection with a transfer of shares of Common Stock, Morgan Stanley and BAML will notify the Company of the impending release or waiver, and (ii) the Company will agree or has agreed in the Underwriting Agreement to announce the impending release or waiver by press release through a major news service at least two business days before the effective date of the release or waiver. Any release or waiver granted by Morgan Stanley and BAML hereunder to any such officer or director shall only be effective two business days after the publication date of such press release. The provisions of this paragraph will not apply if (a) the release or waiver is effected solely to permit a transfer not for consideration and (b) the transferee has agreed in writing to be bound by the same terms described in this letter to the extent and for the duration that such terms remain in effect at the time of the transfer.

The undersigned also agrees and consents to the entry of stop transfer instructions with the Company's transfer agent and registrar against the transfer of the undersigned's shares of Common Stock except in compliance with the foregoing restrictions.

The undersigned understands that the Company and the Underwriters are relying upon this agreement in proceeding toward consummation of the Public Offering. The undersigned further understands that this agreement is irrevocable and shall be binding upon the undersigned's heirs, legal representatives, successors and assigns.

This lock-up letter shall automatically terminate and the undersigned shall be released from all obligations under this lock-up letter upon the earliest to occur, if any, of (i) the date the Company advises Morgan Stanley and BAML, in writing, prior to the execution of the Underwriting Agreement, that it has determined not to proceed with the Public Offering, (ii) the date of the termination of the Underwriting Agreement (other than the provisions thereof which survive termination) if prior to the closing of the Public Offering or (c) June 30, 2019 if, and only if, the Underwriting Agreement has not been signed by such date (provided that the Company may by written notice to the undersigned prior to June 30, 2019 extend such date for a period of up to an additional three months).

Whether or not the Public Offering actually occurs depends on a number of factors, including market conditions. Any Public Offering will only be made pursuant to an Underwriting Agreement, the terms of which are subject to negotiation between the Company and the Underwriters.

This agreement and any claim, controversy or dispute arising under or related to this agreement shall be governed by and construed in accordance with the laws of the State of New York, without regard to the conflict of laws principles thereof.

*[Signature page follows]*

Very truly yours,

\_\_\_\_\_  
Name of Securityholder (*Print exact name*)

By: \_\_\_\_\_  
Signature

If not signing in an individual capacity:

\_\_\_\_\_  
Name of Authorized Signatory (*Print*)

\_\_\_\_\_  
Title of Authorized Signatory (*Print*)

*(indicate capacity of person signing if signing as custodian,  
trustee, or on behalf of an entity)*

*[Signature Page to Lock-Up Letter]*



## FORM OF WAIVER OF LOCK-UP

\_\_\_\_\_, 20\_\_

[Name and Address of  
Officer or Director  
Requesting Waiver]

Dear Mr./Ms. [Name]:

This letter is being delivered to you in connection with the offering by ShockWave Medical, Inc. (the "**Company**") of [**•**] shares of common stock, \$0.001 par value per share (the "**Common Stock**"), of the Company and the lock-up letter dated \_\_\_\_, 201\_\_ (the "**Lock-up Letter**"), executed by you in connection with such offering, and your request for a [waiver] [release] dated \_\_\_\_, 20\_\_, with respect to \_\_\_\_ shares of Common Stock (the "**Shares**").

Morgan Stanley & Co. LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated hereby agree to [waive] [release] the transfer restrictions set forth in the Lock-up Letter, but only with respect to the Shares, effective \_\_\_\_, 20\_\_; provided, however, that such [waiver] [release] is conditioned on the Company announcing the impending [waiver] [release] by press release through a major news service at least two business days before effectiveness of such [waiver] [release]. This letter will serve as notice to the Company of the impending [waiver] [release].

Except as expressly [waived] [released] hereby, the Lock-up Letter shall remain in full force and effect.

Very truly yours,

Morgan Stanley & Co. LLC  
Merrill Lynch, Pierce, Fenner & Smith  
Incorporated Acting severally on behalf of  
themselves and the several Underwriters named in Schedule  
I hereto

Morgan Stanley & Co. LLC

By: \_\_\_\_\_  
Name:  
Title:

By: \_\_\_\_\_  
Name:  
Title:

cc: ShockWave Medical, Inc

FORM OF PRESS RELEASE

ShockWave Medical, Inc.  
[Date]

ShockWave Medical, Inc. (the “**Company**”) announced today that Morgan Stanley & Co. LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated, the lead book-running managers in the Company’s recent public sale of [\*] shares of common stock are [waiving][releasing] a lock-up restriction with respect to \_\_\_\_ shares of the Company’s common stock held by [certain officers or directors] [an officer or director] of the Company. The [waiver] [release] will take effect on \_\_\_\_, 20\_\_ , and the shares may be sold on or after such date.

**This press release is not an offer for sale of the securities in the United States or in any other jurisdiction where such offer is prohibited, and such securities may not be offered or sold in the United States absent registration or an exemption from registration under the United States Securities Act of 1933, as amended.**

**AMENDED AND RESTATED**  
**CERTIFICATE OF INCORPORATION OF**  
**SHOCKWAVE MEDICAL, INC.**

The undersigned, Douglas Godshall, does hereby verify that:

ONE: He is the duly elected and acting President and Chief Executive Officer of Shockwave Medical, Inc. (the “**Corporation**”), a corporation organized and existing under the laws of the State of Delaware.

TWO: The original Certificate of Incorporation of the Corporation was filed with the Secretary of State of the State of Delaware on June 17, 2009, was amended and restated on May 17, 2011, July 1, 2013, May 5, 2015, November 9, 2016 and December 6, 2018 and amended on February 22, 2019.

THREE: This Amended and Restated Certificate of Incorporation (the “**Certificate of Incorporation**”) was duly adopted in accordance with Sections 242 and 245 of the General Corporation Law of the State of Delaware, and has been duly approved by the written consent of the stockholders of the Corporation in accordance with Section 228 of the General Corporation Law of the State of Delaware.

FOUR: The text of the Certificate of Incorporation is amended and restated in its entirety to read as follows:

**ARTICLE I**  
**NAME**

The name of the Corporation is ShockWave Medical, Inc.

**ARTICLE II**  
**REGISTERED OFFICE AND AGENT**

The address of its registered office in the State of Delaware is The Corporation Trust Company, 1209 Orange Street, City of Wilmington, County of New Castle, DE 19801. The name of its registered agent at such address is The Corporation Trust Company.

**ARTICLE III**  
**PURPOSE AND POWERS**

The purpose of the Corporation is to engage in any lawful act or activity for which corporations may be organized under the General Corporation Law of the State of Delaware as the same exists or may hereafter be amended (“**Delaware Law**”).

**ARTICLE IV  
CAPITAL STOCK**

**(A) Authorized Shares.**

1. **Classes of Stock.** The total number of shares of stock that the Corporation shall have authority to issue is 305,000,000, consisting of 281,274,838 shares of common stock, \$0.001 par value per share ("**Common Stock**"), and 23,725,162 shares of preferred stock, \$0.001 par value per share ("**Preferred Stock**"). The first series of Preferred Stock shall be designated "**Series A Preferred Stock**" and shall consist of 1,580,371 shares. The second series of Preferred Stock shall be designated "**Series A-1 Preferred Stock**" and shall consist of 4,252,018 shares. The third series of Preferred Stock shall be designated "**Series B Preferred Stock**" and shall consist of 5,309,601 shares. The fourth series of Preferred Stock shall be designated "**Series C Preferred Stock**" and shall consist of 6,492,564 shares. The fifth series of Preferred Stock shall be designated "**Series D Preferred Stock**" and shall consist of 1,090,608 shares. The Series A Preferred Stock, Series A-1 Preferred Stock, Series B Preferred Stock, Series C Preferred Stock and Series D Preferred Stock shall be the "**Designated Preferred Stock**," and 5,000,000 shares shall be the "**Undesignated Preferred Stock**."

The powers, preferences and rights of, and the qualifications, limitations and restrictions upon, each class or series of stock shall be determined in accordance with, or as set forth below in, this Article IV. Every reference to Preferred Stock in Article IV(C) below means the Designated Preferred Stock. Immediately following the conversion of all outstanding Designated Preferred Stock into Common Stock pursuant to Article V Section 4, such shares so converted shall be cancelled, retired and eliminated from the shares that the Corporation shall be authorized to issue, and the Corporation shall no longer have the authority to issue any Designated Preferred Stock. This Certificate of Incorporation of this Corporation shall be appropriately amended to effect the conversion and the corresponding reductions in this Corporation's authorized capital stock.

2. **Undesignated Preferred Stock.** The Board of Directors is hereby empowered, without any action or vote by the Corporation's stockholders (except as may otherwise be provided by the terms of any class or series of Preferred Stock then outstanding), to authorize by resolution or resolutions from time to time the issuance of one or more classes or series of Undesignated Preferred Stock and to fix the designations, powers, preferences and relative, participating, optional or other rights, if any, and the qualifications, limitations or restrictions thereof, if any, with respect to each such class or series thereof and the number of shares constituting each such class or series, and to increase or decrease the number of shares of any such class or series to the extent permitted by Delaware Law.

**(B) Common Stock.**

Each holder of Common Stock, as such, shall be entitled to one vote for each share of Common Stock held of record by such holder on all matters on which stockholders generally are entitled to vote; *provided, however*, that, except as otherwise required by law, holders of Common Stock, as such, shall not be entitled to vote on any amendment to this Certificate of Incorporation (including any certificate of designations relating to any class or series of Preferred Stock) that relates solely to the terms of one or more outstanding classes or series of Preferred Stock if the holders of such affected class or series are entitled, either separately or together with the holders of one or more other such classes or series, to vote thereon pursuant to this Certificate of Incorporation (including any certificate of designations relating to any class or series of Preferred Stock) or pursuant to Delaware Law.

**(C) Designated Preferred Stock.**

The terms and provisions of the Designated Preferred Stock are as follows:

1. **Definitions.** For purposes of this ARTICLE IV(C), the following definitions shall apply:

(a) “**Conversion Price**” shall mean \$2.8304 per share for the Series A Preferred Stock, \$3.09636 per share for the Series A-1 Preferred Stock, \$7.5335 per share for the Series B Preferred Stock, \$12.321756 per share for the Series C Preferred Stock and \$13.753792 per share for the Series D Preferred Stock (each subject to adjustment from time to time for Recapitalizations and as otherwise set forth elsewhere herein).

(b) “**Convertible Securities**” shall mean any evidences of indebtedness, shares or other securities, directly or indirectly, convertible into or exchangeable for Common Stock.

(c) “**Corporation**” shall mean ShockWave Medical, Inc.

(d) “**Distribution**” shall mean the transfer of cash or other property without consideration whether by way of dividend or otherwise, other than dividends on Common Stock payable in Common Stock, or the purchase or redemption of shares of the Corporation by the Corporation for cash or property other than: (i) repurchases of Common Stock issued to or held by employees, officers, directors or consultants of the Corporation upon termination of their employment or services pursuant to agreements providing for the right of said repurchase, (ii) repurchases of Common Stock issued to or held by employees, officers, directors or consultants of the Corporation or its subsidiaries pursuant to rights of first refusal contained in agreements providing for such right, (iii) repurchase of capital stock of the Corporation in connection with the settlement of disputes with any stockholder, as approved by the Board of Directors, and (iv) any other repurchase or redemption of capital stock of the Corporation approved by the Preferred Requisite Majority, which shall include the Series C Consent.

(e) “**Dividend Rate**” shall mean an annual rate of \$0.226432 per share for the Series A Preferred Stock, \$0.24766 per share for the Series A-1 Preferred Stock, \$0.60268 per share for the Series B Preferred Stock, \$0.98576 per share for the Series C Preferred Stock and \$1.10044 per share for the Series D Preferred Stock (each subject to adjustment from time to time for Recapitalizations as set forth elsewhere herein).

(f) "**Liquidation Preference**" shall mean \$2.8304 per share for the Series A Preferred Stock, \$3.09636 per share for the Series A-1 Preferred Stock, \$7.5335 per share for the Series B Preferred Stock, \$12.321756 per share for the Series C Preferred Stock and \$13.753792 per share for the Series D Preferred Stock (each subject to adjustment from time to time for Recapitalizations as set forth elsewhere herein).

(g) "**Options**" shall mean rights, options or warrants to subscribe for, purchase or otherwise acquire Common Stock or Convertible Securities.

(h) "**Original Issue Price**" shall mean \$2.8304 per share for the Series A Preferred Stock, \$3.09636 per share for the Series A-1 Preferred Stock, \$7.5335 per share for the Series B Preferred Stock, \$12.321756 per share for the Series C Preferred Stock and \$13.753792 per share for the Series D Preferred Stock (each subject to adjustment from time to time for Recapitalizations as set forth elsewhere herein).

(i) "**Preferred Requisite Majority**" shall mean the holders of at least fifty-five percent (55%) of the outstanding shares of Preferred Stock (voting as a single class on an as-converted basis).

(j) "**Recapitalization**" shall mean any stock dividend, stock split, combination of shares, reorganization, recapitalization, reclassification or other similar event.

## 2. Dividends.

### (a) Preferred Stock Dividends.

(i) **Series D Preferred Stock Dividends and C Preferred Stock Dividends.** The holders of outstanding shares of Series D Preferred Stock and Series C Preferred Stock shall be entitled to receive dividends, when, as and if declared by the Board of Directors, out of any assets at the time legally available therefor, at the Dividend Rate specified for such shares of Series D Preferred Stock or Series C Preferred Stock, as the case may be, payable in preference and priority to any declaration or payment of any Distribution on the Series B Preferred Stock, Series A-1 Preferred Stock, Series A Preferred Stock and/or Common Stock of the Corporation in such calendar year. No Distributions shall be made with respect to the Series B Preferred Stock, Series A Preferred Stock, Series A-1 Preferred Stock and/or Common Stock unless dividends on the Series B Preferred Stock and Series C Preferred Stock have been declared in accordance with the preferences stated herein and all declared dividends on the Series D Preferred Stock and Series C Preferred Stock have been paid or set aside for payment to the Series D Preferred Stock holders and the Series C Preferred Stock holders. The right to receive dividends on shares of Series D Preferred Stock and Series C Preferred Stock shall not be cumulative, and no right to dividends shall accrue to holders of Series D Preferred Stock or Series C Preferred Stock by reason of the fact that dividends on said shares are not declared or paid. Payment of any dividends to the holders of Series D Preferred Stock and Series C Preferred Stock shall be on a *pro rata* basis. If, in connection with any dividend described in this Section 2(a)(i), the amount of dividends to be paid to the holders of Series D Preferred Stock and Series C Preferred Stock in the aggregate shall be insufficient to permit the payment to such holders of the full amount of their

respective Dividend Rates, then the amount of such dividends apportioned for payment to holders of Series D Preferred Stock and holders of Series C Preferred Stock, respectively, shall equal the aggregate amount of the dividends declared by the Board of Directors, multiplied by a fraction equal to the quotient of (A) the Dividend Rate for the applicable series of Preferred Stock, multiplied by the number of shares of such series of Preferred Stock then outstanding, *divided by*, (B) the sum of (x) the Dividend Rate for the Series D Preferred Stock, multiplied by the number of shares of Series D Preferred Stock then outstanding, *plus* (y) the Dividend Rate for the Series C Preferred Stock, multiplied by the number of shares of Series C Preferred Stock then outstanding.

(ii) **Series B Preferred Stock Dividends.** After all dividends on the Series D Preferred Stock and Series C Preferred Stock have been paid or set aside for payment to the holders of Series D Preferred Stock and Series C Preferred Stock, the holders of outstanding shares of Series B Preferred Stock shall be entitled to receive dividends, when, as and if declared by the Board of Directors, out of any assets at the time legally available therefor, at the Dividend Rate specified for such shares of Series B Preferred Stock payable in preference and priority to any declaration or payment of any Distribution on the Series A-1 Preferred Stock, Series A Preferred Stock and/or Common Stock of the Corporation in such calendar year. No Distributions shall be made with respect to the Common Stock unless dividends on the Series B Preferred Stock have been declared in accordance with the preferences stated herein and all declared dividends on the Series B Preferred Stock have been paid or set aside for payment to the Series B Preferred Stock holders. The right to receive dividends on shares of Series B Preferred Stock shall not be cumulative, and no right to dividends shall accrue to holders of Series B Preferred Stock by reason of the fact that dividends on said shares are not declared or paid. Payment of any dividends to the holders of Series B Preferred Stock shall be on a *pro rata* basis.

(iii) **Series A-1 Preferred Stock Dividends.** After all dividends on the Series B Preferred Stock have been paid or set aside for payment to the holders of Series B Preferred Stock, the holders of outstanding shares of Series A-1 Preferred Stock shall be entitled to receive dividends, when, as and if declared by the Board of Directors, out of any assets at the time legally available therefor, at the Dividend Rate specified for such shares of Series A-1 Preferred Stock payable in preference and priority to any declaration or payment of any Distribution on the Series A Preferred Stock and/or Common Stock of the Corporation in such calendar year. No Distributions shall be made with respect to the Common Stock unless dividends on the Series A-1 Preferred Stock have been declared in accordance with the preferences stated herein and all declared dividends on the Series A-1 Preferred Stock have been paid or set aside for payment to the Series A-1 Preferred Stock holders. The right to receive dividends on shares of Series A-1 Preferred Stock shall not be cumulative, and no right to dividends shall accrue to holders of Series A-1 Preferred Stock by reason of the fact that dividends on said shares are not declared or paid. Payment of any dividends to the holders of Series A-1 Preferred Stock shall be on a *pro rata* basis.

(iv) **Series A Preferred Stock Dividends.** After all dividends on the Series A-1 Preferred Stock have been paid or set aside for payment to the holders of Series A-1 Preferred Stock, the holders of outstanding shares of Series A Preferred Stock shall be entitled to receive dividends, when, as and if declared by the Board of Directors, out of any assets at the time legally available therefor, at the Dividend Rate specified for such shares of Series A Preferred Stock payable



in preference and priority to any declaration or payment of any Distribution on the Common Stock of the Corporation in such calendar year. No Distributions shall be made with respect to the Common Stock unless dividends on the Series A Preferred Stock have been declared in accordance with the preferences stated herein and all declared dividends on the Series A Preferred Stock have been paid or set aside for payment to the Series A Preferred Stock holders. The right to receive dividends on shares of Series A Preferred Stock shall not be cumulative, and no right to dividends shall accrue to holders of Series A Preferred Stock by reason of the fact that dividends on said shares are not declared or paid. Payment of any dividends to the holders of Series A Preferred Stock shall be on a *pro rata* basis.

(b) **Additional Dividends.** After the payment or setting aside for payment of the dividends described in Section 2(a), any additional dividends (other than dividends on Common Stock payable solely in Common Stock) set aside or paid in any fiscal year shall be set aside or paid among the holders of the Preferred Stock and Common Stock then outstanding in proportion to the greatest whole number of shares of Common Stock which would be held by each such holder if all shares of Preferred Stock were converted at the then-effective Conversion Rate (as defined in Section 4).

(c) **Non-Cash Distributions.** Whenever a Distribution provided for in this Section 2 shall be payable in property other than cash, the value of such Distribution shall be deemed to be the fair market value of such property as determined in good faith by the Board of Directors.

(d) **Consent to Certain Distributions.** In accordance with Section 500 of the California Corporations Code, a distribution can be made without regard to any preferential dividends arrears amount (as defined in Section 500 of the California Corporations Code) or any preferential rights amount (as defined in Section 500 of the California Corporations Code) in connection with (i) repurchases of Common Stock issued to or held by employees, officers, directors or consultants of the Corporation or its subsidiaries upon termination of their employment or services pursuant to agreements providing for the right of said repurchase, (ii) repurchases of Common Stock issued to or held by employees, officers, directors or consultants of the Corporation or its subsidiaries pursuant to rights of first refusal contained in agreements providing for such right, (iii) repurchases of Common Stock or Preferred Stock in connection with the settlement of disputes with any stockholder, as approved by the Board of Directors, and (iv) any other repurchase or redemption of Common Stock or Preferred Stock approved by the Preferred Requisite Majority.

(e) **Waiver of Dividends.** Any dividend preference of any series of Preferred Stock may be waived, in whole or in part, by the consent or vote of the holders of the majority of the outstanding shares of such series.

### 3. Liquidation Rights.

(a) **Liquidation Preference.** In the event of any liquidation, dissolution or winding up of the Corporation, either voluntary or involuntary:

(i) **Series D Preferred Stock and Series C Preferred Stock.** The holders of the Series D Preferred Stock and the Series C Preferred Stock shall be entitled to receive, prior and in preference to any Distribution of any of the assets of the Corporation to the holders of the Series B Preferred Stock, Series A-1 Preferred Stock, Series A Preferred Stock and/or Common Stock by reason of their ownership of such stock, an amount per share for each share of Series D Preferred Stock and Series C Preferred Stock, respectively, held by them equal to the sum of (i) the Liquidation Preference specified for such share of Series D Preferred Stock or Series C Preferred Stock, as the case may be, and (ii) all declared but unpaid dividends (if any) on such share of Series D Preferred Stock and Series C Preferred Stock, as the case may be. If upon the liquidation, dissolution or winding up of the Corporation, the assets of the Corporation legally available for distribution to the holders of the Series D Preferred Stock and Series C Preferred Stock are insufficient to permit the payment to such holders of the full amounts specified in this Section 3(a)(i), then the entire assets of the Corporation legally available for distribution shall be apportioned for distribution to holders of Series D Preferred Stock and holders of Series C Preferred Stock, respectively, with equal priority and *pro rata* among the holders of such series of Preferred Stock, in proportion to the full amounts they would otherwise be entitled to receive pursuant to this Section 3(a)(i), in an amount equal to the aggregate amount of the entire assets of the Corporation legally available for distribution, multiplied by a fraction equal to the quotient of (A) the full amounts specified in this Section 3(a)(i) as distributable to the holders of such series of Preferred Stock, *divided by*, (B) the full amounts specified in this Section 3(a)(i) as distributable to the holders of the Series D Preferred Stock and the Series C Preferred Stock.

(ii) **Series B Preferred Stock.** After payment has been made or set aside of the full amounts specified in Section 3(a)(i), the holders of the Series B Preferred Stock shall be entitled to receive, prior and in preference to any Distribution of any of the assets of the Corporation to the holders of the Series A-1 Preferred Stock, Series A Preferred Stock and/or Common Stock by reason of their ownership of such stock, an amount per share for each share of Series B Preferred Stock held by them equal to the sum of (i) the Liquidation Preference specified for such share of Series B Preferred Stock and (ii) all declared but unpaid dividends (if any) on such share of Series B Preferred Stock. If upon the liquidation, dissolution or winding up of the Corporation, the assets of the Corporation legally available for distribution to the holders of the Series B Preferred Stock are insufficient to permit the payment to such holders of the full amounts specified in this Section 3(a)(ii), then the entire assets of the Corporation legally available for distribution shall be distributed with equal priority and *pro rata* among the holders of the Series B Preferred Stock in proportion to the full amounts they would otherwise be entitled to receive pursuant to this Section 3(a)(ii).

(iii) **Series A-1 Preferred Stock.** After payment has been made or set aside of the full amounts specified in Section 3(a)(i) and Section 3(a)(ii), the holders of the Series A-1 Preferred Stock shall be entitled to receive, prior and in preference to any Distribution of any of the assets of the Corporation to the holders of the Series A Preferred Stock and/or Common Stock by reason of their ownership of such stock, an amount per share for each share of Series A-1 Preferred Stock held by them equal to the sum of (i) the Liquidation Preference specified for such share of Series A-1 Preferred Stock and (ii) all declared but unpaid dividends (if any) on such share of Series A-1 Preferred Stock. If upon the liquidation, dissolution or winding up of the Corporation, the assets of the Corporation legally available for distribution to the holders of the Series A-1 Preferred Stock are insufficient to permit the payment to such holders of the full amounts specified in this Section 3(a)(iii), then the entire assets of the Corporation legally available for distribution shall be distributed with equal priority and *pro rata* among the holders of the Series A-1 Preferred Stock in proportion to the full amounts they would otherwise be entitled to receive pursuant to this Section 3(a)(iii).

(iv) **Series A Preferred Stock.** After payment has been made or set aside of the full amounts specified in Section 3(a)(i), Section 3(a)(ii) and Section 3(a)(iii), the holders of the Series A Preferred Stock shall be entitled to receive, prior and in preference to any Distribution of any of the assets of the Corporation to the holders of the Common Stock by reason of their ownership of such stock, an amount per share for each share of Series A Preferred Stock held by them equal to the sum of (i) the Liquidation Preference specified for such share of Series A Preferred Stock and (ii) all declared but unpaid dividends (if any) on such share of Series A Preferred Stock. If upon the liquidation, dissolution or winding up of the Corporation, the assets of the Corporation legally available for distribution to the holders of the Series A Preferred Stock are insufficient to permit the payment to such holders of the full amounts specified in this Section 3(a)(iv), then the entire assets of the Corporation legally available for distribution shall be distributed with equal priority and *pro rata* among the holders of the Series A Preferred Stock in proportion to the full amounts they would otherwise be entitled to receive pursuant to this Section 3(a)(iv).

(b) **Remaining Assets.** After the payment or setting aside for payment to the holders of Preferred Stock of the full amounts specified in Section 3(a), the entire remaining assets of the Corporation legally available for distribution shall be distributed *pro rata* to holders of Common Stock of the Corporation in proportion to the number of shares of Common Stock held by them.

(c) **Shares not Treated as Both Preferred Stock and Common Stock in any Distribution.** Shares of Preferred Stock shall not be entitled to be converted into shares of Common Stock in order to participate in any Distribution, or series of Distributions, as shares of Common Stock, without first forgoing participation in the Distribution, or series of Distributions, as shares of Preferred Stock. Notwithstanding the above, for purposes of determining the amount each holder of shares of Preferred Stock is entitled to receive with respect to a Liquidation Event, each such holder of shares of a series of Preferred Stock shall be deemed to have converted (regardless of whether such holder actually converted) such holder's shares of such series into shares of Common Stock immediately prior to the Liquidation Event if, as a result of an actual conversion, such holder would receive, in the aggregate, an amount greater than the amount that would be distributed to such holder if such holder did not convert such series of Preferred Stock into shares of Common Stock. If any such holder shall be deemed to have converted shares of Preferred Stock into Common Stock pursuant to this paragraph, then such holder shall not be entitled to receive any distribution that would otherwise be made to holders of Preferred Stock that have not converted (or have not been deemed to have converted) into shares of Common Stock.

(d) **Reorganization.** For purposes of this Section 3, a liquidation, dissolution or winding up of the Corporation shall be deemed to be occasioned by, or to include, (i) the acquisition of the Corporation by another entity by means of any transaction or series of related transactions to which the Corporation is party (including, without limitation, any stock acquisition, reorganization, merger or consolidation but excluding any sale of stock for capital raising purposes) other than a transaction or series of transactions in which the holders of the voting securities of the Corporation outstanding immediately prior to such transaction retain, immediately after such transaction or series of transactions, as a result of shares in the Corporation held by such holders prior to such transaction, at least a majority of the total voting power represented by the outstanding voting securities of the Corporation or such other surviving or resulting entity (or if the Corporation or such other surviving

or resulting entity is a wholly-owned subsidiary immediately following such acquisition, its parent); (ii) a sale, lease or other disposition (including by exclusive license) of all or substantially all of the assets of the Corporation and its subsidiaries taken as a whole by means of any transaction or series of related transactions, except where such sale, lease or other disposition is to a wholly-owned subsidiary of the Corporation; or (iii) any liquidation, dissolution or winding up of the Corporation, whether voluntary or involuntary (each of the foregoing clauses (i), (ii) and (iii), a “**Liquidation Event**”). The treatment of any transaction or series of related transactions as a liquidation, dissolution or winding up pursuant to clause (i) or (ii) of the preceding sentence may be waived by the consent or vote of the Preferred Requisite Majority and, in the event of a Series C Liquidity Event or a Series D Liquidity Event (each as defined below), the Series C Consent and/or the Series D Consent, as the case may be (each as defined below).

(e) **Valuation of Non-Cash Consideration.** If any assets of the Corporation distributed to stockholders in connection with any liquidation, dissolution, or winding up of the Corporation are other than cash, then the value of such assets shall be their fair market value as determined in good faith by the Board of Directors, *except that* any publicly-traded securities to be distributed to stockholders in a liquidation, dissolution, or winding up of the Corporation shall be valued as follows:

(i) If the securities are then traded on a national securities exchange, then the value of the securities shall be deemed to be the average of the closing prices of the securities on such exchange over the ten (10) trading day period ending five (5) trading days prior to the Distribution;

(ii) if the securities are actively traded over-the-counter, then the value of the securities shall be deemed to be the average of the closing bid prices of the securities over the ten (10) trading day period ending five (5) trading days prior to the Distribution.

In the event of a merger or other acquisition of the Corporation by another entity, the Distribution date shall be deemed to be the date such transaction closes.

For the purposes of this subsection 3(e), “**trading day**” shall mean any day which the exchange or system on which the securities to be distributed are traded is open and “**closing prices**” or “**closing bid prices**” shall be deemed to be: (i) for securities traded primarily on the New York Stock Exchange, NYSE American or a NASDAQ market, the last reported trade price or sale price, as the case may be, at 4:00 p.m., New York time, on that day and (ii) for securities listed or traded on other exchanges, markets and systems, the market price as of the end of the regular hours trading period that is generally accepted as such for such exchange, market or system. If, after the date hereof, the benchmark times generally accepted in the securities industry for determining the market price of a stock as of a given trading day shall change from those set forth above, the fair market value shall be determined as of such other generally accepted benchmark times.

4. **Conversion.** The holders of the Preferred Stock shall have conversion rights as follows:

(a) **Right to Convert.** Each share of Preferred Stock shall be convertible, at the option of the holder thereof, at any time after the date of issuance of such share at the office of the Corporation or any transfer agent for the Preferred Stock, into that number of fully-paid, nonassessable shares of Common Stock determined by dividing the Original Issue Price for the relevant series by the Conversion Price for such series. (The number of shares of Common Stock into which each share of Preferred Stock of a series may be converted is hereinafter referred to as the “**Conversion Rate**” for each such series.) Upon any decrease or increase in the Conversion Price for any series of Preferred Stock, as described in this Section 4, the Conversion Rate for such series shall be appropriately increased or decreased.

(b) **Automatic Conversion.** Each share of Preferred Stock shall automatically be converted into fully-paid, non-assessable shares of Common Stock at the then effective Conversion Rate for such share (i) immediately prior to the closing of a firm commitment underwritten initial public offering pursuant to an effective registration statement filed under the Securities Act of 1933, as amended (the “**Securities Act**”), covering the offer and sale of the Corporation’s Common Stock, *provided* that the offering price per share is not less than \$24.643512 (as adjusted for Recapitalizations) and the aggregate gross proceeds to the Corporation are not less than \$30,000,000 (the “**Qualified IPO**”), or (ii) upon the receipt by the Corporation of a written request for such conversion from the Preferred Requisite Majority and, unless such conversion is in connection with a Series D/C Conversion Event (as defined below), the Series D/C Consent (as defined below) and, if applicable, the Series D Consent, or, if later, the effective date for conversion specified in such requests (each of the events referred to in (i) and (ii) are referred to herein as an “**Automatic Conversion Event**”).

(c) **Mechanics of Conversion.** No fractional shares of Common Stock shall be issued upon conversion of Preferred Stock. In lieu of any fractional shares to which the holder would otherwise be entitled, the Corporation shall pay cash equal to such fraction multiplied by the then fair market value of a share of Common Stock as determined by the Board of Directors. For such purpose, all shares of Preferred Stock held by each holder of Preferred Stock shall be aggregated, and any resulting fractional share of Common Stock shall be paid in cash. Before any holder of Preferred Stock shall be entitled to convert the same into full shares of Common Stock, and to receive certificates therefor, the holder shall either (A) surrender the certificate or certificates therefor, duly endorsed, at the office of the Corporation or of any transfer agent for the Preferred Stock or (B) notify the Corporation or its transfer agent that such certificates have been lost, stolen or destroyed and execute an agreement satisfactory to the Corporation to indemnify the Corporation from any loss incurred by it in connection with such certificates, and shall give written notice to the Corporation at such office that the holder elects to convert the same; *provided, however*, that on the date of an Automatic Conversion Event, the outstanding shares of Preferred Stock shall be converted automatically without any further action by the holders of such shares and whether or not the certificates representing such shares are surrendered to the Corporation or its transfer agent; *provided further*, however, that the Corporation shall not be obligated to issue certificates evidencing the shares of Common Stock issuable upon such Automatic Conversion Event unless either the certificates evidencing such shares of Preferred Stock are delivered to the Corporation or its transfer agent as provided above, or the holder notifies the Corporation or its transfer agent that such certificates have been lost, stolen or destroyed and executes an agreement satisfactory to the Corporation to indemnify the Corporation from any loss incurred by it in connection with such certificates. On the date of the occurrence of an

Automatic Conversion Event, each holder of record of shares of Preferred Stock shall be deemed to be the holder of record of the Common Stock issuable upon such conversion, notwithstanding that the certificates representing such shares of Preferred Stock shall not have been surrendered at the office of the Corporation, that notice from the Corporation shall not have been received by any holder of record of shares of Preferred Stock, or that the certificates evidencing such shares of Common Stock shall not then be actually delivered to such holder.

(d) **Adjustments to Conversion Price for Diluting Issues.**

(i) **Special Definition.** For purposes of this paragraph 4(d), “**Additional Shares of Common**” shall mean all shares of Common Stock issued (or, pursuant to paragraph 4(d)(iii), deemed to be issued) by the Corporation after the filing of this Amended and Restated Certificate of Incorporation (the “**Filing Date**”), other than issuances or deemed issuances of:

- (1) shares of Common Stock upon the conversion of the Preferred Stock outstanding as of the date of the first issuance of shares of Series D Preferred Stock;
- (2) shares of Common Stock and options, warrants or other rights to purchase Common Stock issued or issuable to employees, officers or directors of, or consultants, advisors or other service providers to the Corporation or any subsidiary pursuant to stock grants, restricted stock purchase agreements, option plans, purchase plans, incentive programs or similar arrangements approved by the Board of Directors, including the affirmative vote of at least two of the Preferred Directors (as defined below);
- (3) shares of Common Stock upon the exercise or conversion of Options or Convertible Securities outstanding as of the date of the first issuance of shares of Series D Preferred Stock;
- (4) shares of Common Stock issued or issuable as a dividend or distribution on Preferred Stock or pursuant to any event for which adjustment is made pursuant to paragraph 4(e), 4(f) or 4(g) hereof;
- (5) shares of Common Stock issued or issuable in a Qualified IPO or registered public offering under the Securities Act;
- (6) shares of Common Stock issued or issuable pursuant to the acquisition of another corporation by the Corporation by merger, purchase of substantially all of the assets or other reorganization or to a joint venture agreement, *provided*, that such issuances are approved by the Board of Directors, including the affirmative vote of at least two of the Preferred Directors;
- (7) shares of Common Stock issued or issuable to banks, equipment lessors, real property lessors, financial institutions or other persons engaged in the business of making loans pursuant to a debt financing, commercial leasing or real property leasing transaction approved by the Board of Directors, including the affirmative vote of at least two of the Preferred Directors;

(8) shares of Common Stock issued or issuable in connection with any settlement of any action, suit, proceeding or litigation approved by the Board of Directors, including the affirmative vote of at least two of the Preferred Directors;

(9) shares of Common Stock issued or issuable in connection with sponsored research, collaboration, technology license, development, OEM, marketing or other similar agreements or strategic partnerships approved by the Board of Directors, including the affirmative vote of at least two of the Preferred Directors;

(10) shares of Common Stock issued or issuable to suppliers or third party service providers in connection with the provision of goods or services pursuant to transactions approved by the Board of Directors, including the affirmative vote of at least two of the Preferred Directors; and

(11) shares of Common Stock that are otherwise excluded from the definition of “**Additional Shares of Common**” by the approval of the Preferred Requisite Majority and, if such issuance or deemed issuance would constitute a Series C Dilutive Issuance or a Series D Dilutive Issuance (each as defined below), as the case may be, the Series C Consent and/or the Series D Consent, as the case may be.

(ii) **No Adjustment of Conversion Price.** No adjustment in the Conversion Price of a particular series of Preferred Stock shall be made in respect of the issuance of Additional Shares of Common unless the consideration per share (as determined pursuant to paragraph 4(d)(v)) for an Additional Share of Common issued or deemed to be issued by the Corporation is less than the Conversion Price in effect on the date of, and immediately prior to such issue, for such series of Preferred Stock.

(iii) **Deemed Issue of Additional Shares of Common.** In the event the Corporation at any time or from time to time after the date of the filing of this Amended and Restated Certificate of Incorporation shall issue any Options or Convertible Securities or shall fix a record date for the determination of holders of any class of securities entitled to receive any such Options or Convertible Securities, then the maximum number of shares (as set forth in the instrument relating thereto without regard to any provisions contained therein for a subsequent adjustment of such number) of Common Stock issuable upon the exercise of such Options or, in the case of Convertible Securities, the conversion or exchange of such Convertible Securities or, in the case of Options for Convertible Securities, the exercise of such Options and the conversion or exchange of the underlying securities, shall be deemed to have been issued as of the time of such issue or, in case such a record date shall have been fixed, as of the close of business on such record date, *provided* that in any such case in which shares are deemed to be issued:

(1) no further adjustment in the Conversion Price of any series of Preferred Stock shall be made upon the subsequent issue of Convertible Securities or shares of Common Stock in connection with the exercise of such Options or conversion or exchange of such Convertible Securities;

(2) if such Options or Convertible Securities by their terms provide, with the passage of time or otherwise, for any change in the consideration payable to the Corporation or in the number of shares of Common Stock issuable upon the exercise, conversion or exchange thereof (other than a change pursuant to the anti-dilution provisions of such Options or Convertible Securities such as this Section 4(d) or pursuant to Recapitalization provisions of such Options or Convertible Securities such as Sections 4(e), 4(f) and 4(g) hereof), the Conversion Price of each series of Preferred Stock and any subsequent adjustments based thereon shall be recomputed to reflect such change as if such change had been in effect as of the original issue thereof (or upon the occurrence of the record date with respect thereto);

(3) no readjustment pursuant to clause (2) above shall have the effect of increasing the Conversion Price of a series of Preferred Stock to an amount above the Conversion Price that would have resulted from any other issuances of Additional Shares of Common and any other adjustments provided for herein between the original adjustment date and such readjustment date;

(4) upon the expiration of any such Options or any rights of conversion or exchange under such Convertible Securities which shall not have been exercised, the Conversion Price of each series of Preferred Stock computed upon the original issue thereof (or upon the occurrence of a record date with respect thereto) and any subsequent adjustments based thereon shall, upon such expiration, be recomputed as if:

(a) in the case of Convertible Securities or Options for Common Stock, the only Additional Shares of Common issued were the shares of Common Stock, if any, actually issued upon the exercise of such Options or the conversion or exchange of such Convertible Securities and the consideration received therefor was the consideration actually received by the Corporation for the issue of such exercised Options plus the consideration actually received by the Corporation upon such exercise or for the issue of all such Convertible Securities which were actually converted or exchanged, plus the additional consideration, if any, actually received by the Corporation upon such conversion or exchange, and

(b) in the case of Options for Convertible Securities, only the Convertible Securities, if any, actually issued upon the exercise thereof were issued at the time of issue of such Options, and the consideration received by the Corporation for the Additional Shares of Common deemed to have been then issued was the consideration actually received by the Corporation for the issue of such exercised Options, plus the consideration deemed to have been received by the Corporation (determined pursuant to Section 4(d)(v)) upon the issue of the Convertible Securities with respect to which such Options were actually exercised; and

(5) if such record date shall have been fixed and such Options or Convertible Securities are not issued on the date fixed therefor, the adjustment previously made in the Conversion Price which became effective on such record date shall be canceled as of the close of business on such record date, and thereafter the Conversion Price shall be adjusted pursuant to this paragraph 4(d)(iii) as of the actual date of their issuance.



(iv) **Adjustment of Conversion Price Upon Issuance of Additional Shares of Common.** In the event this Corporation shall issue Additional Shares of Common (including Additional Shares of Common deemed to be issued pursuant to paragraph 4(d)(iii)) without consideration or for a consideration per share less than the applicable Conversion Price of a series of Preferred Stock in effect on the date of and immediately prior to such issue, then, the Conversion Price of the affected series of Preferred Stock shall be reduced, concurrently with such issue, to a price (calculated to the nearest cent) determined by multiplying such Conversion Price by a fraction, the numerator of which shall be the number of shares of Common Stock outstanding immediately prior to such issue plus the number of shares which the aggregate consideration received by the Corporation for the total number of Additional Shares of Common so issued would purchase at such Conversion Price, and the denominator of which shall be the number of shares of Common Stock outstanding immediately prior to such issue plus the number of such Additional Shares of Common so issued. Notwithstanding the foregoing, the Conversion Price shall not be reduced at such time if the amount of such reduction would be less than \$0.01, but any such amount shall be carried forward, and a reduction will be made with respect to such amount at the time of, and together with, any subsequent reduction which, together with such amount and any other amounts so carried forward, equal \$0.01 or more in the aggregate. For the purposes of this Subsection 4(d)(iv), all shares of Common Stock issuable upon conversion of all outstanding shares of Preferred Stock and the exercise and/or conversion of any other outstanding Convertible Securities and all outstanding Options shall be deemed to be outstanding.

(v) **Determination of Consideration.** For purposes of this subsection 4(d), the consideration received by the Corporation for the issue (or deemed issue) of any Additional Shares of Common shall be computed as follows:

(1) **Cash and Property.** Such consideration shall:

(a) insofar as it consists of cash, be computed at the aggregate amount of cash received by the Corporation before deducting any discounts, commissions or other expenses allowed, paid or incurred by the Corporation for any underwriting or otherwise in connection with such issuance;

(b) insofar as it consists of property other than cash, be computed at the fair market value thereof at the time of such issue, as determined in good faith by the Board of Directors; and

(c) in the event Additional Shares of Common are issued together with other shares or securities or other assets of the Corporation for consideration which covers both, be the proportion of such consideration so received, computed as provided in clauses (a) and (b) above, as reasonably determined in good faith by the Board of Directors.

(2) **Options and Convertible Securities.** The consideration per share received by the Corporation for Additional Shares of Common deemed to have been issued pursuant to paragraph 4(d)(iii) shall be determined by dividing:

(x) the total amount, if any, received or receivable by the Corporation as consideration for the issue of such Options or Convertible Securities, plus the minimum aggregate amount of additional consideration (as set forth in the instruments relating thereto, without regard to any provision contained therein for a subsequent adjustment of such consideration) payable to the Corporation upon the exercise of such Options or the conversion or exchange of such Convertible Securities, or in the case of Options for Convertible Securities, the exercise of such Options for Convertible Securities and the conversion or exchange of such Convertible Securities by

(y) the maximum number of shares of Common Stock (as set forth in the instruments relating thereto, without regard to any provision contained therein for a subsequent adjustment of such number) issuable upon the exercise of such Options or the conversion or exchange of such Convertible Securities.

(e) **Adjustments for Subdivisions or Combinations of Common Stock.** In the event the outstanding shares of Common Stock shall be subdivided (by stock split, by payment of a stock dividend or otherwise), into a greater number of shares of Common Stock, the Conversion Price of each series of Preferred Stock in effect immediately prior to such subdivision shall, concurrently with the effectiveness of such subdivision, be proportionately decreased. In the event the outstanding shares of Common Stock shall be combined (by reclassification or otherwise) into a lesser number of shares of Common Stock, the Conversion Prices in effect immediately prior to such combination shall, concurrently with the effectiveness of such combination, be proportionately increased.

(f) **Adjustments for Subdivisions or Combinations of Preferred Stock.** In the event the outstanding shares of Preferred Stock or a series of Preferred Stock shall be subdivided (by stock split, by payment of a stock dividend or otherwise), into a greater number of shares of Preferred Stock, the Dividend Rate, Original Issue Price and Liquidation Preference of the affected series of Preferred Stock in effect immediately prior to such subdivision shall, concurrently with the effectiveness of such subdivision, be proportionately decreased. In the event the outstanding shares of Preferred Stock or a series of Preferred Stock shall be combined (by reclassification or otherwise) into a lesser number of shares of Preferred Stock, the Dividend Rate, Original Issue Price and Liquidation Preference of the affected series of Preferred Stock in effect immediately prior to such combination shall, concurrently with the effectiveness of such combination, be proportionately increased.

(g) **Adjustments for Reclassification, Exchange and Substitution.** Subject to Section 3, if the Common Stock issuable upon conversion of the Preferred Stock shall be changed into the same or a different number of shares of any other class or classes of stock, whether by capital reorganization, reclassification or otherwise (other than a subdivision or combination of shares provided for above), then, in any such event, in lieu of the number of shares of Common Stock which the holders would otherwise have been entitled to receive each holder of such Preferred Stock shall have the right thereafter to convert such shares of Preferred Stock into a number of shares of such other class or classes of stock which a holder of the number of shares of Common Stock deliverable upon conversion of such series of Preferred Stock immediately before that change would have been entitled to receive in such reorganization or reclassification, all subject to further adjustment as provided herein with respect to such other shares.

(h) **Certificate as to Adjustments.** Upon the occurrence of each adjustment or readjustment of the Conversion Price pursuant to this Section 4, the Corporation at its expense shall promptly compute such adjustment or readjustment in accordance with the terms hereof and furnish to each holder of Preferred Stock a certificate setting forth such adjustment or readjustment and showing in detail the facts upon which such adjustment or readjustment is based. The Corporation shall, upon the written request at any time of any holder of Preferred Stock, furnish or cause to be furnished to such holder a like certificate setting forth (i) such adjustments and readjustments, (ii) the Conversion Price at the time in effect and (iii) the number of shares of Common Stock and the amount, if any, of other property which at the time would be received upon the conversion of Preferred Stock.

(i) **Waiver of Adjustment of Conversion Price.** Notwithstanding anything herein to the contrary, any downward adjustment of the Conversion Price of any series of Preferred Stock may be waived by the consent or vote of the holders of a majority of the outstanding shares of such series. Any such waiver shall bind all future holders of shares of such series of Preferred Stock.

(j) **Notices of Record Date.** In the event that this Corporation shall propose at any time:

(i) to declare any Distribution upon its Common Stock, whether in cash, property, stock or other securities, whether or not a regular cash dividend and whether or not out of earnings or earned surplus;

(ii) to effect any reclassification or recapitalization of its Common Stock outstanding involving a change in the Common Stock; or

(iii) to voluntarily liquidate or dissolve or to enter into any transaction deemed to be a Liquidation Event pursuant to Section 3(d);

then, in connection with each such event, this Corporation shall send to the holders of the Preferred Stock ten (10) days prior written notice of the date on which a record shall be taken for such Distribution (and specifying the date on which the holders of Common Stock shall be entitled thereto and, if applicable, the amount and character of such Distribution) or for determining rights to vote in respect of the matters referred to in (ii) and (iii) above.

Such written notice shall be given by first class certified or registered mail or express courier, postage prepaid, addressed to the holders of Preferred Stock at the address for each such holder as shown on the books of the Corporation and shall be deemed given on the earlier of the date such notice is received and, if sent by registered or certified mail, five (5) days after deposit with the postal service or, if sent by express courier specifying next day delivery, one (1) day after deposit with such courier.

The notice provisions set forth in this section may be shortened or waived prospectively or retrospectively by the consent or vote of the Preferred Requisite Majority.

(k) **Reservation of Stock Issuable Upon Conversion.** The Corporation shall at all times reserve and keep available out of its authorized but unissued shares of Common Stock solely for the purpose of effecting the conversion of the shares of the Preferred Stock, such number of its shares of Common Stock as shall from time to time be sufficient to effect the conversion of all then outstanding shares of the Preferred Stock; and if at any time the number of authorized but unissued shares of Common Stock shall not be sufficient to effect the conversion of all then outstanding shares of the Preferred Stock, the Corporation will take such corporate action as may, in the opinion of its counsel, be necessary to increase its authorized but unissued shares of Common Stock to such number of shares as shall be sufficient for such purpose.

#### 5. Voting.

(a) **Restricted Class Voting.** Except as otherwise expressly provided herein or as required by law, the holders of Preferred Stock and the holders of Common Stock shall vote together and not as separate classes.

(b) **No Series Voting.** Other than as provided herein or required by law, there shall be no series voting.

(c) **Preferred Stock.** Each holder of Preferred Stock shall be entitled to the number of votes equal to the number of shares of Common Stock into which the shares of Preferred Stock held by such holder could be converted as of the record date. Fractional votes shall not be permitted and any fractional voting rights resulting from the above formula (after aggregating all shares into which shares of Preferred Stock held by each holder could be converted) shall be disregarded. Except as otherwise expressly provided herein or as required by law, the holders of shares of the Preferred Stock shall be entitled to vote on all matters on which the Common Stock shall be entitled to vote. Holders of Preferred Stock shall be entitled to notice of any stockholders' meeting in accordance with the Bylaws of the Corporation.

#### (d) Election of Directors.

(i) **Series D/C Director.** So long as an aggregate of at least 1,000,000 shares (as adjusted for Recapitalizations) of Series D Preferred Stock and Series C Preferred Stock remain outstanding, the holders of Series D Preferred Stock and Series C Preferred Stock, voting together as a separate class, shall be entitled to elect one member of the Corporation's Board of Directors (the "**Series D/C Director**").

(ii) **Series B Director.** So long as at least 1,000,000 shares (as adjusted for Recapitalizations) of Series B Preferred Stock remain outstanding, the holders of Series B Preferred Stock, voting as a separate class, shall be entitled to elect one member of the Corporation's Board of Directors (the "**Series B Director**").

(iii) **Series A-1 Director.** So long as at least 1,000,000 shares (as adjusted for Recapitalizations) of Series A-1 Preferred Stock remain outstanding, the holders of Series A-1 Preferred Stock, voting as a separate class, shall be entitled to elect one member of the Corporation's Board of Directors (the "**Series A-1 Director**").

(iv) **Series A Director.** So long as at least 1,000,000 shares (as adjusted for Recapitalizations) of Series A Preferred Stock remain outstanding, the holders of Series A Preferred Stock, voting as a separate class, shall be entitled to elect one member of the Corporation's Board of Directors (the "**Series A Director**" and together with the Series B Director, Series A-1 Director, and Series D/C Director, the "**Preferred Directors**").

(v) **Common Directors.** The holders of Common Stock, voting as a separate class, shall be entitled to elect two members of the Corporation's Board of Directors.

(vi) **Mutual Directors.** Any other members of the Corporation's Board of Directors shall be elected by both (A) the holders of Preferred Stock, voting as a separate class and on an as-converted basis, and (B) the holders of Common Stock, voting as a separate class.

(vii) Any director elected pursuant to Section 5(d) may be removed without cause by, and only by, the affirmative vote of the holders of the shares of the class or series of capital stock entitled to elect such director, given either at a special meeting of such stockholders duly called for that purpose or pursuant to a written consent of stockholders. If the holders of such shares fail to elect a sufficient number of directors to fill all respective directorships for which they are entitled to elect directors, voting as a separate class and series, pursuant to Section 5(d), then any directorship not so filled shall remain vacant until such time as the holders of such shares elect a person to fill such directorship by vote or written consent in lieu of a meeting, and no such directorship may be filled by stockholders of the Corporation other than by the stockholders of the Corporation that are entitled to elect a person to fill such directorship, voting as separate class and series. At any meeting held for the purpose of electing a director, the presence in person or by proxy of the holders of a majority of the outstanding shares of the class or series entitled to elect such director shall constitute a quorum for the purpose of electing such director. Except as otherwise provided in this Section 5(d), a vacancy in any directorship filled by the holders of any class or series shall be filled only by vote or written consent in lieu of a meeting of the holders of such class or series or by any remaining director or directors elected by the holders of such class or series pursuant to this Section 5(d).

(e) **Adjustment in Authorized Common Stock.** The number of authorized shares of Common Stock may be increased or decreased (but not below the number of shares of Common Stock then outstanding) by an affirmative vote of the holders of a majority of the outstanding shares of Preferred Stock, voting as a combined class on an as-converted basis.

(f) **Common Stock.** Each holder of shares of Common Stock shall be entitled to one vote for each share thereof held.

## 6. Protective Provisions.

(a) **Preferred Stock Protective Provisions.** So long as any shares of Preferred Stock remain outstanding, the Corporation shall not (either directly or indirectly, whether by amendment, merger, consolidation or otherwise), without first obtaining the approval of the Preferred Requisite Majority (by vote or written consent as provided by law), in addition to any other vote required by law:

(i) amend, alter or repeal any provision of this Amended and Restated Certificate of Incorporation or bylaws of the Corporation if such action would alter the rights, preferences, privileges or powers of, or restrictions provided for the benefit of the Preferred Stock or any series thereof;

(ii) increase or decrease (other than for decreases resulting from conversion of the Preferred Stock or any series thereof) the authorized number of shares of Common Stock or Preferred Stock, or any series thereof;

(iii) increase or decrease the size of the Board of Directors;

(iv) authorize or create (by reclassification, merger or otherwise), issue, or obligate itself to issue, any new class or series of equity security (including any security convertible into or exercisable or exchangeable for any equity security) having rights, preferences or privileges with respect to dividends, redemption or payments upon liquidation senior to or on parity with the Series D Preferred Stock or having voting rights other than those granted to the Series D Preferred Stock generally;

(v) make or obligate itself to make any transfer of cash or other property without consideration whether by way of dividend or otherwise, other than dividends on Common Stock payable in Common Stock, or the purchase or redemption of shares of the Corporation by the Corporation or its subsidiaries for cash or property other than: (A) repurchases of Common Stock issued to or held by employees, officers, directors or consultants of the Corporation upon termination of their employment or services pursuant to agreements providing for the right of said repurchase at the original cost thereof, (B) repurchases of Common Stock issued to or held by employees, officers, directors or consultants of the Corporation or its subsidiaries pursuant to the bona fide exercise of rights of first refusal contained in agreements providing for such right and approved by the Board (including the affirmative vote of at least two Preferred Directors), and (C) repurchases of capital stock of the Corporation in connection with the settlement of disputes with any stockholder approved by the Board of Directors (including the affirmative vote of at least two Preferred Directors);

(vi) conduct any liquidation, acquisition, reorganization, merger or consolidation of the Company or enter into any or obligate itself to enter into any transaction or series of related transactions deemed to be a Liquidation Event, including but not limited to (A) a sale, lease or other disposition (including by exclusive license) of all or substantially all of the assets or intellectual property of the Corporation and its subsidiaries, if any, taken as a whole by means of any transaction or series of related transactions, except where such sale, lease or other disposition is to a wholly-owned subsidiary of the Corporation; or (B) any liquidation, dissolution or winding up of the Corporation, whether voluntary or involuntary;

(vii) enter into or obligate itself to enter into any exclusive license of the assets or of a significant program of the Corporation;

(viii) conduct any liquidation, acquisition, reorganization, merger or consolidation by the Corporation of a business for consideration with value of \$500,000 or more in the aggregate (other than a merger exclusively to effect a change of domicile of the Corporation);

(ix) incur or assume or obligate itself to incur or assume any non-capital lease indebtedness of \$500,000 or more in the aggregate;  
(x) increase the number of shares authorized for issuance under any existing stock or option plan or create any new stock or option plan;

(xi) negotiate or authorize the disposal of any shares in a public offering pursuant to an effective registration statement filed under the Securities Act, whether a Qualified IPO or otherwise;

(xii) create or hold capital stock in any subsidiary that is not a wholly-owned subsidiary, dispose of any subsidiary stock or permit any subsidiary to sell to any party other than the Corporation any of its securities or all or substantially all of its assets;

(xiii) amend or deviate in a material manner from the Financing Budget (as defined in a certain Series D Preferred Stock Purchase Agreement) unless otherwise approved by the Board of Directors, including the affirmative vote of at least two Preferred Directors; or

(xiv) amend this Section 6(a).

(b) **Series D Preferred Stock and Series C Preferred Stock Protective Provisions.** So long as any shares of Series D Preferred Stock or Series C Preferred Stock remain outstanding, the Corporation shall not (either directly or indirectly, whether by amendment, merger, consolidation or otherwise), without first obtaining the approval of sixty percent (60%) in aggregate of the outstanding shares of Series D Preferred Stock and Series C Preferred Stock (by vote or written consent as provided by law, the “**Series D/C Consent**”), in addition to any other vote required by law:

(i) waive, amend, alter, or repeal the right of the holders of Series D Preferred Stock and Series C Preferred Stock to elect one member of the Corporation’s Board of Directors as currently set forth in Section 5(d)(i);

(ii) effect an automatic conversion pursuant to Section 4(b)(ii) hereof unless in connection with a Liquidation Event where the amounts paid in cash upon consummation of such transaction to the holders of Series D Preferred Stock and Series C Preferred Stock exceed the Liquidation Preference of such Series C Preferred Stock and such Series D Preferred Stock (a “**Series D/C Conversion Event**”); *provided*, that if the amounts paid in cash upon consummation of such transaction to the holders of Series D Preferred Stock does not exceed the Liquidation Preference of such Series D Preferred Stock, then the Series D Consent (as defined below) shall also be obtained; or

(iii) waive, amend, alter, or repeal this Section 6(b) or Section 4(b)(ii) of this Article IV(C).

(c) **Additional Series D Preferred Stock Protective Provisions.** So long as any shares of Series D Preferred Stock remain outstanding, the Corporation shall not (either directly or indirectly, whether by amendment, merger, consolidation or otherwise), without first obtaining the approval of sixty percent (60%) in aggregate of the outstanding shares of Series D Preferred Stock (by vote or

written consent as provided by law, the “**Series D Consent**”), in addition to any other vote required by law, amend, alter or repeal any provision of this Amended and Restated Certificate of Incorporation or bylaws of the Corporation if such action would adversely and disproportionately alter the rights, preferences, privileges or powers of, or restrictions provided for the benefit of the Series D Preferred Stock compared with other series of Preferred Stock. Without limiting the generality of the foregoing, so long as any shares of Series D Preferred Stock remain outstanding, the Corporation shall not (either directly or indirectly, whether by amendment, merger, consolidation or otherwise), without first obtaining the Series D Consent, in addition to any other vote required by law:

(i) exclude an issuance of Common Stock or Convertible Securities from the definition of “Additional Shares of Common” pursuant to Section 4(d)(i)(11) with a price per share of Common Stock (as converted) below the Conversion Price applicable to Series D Preferred Stock (a “**Series D Dilutive Issuance**”);

(ii) allow for the waiver of a Liquidation Event by the Preferred Requisite Majority for a transaction in which the holders of Series D Preferred Stock would receive less than the Liquidation Preference specified for each such share of Series D Preferred Stock (a “**Series D Liquidity Event**”); or

(iii) waive, amend, alter, or repeal this Section 6(c), the last sentence of Section 3(d) (in respect of a Series D Liquidity Event) or Section 4(d)(i)(11) (in respect of a Series D Dilutive Issuance) of this Article IV(C).

(d) **Additional Series C Preferred Stock Protective Provisions.** So long as any shares of Series C Preferred Stock remain outstanding, the Corporation shall not (either directly or indirectly, whether by amendment, merger, consolidation or otherwise), without first obtaining the approval of sixty percent (60%) in aggregate of the outstanding shares of Series C Preferred Stock (by vote or written consent as provided by law, the “**Series C Consent**”), in addition to any other vote required by law, amend, alter or repeal any provision of this Amended and Restated Certificate of Incorporation or bylaws of the Corporation if such action would adversely and disproportionately alter the rights, preferences, privileges or powers of, or restrictions provided for the benefit of the Series C Preferred Stock compared with other series of Preferred Stock. Without limiting the generality of the foregoing, so long as any shares of Series C Preferred Stock remain outstanding, the Corporation shall not (either directly or indirectly, whether by amendment, merger, consolidation or otherwise), without first obtaining the Series C Consent, in addition to any other vote required by law:

(i) exclude an issuance of Common Stock or Convertible Securities from the definition of “Additional Shares of Common” pursuant to Section 4(d)(i)(11) with a price per share of Common Stock (as converted) below the Conversion Price applicable to Series C Preferred Stock (a “**Series C Dilutive Issuance**”);

(ii) allow for the waiver of a Liquidation Event by the Preferred Requisite Majority for a transaction in which the holders of Series C Preferred Stock would receive less than the Liquidation Preference specified for each such share of Series C Preferred Stock (a “**Series C Liquidity Event**”); or



(iii) waive, amend, alter, or repeal this Section 6(d), the last sentence of Section 3(d) (in respect of a Series C Liquidity Event) or Section 4(d)(i)(11) (in respect of a Series C Dilutive Issuance) of this Article IV(C).

7. **Notices.** Unless otherwise expressly provided in this Amended and Restated Certificate of Incorporation, any notice required or permitted by the provisions of this ARTICLE IV(C) to be given to the holders of Preferred Stock shall be mailed, postage prepaid, to each holder of record at such holder's address appearing on the books of the Corporation, or given by electronic communication in compliance with the provisions of the Delaware General Corporation Law, and shall be deemed given upon such mailing or electronic transmission.

#### **ARTICLE V BYLAWS**

The Board of Directors shall have the power to adopt, amend or repeal the bylaws of the Corporation (the "**Bylaws**").

The stockholders may adopt, amend or repeal the Bylaws only with the affirmative vote of the holders of not less than 75% of the voting power of all outstanding securities of the Corporation generally entitled to vote in the election of directors, voting together as a single class.

#### **ARTICLE VI BOARD OF DIRECTORS**

**(A) Power of the Board of Directors.** The business and affairs of the Corporation shall be managed by or under the direction of a Board of Directors.

**(B) Number of Directors.** The number of directors which shall constitute the Board of Directors shall, as of the date this Certificate of Incorporation becomes effective, be seven and, thereafter, shall be fixed exclusively by one or more resolutions adopted from time to time solely by the affirmative vote of a majority of the Board of Directors.

**(C) Election of Directors.**

(1) The directors shall be divided into three classes, designated Class I, Class II and Class III. Each class shall consist, as nearly as may be practicable, of one-third of the total number of directors constituting the entire Board of Directors. Each director shall serve for a term ending on the date of the third annual meeting of stockholders next following the annual meeting at which such director was elected; *provided* that directors initially designated as Class I directors shall serve for a term ending on the date of the 2019 annual meeting, directors initially designated as Class II directors shall serve for a term ending on the date of the 2020 annual meeting, and directors initially designated as Class III directors shall serve for a term ending on the date of the 2021 annual meeting. Notwithstanding the foregoing, each director shall hold office until such director's successor shall have been duly elected and qualified or until such director's earlier death, resignation or removal. In the event of any change in the number of directors, the Board of Directors shall apportion any newly created directorships among, or reduce the number of directorships in, such class or classes as shall equalize, as nearly as possible, the number of directors in each class. In no event will a decrease in the number of directors shorten the term of any incumbent director.

(2) The Board of Directors may assign members of the Board of Directors already in office to the Classes described in Article VI(C)(1), which assignments shall become effective at the same time this Amended and Restated Certificate of Incorporation becomes effective.

(3) There shall be no cumulative voting in the election of directors. Election of directors need not be by written ballot unless the Bylaws so provide.

**(D) Vacancies.** Vacancies on the Board of Directors resulting from death, resignation, removal or otherwise and newly created directorships resulting from any increase in the number of directors shall, except as otherwise required by law, be filled solely by a majority of the directors then in office (although less than a quorum) or by the sole remaining director, and each director so elected shall hold office for a term that shall coincide with the term of the Class to which such director shall have been elected.

**(E) Removal.** No director may be removed from office by the stockholders except for cause with the affirmative vote of the holders of not less than a majority of the total voting power of all outstanding securities of the Corporation generally entitled to vote in the election of directors, voting together as a single class.

## **ARTICLE VII MEETINGS OF STOCKHOLDERS**

**(A) Annual Meetings.** An annual meeting of stockholders for the election of directors to succeed those whose terms expire and for the transaction of such other business as may properly come before the meeting shall be held at such place, on such date, and at such time as the Board of Directors shall determine.

**(B) Special Meetings.** Special meetings of the stockholders may be called only by the Board of Directors acting pursuant to a resolution adopted by a majority of the Board of Directors.

**(C) No Action by Consent.** Subject to the rights of the holders of any class or series of Preferred Stock then outstanding, as may be set forth in the resolution or resolutions adopted by the Board of Directors pursuant to Article IV(A)(2) hereto for such class or series of Preferred Stock, any action required or permitted to be taken at any annual or special meeting of stockholders may be taken only upon the vote of stockholders at an annual or special meeting duly noticed and called in accordance with Delaware Law, as amended from time to time, and this Article VII and may not be taken by written consent of stockholders without a meeting.

**ARTICLE VIII  
INDEMNIFICATION**

**(A) Limited Liability.** A director of the Corporation shall not be liable to the Corporation or its stockholders for monetary damages for breach of fiduciary duty as a director to the fullest extent permitted by Delaware Law.

**(B) Right to Indemnification.**

(1) Each person (and the heirs, executors or administrators of such person) who was or is a party or is threatened to be made a party to, or is involved in any threatened, pending or completed action, suit or proceeding, whether civil, criminal, administrative or investigative, by reason of the fact that such person is or was a director or officer of the Corporation or is or was serving at the request of the Corporation as a director or officer of another corporation, partnership, joint venture, trust or other enterprise, shall be indemnified and held harmless by the Corporation to the fullest extent permitted by Delaware Law. The right to indemnification conferred in this Article VIII shall also include the right to be paid by the Corporation the expenses incurred in connection with any such proceeding in advance of its final disposition to the fullest extent authorized by Delaware Law. The right to indemnification conferred in this Article VIII shall be a contract right.

(2) The Corporation may, by action of its Board of Directors, provide indemnification to such of the employees and agents of the Corporation to such extent and to such effect as the Board of Directors shall determine to be appropriate and authorized by Delaware Law.

**(C) Insurance.** The Corporation shall have power to purchase and maintain insurance on behalf of any person who is or was a director, officer, employee or agent of the Corporation, or is or was serving at the request of the Corporation as a director, officer, employee or agent of another corporation, partnership, joint venture, trust or other enterprise against any expense, liability or loss incurred by such person in any such capacity or arising out of such person's status as such, whether or not the Corporation would have the power to indemnify such person against such liability under Delaware Law.

**(D) Nonexclusivity of Rights.** The rights and authority conferred in this Article VIII shall not be exclusive of any other right that any person may otherwise have or hereafter acquire.

**(E) Preservation of Rights.** Neither the amendment nor repeal of this Article VIII, nor the adoption of any provision of this Certificate of Incorporation or the Bylaws, nor, to the fullest extent permitted by Delaware Law, any modification of law, shall adversely affect any right or protection of any person granted pursuant hereto existing at, or arising out of or related to any event, act or omission that occurred prior to, the time of such amendment, repeal, adoption or modification (regardless of when any proceeding (or part thereof) relating to such event, act or omission arises or is first threatened, commenced or completed).

**ARTICLE IX  
AMENDMENTS**

The Corporation reserves the right to amend this Certificate of Incorporation in any manner permitted by Delaware Law and all rights and powers conferred upon stockholders, directors and officers herein are granted subject to this reservation. Notwithstanding the foregoing, the provisions set forth in Articles IV(B), V, VI, VII and this Article IX may not be repealed or amended in any respect, and no other provision may be adopted, amended or repealed which would have the effect of modifying or permitting the circumvention of the provisions set forth in any of Articles IV(B), V, VI, VII or this Article IX, unless such action is approved by the affirmative vote of the holders of not less than 75% of the total voting power of all outstanding securities of the Corporation generally entitled to vote in the election of directors, voting together as a single class.

**IN WITNESS WHEREOF**, the undersigned has executed this Amended and Restated Certificate of Incorporation as of the date set forth below and certifies under penalty of perjury that he has read the foregoing Amended and Restated Certificate of Incorporation and knows the contents thereof and that the statements therein are true.

Executed at Santa Clara, California on \_\_\_\_\_, 2019.

---

Douglas Godshall  
President and Chief Executive Officer

**AMENDED AND RESTATED  
BYLAWS  
OF  
SHOCKWAVE MEDICAL, INC.**

ARTICLE 1  
OFFICES

Section 1.01. *Registered Office.* The registered office of the Corporation shall be 1209 Orange Street, City of Wilmington, County of New Castle, DE 19801, State of Delaware.

Section 1.02. *Other Offices.* The Corporation may also have offices at such other places both within and without the State of Delaware as the Board of Directors may from time to time determine or the business of the Corporation may require.

Section 1.03. *Books.* The books of the Corporation may be kept within or without the State of Delaware as the Board of Directors may from time to time determine or the business of the Corporation may require.

ARTICLE 2  
MEETINGS OF STOCKHOLDERS

Section 2.01. *Time and Place of Meetings.* All meetings of stockholders shall be held at such place, either within or without the State of Delaware, on such date and at such time as may be determined from time to time by the Board of Directors (or the Chairman of the Board of Directors in the absence of a designation by the Board of Directors).

Section 2.02. *Annual Meetings.* An annual meeting of stockholders, commencing with the year 2020, shall be held for the election of directors and to transact such other business as may properly be brought before the meeting.

Section 2.03. *Special Meetings.* Special meetings of the stockholders may be called only by the Chairman of the Board of Directors or by a resolution adopted by a majority of the Board of Directors.

Section 2.04. *Notice of Meetings and Adjourned Meetings; Waivers of Notice.* (a) Whenever stockholders are required or permitted to take any action at a meeting, a written notice of the meeting shall be given which shall state the place, if any, date and hour of the meeting, the means of remote communications, if any, by which stockholders and proxy holders may be deemed to be present in person and vote at such meeting, and, in the case of a special meeting, the purpose or purposes for which the meeting is called. Unless otherwise provided by the General Corporation Law of the State of

Delaware as the same exists or may hereafter be amended from time to time (“**Delaware Law**”), such notice shall be given not fewer than 10 nor more than 60 days before the date of the meeting to each stockholder of record entitled to vote at such meeting. The Board of Directors or the chairman of the meeting may adjourn the meeting to another time or place (whether or not a quorum is present), and notice need not be given of the adjourned meeting if the time, place, if any, and the means of remote communications, if any, by which stockholders and proxy holders may be deemed to be present in person and vote at such meeting, are announced at the meeting at which such adjournment is made. At the adjourned meeting, the Corporation may transact any business that might have been transacted at the original meeting. If the adjournment is for more than 30 days, or after the adjournment a new record date is fixed for the adjourned meeting, a notice of the adjourned meeting shall be given to each stockholder of record entitled to vote at the meeting.

(b) A written waiver of any such notice signed by the person entitled thereto, or a waiver by electronic transmission by the person entitled to notice, whether before or after the time stated therein, shall be deemed equivalent to notice. Attendance of a person at a meeting shall constitute a waiver of notice of such meeting, except when the person attends the meeting for the express purpose of objecting, at the beginning of the meeting, to the transaction of any business because the meeting is not lawfully called or convened. Business transacted at any special meeting of stockholders shall be limited to the purposes stated in the notice.

Section 2.05. *Quorum.* Unless otherwise provided in the Certificate of Incorporation or these Bylaws and subject to Delaware Law, the presence, in person or by proxy, of the holders of a majority of the total voting power of all outstanding securities of the Corporation generally entitled to vote at a meeting of stockholders shall constitute a quorum for the transaction of business. If, however, such quorum shall not be present or represented at any meeting of the stockholders, the chairman of the meeting or a majority in voting interest of the stockholders present in person or represented by proxy may adjourn the meeting, without notice other than announcement at the meeting, until a quorum shall be present or represented. At such adjourned meeting at which a quorum shall be present or represented any business may be transacted that might have been transacted at the meeting as originally notified.

Section 2.06. *Voting.* (a) Unless otherwise provided in the Certificate of Incorporation and subject to Delaware Law, each stockholder shall be entitled to one vote for each outstanding share of capital stock of the Corporation held by such stockholder. Any share of capital stock of the Corporation held by the Corporation shall have no voting rights. Except as otherwise required by law, the Certificate of Incorporation or these Bylaws,



in all matters other than the election of directors, the affirmative vote of the holders of a majority of the votes cast at the meeting on the subject matter shall be the act of the stockholders. Abstentions and broker non-votes shall not be counted as votes cast. Subject to the rights of the holders of any class or series of preferred stock to elect additional directors under specific circumstances, as may be set forth in the certificate of designations for such class or series of preferred stock, directors shall be elected by a plurality of the votes of the shares of capital stock of the Corporation present in person or represented by proxy at the meeting and entitled to vote on the election of directors.

(b) Each stockholder entitled to vote at a meeting of stockholders or to express consent or dissent to a corporate action in writing without a meeting may authorize another person or persons to act for such stockholder by proxy, appointed by an instrument in writing, subscribed by such stockholder or by his attorney thereunto authorized, or by proxy sent by cable, telegram or by any means of electronic communication permitted by law, which results in a writing from such stockholder or by his attorney, and delivered to the secretary of the meeting. No proxy shall be voted after three (3) years from its date, unless said proxy provides for a longer period.

Section 2.07. *Action by Consent.* Subject to the rights of the holders of any class or series of preferred stock then outstanding, as may be set forth in the certificate of designations for such class or series of preferred stock, any action required or permitted to be taken at any annual or special meeting of stockholders may be taken only upon the vote of stockholders at an annual or special meeting duly noticed and called in accordance with Delaware Law and may not be taken by written consent of stockholders without a meeting, unless such consent is unanimous.

Section 2.08. *Organization.* At each meeting of stockholders, the Chairman of the Board of Directors, if one shall have been elected, or in the Chairman's absence or if one shall not have been elected, the director designated by the vote of the majority of the directors present at such meeting, shall act as chairman of the meeting. The Secretary (or in the Secretary's absence or inability to act, the person whom the chairman of the meeting shall appoint secretary of the meeting) shall act as secretary of the meeting and keep the minutes thereof.

Section 2.09. *Order of Business.* The order of business at all meetings of stockholders shall be as determined by the chairman of the meeting.

Section 2.10. *Nomination of Directors and Proposal of Other Business.*

(a) *Annual Meetings of Stockholders.*

(i) Nominations of persons for election to the Board of Directors or the proposal of other business to be transacted by the stockholders at an annual meeting of stockholders may be made only (A) pursuant to the Corporation's notice of meeting (or any supplement thereto), (B) by or at the direction of the Board of Directors or any committee thereof, (C) as may be provided in the certificate of designations for any class or series of preferred stock or (D) by any stockholder of the Corporation who is a stockholder of record at the time of giving of notice provided for in paragraph (ii) of this Section 2.10(a) and at the time of the annual meeting, who shall be entitled to vote at the meeting and who complies with the procedures set forth in this Section 2.10(a), and, except as otherwise required by law, any failure to comply with these procedures shall result in the nullification of such nomination or proposal.

(ii) For nominations or other business to be properly brought before an annual meeting of stockholders by a stockholder pursuant to clause (D) of paragraph (i) of this Section 2.10(a), the stockholder must have given timely notice thereof in writing to the Secretary of the Corporation and any such proposed business (other than the nominations of persons for election to the Board of Directors) must constitute a proper matter for stockholder action. To be timely, a stockholder's notice shall be delivered to, or mailed and received by, the Secretary of the Corporation at the principal executive offices of the Corporation not fewer than 120 days nor more than 180 days prior to the first anniversary of the preceding year's annual meeting of stockholders; *provided, however*, that in the event that the date of the annual meeting is advanced more than 30 days prior to such anniversary date or delayed more than 60 days after such anniversary date then to be timely such notice must be received by the Corporation no earlier than 120 days prior to such annual meeting and no later than the 10<sup>th</sup> day following the day on which public announcement of the date of the meeting was first made by the Corporation; *provided, however*, that for a stockholder's notice in connection with the election of a director at a special meeting of stockholders to be timely, a stockholder must generally deliver notice not less than 40 nor more than 60 days prior to the date of the special meeting, but in the event that less than 55 days' notice or prior public disclosure of the date of the special meeting of the stockholders is given or made to the stockholders, a stockholder's notice will be timely if received by us not later than the close of business on the 10<sup>th</sup> day following the day on which a notice of the date of the special meeting was mailed to the stockholders or the public disclosure of that date was made. In no event shall the adjournment or postponement of any meeting, or any announcement thereof, commence a new time period (or extend any time period) for the giving of a stockholder's notice as described above.

(iii) A stockholder's notice to the Secretary shall set forth (A) as to each person whom the stockholder proposes to nominate for election or reelection as a director: (1) all information relating to such person that is required to be disclosed in solicitations of proxies for election of directors, or is otherwise required, in each case pursuant to Regulation 14A under the Securities Exchange Act of 1934 (as amended (together with the rules and regulations promulgated thereunder), the "**Exchange Act**") including such person's written consent to being named in the proxy statement as a nominee and to serving as a director if elected; and (2) a reasonably detailed description of any compensatory, payment or other financial agreement, arrangement or understanding that such person has with any other person or entity other than the Corporation including the amount of any payment or payments received or receivable thereunder, in each case in connection with candidacy or service as a director of the Corporation (a "**Third-Party Compensation Arrangement**"), (B) as to any other business that the stockholder proposes to bring before the meeting, a brief description of the business desired to be brought before the meeting, the text of the proposal or business (including the text of any resolutions proposed for consideration and in the event that such business includes a proposal to amend these Bylaws, the text of the proposed amendment), the reasons for conducting such business and any material interest in such business of such stockholder and the beneficial owner, if any, on whose behalf the proposal is made and (C) as to the stockholder giving the notice and the beneficial owner, if any, on whose behalf the proposal is made:

(1) the name and address of such stockholder (as they appear on the Corporation's books) and any such beneficial owner;

(2) for each class or series, the number of shares of capital stock of the Corporation that are held of record or are beneficially owned by such stockholder and by any such beneficial owner;

(3) a description of any agreement, arrangement or understanding between or among such stockholder and any such beneficial owner, any of their respective affiliates or associates, and any other person or persons (including their names) in connection with the proposal of such nomination or other business;

(4) a description of any agreement, arrangement or understanding (including, regardless of the form of settlement, any derivative, long or short positions, profit interests, forwards, futures, swaps, options, warrants, convertible securities, stock appreciation or similar rights, hedging transactions and borrowed or loaned shares) that has been entered into by or on behalf of, or any other agreement, arrangement or understanding that has been made, the effect or intent of which is to create or mitigate loss to, manage risk or benefit of share price changes for, or increase or decrease the voting power of, such stockholder or any such beneficial owner or any such nominee with respect to the Corporation's securities;

(5) a representation that the stockholder is a holder of record of stock of the Corporation entitled to vote at such meeting and intends to appear in person or by proxy at the meeting to bring such nomination or other business before the meeting;

(6) a representation as to whether such stockholder or any such beneficial owner intends or is part of a group that intends to (i) deliver a proxy statement and/or form of proxy to holders of at least the percentage of the voting power of the Corporation's outstanding capital stock required to approve or adopt the proposal or to elect each such nominee and/or (ii) otherwise to solicit proxies from stockholders in support of such proposal or nomination;

(7) any other information relating to such stockholder, beneficial owner, if any, or director nominee or proposed business that would be required to be disclosed in a proxy statement or other filing required to be made in connection with the solicitation of proxies in support of such nominee or proposal pursuant to Section 14 of the Exchange Act; and

(8) such other information relating to any proposed item of business as the Corporation may reasonably require to determine whether such proposed item of business is a proper matter for stockholder action.

If requested by the Corporation, the information required under clauses 2.10(a)(iii)(C)(2), (3) and (4) of the preceding sentence of this Section 2.10 shall be supplemented by such stockholder and any such beneficial owner not later than 10 days after the record date for the meeting to disclose such information as of the record date.

(b) *Special Meetings of Stockholders.* If the election of directors is included as business to be brought before a special meeting in the Corporation's notice of meeting, then nominations of persons for election to the Board of Directors at a special meeting of stockholders may be made by any stockholder who is a stockholder of record at the time of giving of notice provided for in this Section 2.10(b) and at the time of the special meeting, who shall be entitled to vote at the meeting and who complies with the procedures set forth in this Section 2.10(b). For nominations to be properly brought by a stockholder before a special meeting of stockholders pursuant to this Section 2.10(b), the stockholder must have given timely notice thereof in writing to the Secretary of the Corporation. To be timely, a stockholder's notice shall be delivered to or mailed and received at the principal executive offices of the Corporation (A) not earlier than 150 days prior to the date of the special meeting nor (B) later than the later of 120 days prior to the date of the special meeting or the 10<sup>th</sup> day following the day on which public announcement of the date of the special meeting was first made. A stockholder's notice to the Secretary shall comply with the notice requirements of Section 2.10(a)(iii).

(c) *General.* (i) To be eligible to be a nominee for election as a director, the proposed nominee must provide to the Secretary of the Corporation in accordance with the applicable time periods prescribed for delivery of notice under Section 2.10(a)(i) or Section 2.10(b): (1) a completed D&O questionnaire (in the form provided by the secretary of the Corporation at the request of the nominating stockholder) containing information regarding the nominee's background and qualifications and such other information as may reasonably be required by the Corporation to determine the eligibility of such proposed nominee to serve as a director of the Corporation or to serve as an independent director of the Corporation, (2) a written representation that, unless previously disclosed to the Corporation, the nominee is not and will not become a party to any voting agreement, arrangement or understanding with any person or entity as to how such nominee, if elected as a director, will vote on any issue or that could interfere with such person's ability to comply, if elected as a director, with his/her fiduciary duties under applicable law, (3) a written representation and agreement that, unless previously disclosed to the Corporation pursuant to Section 2.10(a)(iii)(A)(2), the nominee is not and will not become a party to any Third-Party Compensation Arrangement and (4) a written representation that, if elected as a director, such nominee would be in compliance and will continue to comply with the Corporation's corporate governance guidelines as disclosed on the Corporation's website, as amended from time to time. At the request of the Board of Directors, any person nominated by the Board of Directors for election as a director shall furnish to the Secretary of the Corporation the information that is required to be set forth in a stockholder's notice of nomination that pertains to the nominee.

(ii) No person shall be eligible to be nominated by a stockholder to serve as a director of the Corporation unless nominated in accordance with the procedures set forth in this Section 2.10. No business proposed by a stockholder shall be conducted at a stockholder meeting except in accordance with this Section 2.10

(iii) The chairman of the meeting shall, if the facts warrant, determine and declare to the meeting that a nomination was not made in accordance with the procedures prescribed by these Bylaws or that business was not properly brought before the meeting, and if he/she should so determine, he/she shall so declare to the meeting and the defective nomination shall be disregarded or such business shall not be transacted, as the case may be. Notwithstanding the foregoing provisions of this Section 2.10, unless otherwise required by law, if the stockholder (or a qualified representative of the stockholder) does not appear at the annual or special meeting of stockholders of the Corporation to present a nomination or other proposed business, such nomination shall be disregarded or such proposed business shall not be transacted, as the case may be, notwithstanding that proxies in respect of such vote may have been received by the Corporation and counted for purposes of determining a quorum. For purposes of this Section 2.10, to be considered a qualified representative of the stockholder, a person must be a duly authorized officer, manager or partner of such stockholder or must be authorized by a writing executed by such stockholder or an electronic transmission delivered by such stockholder to act for such stockholder as proxy at the meeting of stockholders and such person must produce such writing or electronic transmission, or a reliable reproduction of the writing or electronic transmission, at the meeting of stockholders.

(iv) Without limiting the foregoing provisions of this Section 2.10, a stockholder shall also comply with all applicable requirements of the Exchange Act with respect to the matters set forth in this Section 2.10; *provided, however*, that any references in these Bylaws to the Exchange Act are not intended to and shall not limit any requirements applicable to nominations or proposals as to any other business to be considered pursuant to this Section 2.10, and compliance with paragraphs (a)(i)(C) and (b) of this Section 2.10 shall be the exclusive means for a stockholder to make nominations or submit other business (other than as provided in Section 2.10(c)(v)).

(v) Notwithstanding anything to the contrary, the notice requirements set forth herein with respect to the proposal of any business pursuant to this Section 2.10 shall be deemed satisfied by a stockholder if such stockholder has submitted a proposal to the Corporation in compliance with Rule 14a-8 under the Exchange Act, and such stockholder's proposal has been included in a proxy statement that has been prepared by the Corporation to solicit proxies for the meeting of stockholders.

### ARTICLE 3 DIRECTORS

Section 3.01. *General Powers.* Except as otherwise provided in Delaware Law or the Certificate of Incorporation, the business and affairs of the Corporation shall be managed by or under the direction of the Board of Directors.

Section 3.02. *Number, Election and Term Of Office.* The Board of Directors shall consist of not less than five nor more than nine directors, with the exact number of directors to be determined from time to time solely by resolution adopted by the affirmative vote of a majority of the Board. As set forth in Article 6 of the Certificate of Incorporation, the directors shall be divided into three classes, designated Class I, Class II and Class III. Each class shall consist, as nearly as may be practicable, of one-third of the total number of directors constituting the entire Board of Directors. Except as otherwise provided in the Certificate of Incorporation, each director shall serve for a term ending on the date of the third annual meeting of stockholders next following the annual meeting at which such director was elected. Notwithstanding the foregoing, each director shall hold office until such director's successor shall have been duly elected and qualified or until such director's earlier death, resignation or removal. Directors need not be stockholders.

Section 3.03. *Quorum and Manner of Acting.* Unless the Certificate of Incorporation or these Bylaws require a greater number, a majority of the Board of Directors shall constitute a quorum for the transaction of business at any meeting of the Board of Directors and, except as otherwise expressly required by law or by the Certificate of Incorporation, the act of a majority of the directors present at a meeting at which a quorum is present shall be the act of the Board of Directors. When a meeting is adjourned to another time or place (whether or not a quorum is present), notice need not be given of the adjourned meeting if the time and place thereof are announced at the meeting at which the adjournment is taken. At the adjourned meeting, the Board of Directors may transact any business that might have been transacted at the original meeting. If a quorum shall not be present at any meeting of the Board of Directors, the directors present thereat shall adjourn the meeting, from time to time, without notice other than announcement at the meeting, until a quorum shall be present.

Section 3.04. *Time and Place of Meetings.* The Board of Directors shall hold its meetings at such place, either within or without the State of Delaware, and at such time as may be determined from time to time by the Board of Directors (or the Chairman of the Board of Directors in the absence of a determination by the Board of Directors).

Section 3.05. *Annual Meeting.* The Board of Directors shall meet for the purpose of organization, the election of officers and the transaction of other business, as soon as practicable after each annual meeting of stockholders, on the same day and at the same place where such annual meeting shall be held. Notice of such meeting need not be given. In the event such annual meeting is not so held, the annual meeting of the Board of Directors may be held at such place either within or without the State of Delaware, on such date and at such time as shall be specified in a notice thereof given as hereinafter provided in Section 3.07 herein or in a waiver of notice thereof signed by any director who chooses to waive the requirement of notice.

Section 3.06. *Regular Meetings.* After the place and time of regular meetings of the Board of Directors shall have been determined and notice thereof shall have been once given to each member of the Board of Directors, regular meetings may be held without further notice being given.

Section 3.07. *Special Meetings.* Special meetings of the Board of Directors may be called by the Chairman of the Board of Directors, the Chief Executive Officer or the President and shall be called by the Chairman of the Board of Directors, Chief Executive Officer, President or the Secretary, on the written request of three directors. Notice of special meetings of the Board of Directors shall be given to each director at least 48 hours before the date of the meeting in such manner as is determined by the Board of Directors.

Section 3.08. *Committees.* The Board of Directors may designate one or more committees, each committee to consist of one or more of the directors of the Corporation. The Board of Directors may designate one or more directors as alternate members of any committee, who may replace any absent or disqualified member at any meeting of the committee. In the absence or disqualification of a member of a committee, the member or members present at any meeting and not disqualified from voting, whether or not such member or members constitute a quorum, may unanimously appoint another member of the Board of Directors to act at the meeting in the place of any such absent or disqualified member. Any such committee, to the extent provided in the resolution of the Board of Directors, shall have and



may exercise all the powers and authority of the Board of Directors in the management of the business and affairs of the Corporation, and may authorize the seal of the Corporation to be affixed to all papers which may require it; but no such committee shall have the power or authority in reference to the following matters: (a) approving or adopting, or recommending to the stockholders, any action or matter expressly required by Delaware Law to be submitted to the stockholders for approval or (b) adopting, amending or repealing any Bylaw of the Corporation. Each committee shall keep regular minutes of its meetings and report the same to the Board of Directors when required.

Section 3.09. *Action by Consent.* Unless otherwise restricted by the Certificate of Incorporation or these Bylaws, any action required or permitted to be taken at any meeting of the Board of Directors or of any committee thereof may be taken without a meeting, if all members of the Board of Directors or committee, as the case may be, consent thereto in writing or by electronic transmission, and the writing or writings or electronic transmission or transmissions, are filed with the minutes of proceedings of the Board of Directors or committee. Such filing shall be in paper form if the minutes are maintained in paper form and shall be in electronic form if the minutes are maintained in electronic form.

Section 3.10. *Telephonic Meetings.* Unless otherwise restricted by the Certificate of Incorporation or these Bylaws, members of the Board of Directors, or any committee designated by the Board of Directors, may participate in a meeting of the Board of Directors, or such committee, as the case may be, by means of conference telephone or other communications equipment by means of which all persons participating in the meeting can hear each other, and such participation in a meeting shall constitute presence in person at the meeting.

Section 3.11. *Resignation.* Any director may resign from the Board of Directors at any time by giving notice to the Board of Directors or to the Secretary of the Corporation. Any such notice must be in writing or by electronic transmission to the Board of Directors or to the Secretary of the Corporation. The resignation of any director shall take effect upon receipt of notice thereof or at such later time as shall be specified in such notice; and unless otherwise specified therein, the acceptance of such resignation shall not be necessary to make it effective.

Section 3.12. *Vacancies.* Unless otherwise provided in the Certificate of Incorporation, vacancies on the Board of Directors resulting from death, resignation, removal or otherwise and newly created directorships resulting from any increase in the number of directors shall, except as otherwise required by law, be filled solely by a majority of the directors then in office (although less than a quorum) or by the sole remaining director, and each

director so elected shall hold office for a term that shall coincide with the term of the Class to which such director shall have been elected. If there are no directors in office, then an election of directors may be held in accordance with Delaware Law. Unless otherwise provided in the Certificate of Incorporation, when one or more directors shall resign from the Board of Directors, effective at a future date, a majority of the directors then in office, including those who have so resigned, shall have the power to fill such vacancy or vacancies, the vote thereon to take effect when such resignation or resignations shall become effective, and each director so chosen shall hold office as provided in the filling of the other vacancies.

Section 3.13. *Removal.* No director may be removed from office by the stockholders except for cause with the affirmative vote of the holders of not less than a majority of the total voting power of all outstanding securities of the corporation generally entitled to vote in the election of directors, voting together as a single class.

Section 3.14. *Compensation.* Unless otherwise restricted by the Certificate of Incorporation or these Bylaws, the Board of Directors shall have authority to fix the compensation of directors, including fees and reimbursement of expenses.

#### ARTICLE 4 OFFICERS

Section 4.01. *Principal Officers.* The principal officers of the Corporation shall be a Chief Executive Officer, a President, Chief Financial Officer, one or more Vice Presidents and a Secretary who shall have the duty, among other things, to record the proceedings of the meetings of stockholders and directors in a book kept for that purpose. The Corporation may also have such other principal officers, including one or more Controllers, as the Board of Directors may in its discretion appoint. One person may hold the offices and perform the duties of any two or more of said offices, except that no one person shall hold the offices and perform the duties of President and Secretary.

Section 4.02. *Appointment, Term of Office and Remuneration.* The principal officers of the Corporation shall be appointed by the Board of Directors in the manner determined by the Board of Directors. Each such officer shall hold office until his or her successor is appointed, or until his or her earlier death, resignation or removal. The remuneration of all officers of the Corporation shall be fixed by the Board of Directors. Any vacancy in any office shall be filled in such manner as the Board of Directors shall determine.

Section 4.03. *Subordinate Officers.* In addition to the principal officers enumerated in Section 4.01 herein, the Corporation may have one or more Assistant Treasurers, Assistant Secretaries and Assistant Controllers and such other subordinate officers, agents and employees as the Board of Directors may deem necessary, each of whom shall hold office for such period as the Board of Directors may from time to time determine. The Board of Directors may delegate to any principal officer the power to appoint and to remove any such subordinate officers, agents or employees.

Section 4.04. *Removal.* Except as otherwise permitted with respect to subordinate officers, any officer may be removed, with or without cause, at any time, by resolution adopted by the Board of Directors.

Section 4.05. *Resignations.* Any officer may resign at any time by giving notice to the Board of Directors (or to a principal officer if the Board of Directors has delegated to such principal officer the power to appoint and to remove such officer). Any such notice must be in writing. The resignation of any officer shall take effect upon receipt of notice thereof or at such later time as shall be specified in such notice; and unless otherwise specified therein, the acceptance of such resignation shall not be necessary to make it effective.

Section 4.06. *Powers and Duties.* The officers of the Corporation shall have such powers and perform such duties incident to each of their respective offices and such other duties as may from time to time be conferred upon or assigned to them by the Board of Directors.

## ARTICLE 5 CAPITAL STOCK

Section 5.01. *Certificates For Stock; Uncertificated Shares.* The shares of the Corporation shall be represented by certificates, provided that the Board of Directors may provide by resolution or resolutions that some or all of any or all classes or series of its stock shall be uncertificated shares or a combination of certificated and uncertificated shares. Any such resolution that shares of a class or series will only be uncertificated shall not apply to shares represented by a certificate until such certificate is surrendered to the Corporation. Except as otherwise required by law, the rights and obligations of the holders of uncertificated shares and the rights and obligations of the holders of shares represented by certificates of the same class and series shall be identical. Every holder of stock represented by certificates shall be entitled to have a certificate signed by, or in the name of the Corporation by the Chairman or Vice Chairman of the Board of Directors, or the Chief Executive Officer, President or Vice President, and by the Chief Financial Officer or a Treasurer or Assistant Treasurer, or the Secretary or an Assistant

Secretary of such Corporation representing the number of shares registered in certificate form. Any or all of the signatures on the certificate may be a facsimile. In case any officer, transfer agent or registrar who has signed or whose facsimile signature has been placed upon a certificate shall have ceased to be such officer, transfer agent or registrar before such certificate is issued, it may be issued by the Corporation with the same effect as if such person were such officer, transfer agent or registrar at the date of issue. A Corporation shall not have power to issue a certificate in bearer form.

Section 5.02. *Transfer Of Shares.* Shares of the stock of the Corporation may be transferred on the record of stockholders of the Corporation by the holder thereof or by such holder's duly authorized attorney upon surrender of a certificate therefor properly endorsed or upon receipt of proper transfer instructions from the registered holder of uncertificated shares or by such holder's duly authorized attorney and upon compliance with appropriate procedures for transferring shares in uncertificated form, unless waived by the Corporation.

Section 5.03. *Authority for Additional Rules Regarding Transfer.* The Board of Directors shall have the power and authority to make all such rules and regulations as they may deem expedient concerning the issue, transfer and registration of certificated or uncertificated shares of the stock of the Corporation, as well as for the issuance of new certificates in lieu of those which may be lost or destroyed, and may require of any stockholder requesting replacement of lost or destroyed certificates, bond in such amount and in such form as they may deem expedient to indemnify the Corporation, and/or the transfer agents, and/or the registrars of its stock against any claims arising in connection therewith.

## ARTICLE 6 GENERAL PROVISIONS

Section 6.01. *Fixing the Record Date.* (a) In order that the Corporation may determine the stockholders entitled to notice of any meeting of stockholders or any adjournment thereof, the Board of Directors may fix a record date, which record date shall not precede the date upon which the resolution fixing such record date is adopted by the Board of Directors, and which record date shall not be more than 60 nor fewer than 10 days before the date of such meeting. If the Board of Directors so fixes a date, such date shall also be the record date for determining the stockholders entitled to vote at such meeting unless the Board of Directors determines, at the time it fixes such record date, that a later date on or before the date of the meeting shall be the date for making such determination. If no record date is fixed by the Board of Directors, the record date for determining stockholders entitled to notice of or to vote at a meeting of stockholders shall be at the close of

business on the day next preceding the day on which notice is given, or, if notice is waived, at the close of business on the day next preceding the day on which the meeting is held. A determination of stockholders of record entitled to notice of or to vote at a meeting of stockholders shall apply to any adjournment of the meeting; *provided* that the Board of Directors may in its discretion or as required by law fix a new record date for determination of stockholders entitled to vote at the adjourned meeting, and in such case shall fix the same date or an earlier date as the record date for stockholders entitled to notice of such adjourned meeting.

(b) In order that the Corporation may determine the stockholders entitled to receive payment of any dividend or other distribution or allotment of any rights or the stockholders entitled to exercise any rights in respect of any change, conversion or exchange of stock, or for the purpose of any other lawful action, the Board of Directors may fix a record date, which record date shall not precede the date upon which the resolution fixing the record date is adopted, and which record date shall be not more than 60 days prior to such action. If no record date is fixed, the record date for determining stockholders for any such purpose shall be at the close of business on the day on which the Board of Directors adopts the resolution relating thereto.

Section 6.02. *Dividends.* Subject to limitations contained in Delaware Law and the Certificate of Incorporation, the Board of Directors may declare and pay dividends upon the shares of capital stock of the Corporation, which dividends may be paid either in cash, in property or in shares of the capital stock of the Corporation.

Section 6.03. *Year.* The fiscal year of the Corporation shall commence on January 1 and end on December 31 of each year.

Section 6.04. *Corporate Seal.* The corporate seal shall have inscribed thereon the name of the Corporation, the year of its organization and the words "Corporate Seal, Delaware". The seal may be used by causing it or a facsimile thereof to be impressed, affixed or otherwise reproduced.

Section 6.05. *Voting of Stock Owned by the Corporation.* The Board of Directors may authorize any person, on behalf of the Corporation, to attend, vote at and grant proxies to be used at any meeting of stockholders of any corporation (except this Corporation) in which the Corporation may hold stock.

Section 6.06. *Forum Selection.* Unless the Corporation consents in writing to the selection of an alternative forum, the sole and exclusive forum for (i) any derivative action or proceeding brought on behalf of the Corporation, (ii) any action asserting a claim of breach of a fiduciary duty owed by any director, officer or other employee of the Corporation to the Corporation or the Corporation's stockholders, (iii) any action asserting a claim arising pursuant to any provision of Delaware Law or the Certificate of Incorporation or these Bylaws (in each case, as they may be amended from time to time), or (iv) any action asserting a claim governed by the internal affairs doctrine shall be a state court located within the state of Delaware (or, if no state court located within the State of Delaware has jurisdiction, the federal district court for the District of Delaware), in all cases subject to the court's having personal jurisdiction over the indispensable parties named as defendants. Unless the Corporation consents in writing to the selection of an alternative forum, the federal district courts of the United States shall be the exclusive forum for the resolution of any complaint asserting a cause of action arising under the Securities Act, in all cases subject to the court's having personal jurisdiction over the indispensable parties named as defendants. Any person or entity purchasing or otherwise acquiring any interest in shares of capital stock of the Corporation shall be deemed to have notice of and consented to the provisions of this Section 6.06.

Section 6.07. *Amendments.* These Bylaws or any of them, may be altered, amended or repealed, or new Bylaws may be made, by the stockholders entitled to vote thereon at any annual or special meeting thereof or by the Board of Directors. Unless a higher percentage is required by the Certificate of Incorporation as to any matter that is the subject of these Bylaws, all such amendments must be approved by the affirmative vote of the holders of not less than 75% of the total voting power of all outstanding securities of the Corporation, generally entitled to vote in the election of directors, voting together as a single class, or by a majority of the Board of Directors. Notwithstanding the foregoing, any alteration, amendment or repeal of, or adoption of any bylaw inconsistent with, any one or more of these bylaws related to special and annual meetings of stockholders, action of stockholders by written consent, classification of the board of directors, nomination of directors, special meetings of directors, removal of directors, committees of the board of directors or indemnification of directors and officers, requires the affirmative vote of either (a) at least 75% of all directors in office at a meeting called for that purpose or (b) approval by the affirmative vote of the holders of not less than 75% of the total voting power of all outstanding securities of the Corporation, generally entitled to vote in the election of directors, voting together as a single class.

**CERTIFICATE OF RETIREMENT  
OF  
SERIES A PREFERRED STOCK  
SERIES A-1 PREFERRED STOCK  
SERIES B PREFERRED STOCK  
SERIES C PREFERRED STOCK  
AND  
SERIES D PREFERRED STOCK  
OF  
SHOCKWAVE MEDICAL, INC.**

Pursuant to Section 243(b)  
of the General Corporation Law  
of the State of Delaware

Shockwave Medical, Inc., a corporation organized and existing under the laws of the State of Delaware (the “**Corporation**”), HEREBY CERTIFIES as follows:

1. All authorized and outstanding shares of Series A Preferred Stock, par value \$0.001 per share, (the “**Series A Preferred Stock**”), Series A-1 Preferred Stock, par value \$0.001 per share, (the “**Series A-1 Preferred Stock**”), Series B Preferred Stock, par value \$0.001 per share, (the “**Series B Preferred Stock**”), Series C Preferred Stock, par value \$0.001 per share, (the “**Series C Preferred Stock**”) and Series D Preferred Stock, par value \$0.001 per share, (the “**Series D Preferred Stock**” and, together with the Series A Preferred Stock, Series A-1 Preferred Stock, Series B Preferred Stock, Series C Preferred Stock and Series D Preferred Stock, the “**Designated Preferred Stock**”) of the Corporation have been converted into shares of Common Stock, par value \$0.001 per share, of the Corporation (“**Common Stock**”).

2. The Board of Directors of the Corporation has adopted resolutions retiring all previously outstanding shares of the Series A Preferred Stock, Series A-1 Preferred Stock, Series B Preferred Stock, Series C Preferred Stock and Series D Preferred Stock immediately upon their conversion into shares of Common Stock.

3. The Certificate of Incorporation of the Corporation provides that any shares of Designated Preferred Stock converted into Common Stock shall be cancelled, retired and eliminated from the shares that the Corporation shall be authorized to issue and shall not be reissued by the Corporation.

4. Accordingly, pursuant to the provisions of Section 243(b) of the General Corporation Law of the State of Delaware, upon the effective date of the filing of this Certificate of Retirement, the Certificate of Incorporation of the Corporation shall be amended so as to (I) reduce the total authorized number of shares of the capital stock of the Corporation by 18,725,162 shares, such that the total number of authorized shares of the Corporation shall be 305,000,000, such shares consisting of (a) 281,274,838 shares of Common Stock, par value \$0.001 per share and (b) 5,000,000 shares of Preferred Stock, par value \$0.001 per share, all of which are Undesignated Preferred Stock and (II) eliminate from the Certificate of Incorporation of the Corporation all references to the Designated Preferred Stock.

IN WITNESS WHEREOF, the Corporation has caused this Certificate of Retirement to be signed by its duly authorized officer, this [ ] day of [ ], 2019.

---

Douglas Godshall  
Chief Executive Officer and President



New York  
Northern California  
Washington DC  
São Paulo  
London

Paris  
Madrid  
Tokyo  
Beijing  
Hong Kong



Davis Polk & Wardwell LLP      650 752 2000 tel  
1600 El Camino Real            650 752 2111 fax  
Menlo Park, CA 94025

February 25, 2019

ShockWave Medical, Inc.  
5403 Betsy Ross Drive  
Santa Clara, California 95054

Ladies and Gentlemen:

ShockWave Medical, Inc., a Delaware corporation (the “**Company**”), has filed with the Securities and Exchange Commission a Registration Statement on Form S-1 (the “**Registration Statement**”) and the related prospectus (the “**Prospectus**”) for the purpose of registering under the Securities Act of 1933, as amended (the “**Securities Act**”), 5,750,000 shares of its common stock, par value \$0.001 per share (the “**Securities**”), including 750,000 shares subject to the underwriters’ over-allotment option, as described in the Registration Statement.

We, as your counsel, have examined originals or copies of such documents, corporate records, certificates of public officials and other instruments as we have deemed necessary or advisable for the purpose of rendering this opinion.

In rendering the opinion expressed herein, we have, without independent inquiry or investigation, assumed that (i) all documents submitted to us as originals are authentic and complete, (ii) all documents submitted to us as copies conform to authentic, complete originals, (iii) all signatures on all documents that we reviewed are genuine, (iv) all natural persons executing documents had and have the legal capacity to do so, (v) all statements in certificates of public officials and officers of the Company that we reviewed were and are accurate and (vi) all representations made by the Company as to matters of fact in the documents that we reviewed were and are accurate.

Based upon the foregoing, we advise you that, in our opinion, when the price at which the Securities to be sold has been approved by or on behalf of the Board of Directors of the Company and when the Securities have been issued and delivered against payment therefor in accordance with the terms of the Underwriting Agreement referred to in the prospectus which is a part of the Registration Statement, the Securities will be validly issued, fully paid and non-assessable.

We are members of the Bars of the States of New York and California and the foregoing opinion is limited to the laws of the State of New York and the General Corporation Law of the State of Delaware.

We hereby consent to the filing of this opinion as an exhibit to the Registration Statement and further consent to the reference to our name under the caption "Legal Matters" in the Prospectus. In giving this consent, we do not admit that we are in the category of persons whose consent is required under Section 7 of the Securities Act.

Very truly yours,

/s/ Davis Polk & Wardwell LLP

**SHOCKWAVE MEDICAL, INC.**  
**2019 EQUITY INCENTIVE PLAN**

This ShockWave Medical, Inc. 2019 Equity Incentive Plan (the “**Plan**”) is effective upon the Registration Date (the “**Effective Date**”)

1. Purposes and Eligibility.

(a) General Purpose. The purposes of this Plan are (i) to enable ShockWave Medical, Inc., a Delaware corporation, (the “**Company**”) and its Affiliates to attract and retain the types of Employees, Directors and Consultants who will contribute to the Company’s long range success; (ii) provide incentives that align the interests of Employees, Directors and Consultants with those of the shareholders of the Company; and (iii) promote the success of the Company’s business.

(b) Eligible Award Recipients. The persons eligible to receive Awards are the Employees, Consultants and Directors of the Company and its Affiliates, and such other individuals designated by the Administrator who are reasonably expected to become Employees, Consultants and Directors after the receipt of Awards.

(c) Available Awards. The Plan permits the grant of Incentive Stock Options, Nonstatutory Stock Options, Stock Appreciation Rights, Restricted Stock, Restricted Stock Units, Performance Awards and other Awards.

2. Definitions.

(a) “Administrator” means the Board or any of its Committees as will be administering the Plan, in accordance with Section 4 of the Plan.

(b) “Affiliate” means a corporation or other entity that, directly or through one or more intermediaries, controls, is controlled by or is under common control with, the Company.

(c) “Applicable Laws” means the requirements relating to or implicated by the administration of the Plan and Awards under applicable 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 granted under the Plan.

(d) “Award” means, individually or collectively, a right granted under the Plan, including an Incentive Stock Option, a Nonqualified Stock Option, a Stock Appreciation Right, an award of Restricted Stock, or an award of Restricted Stock Units.

(e) “Award Agreement” means the written agreement, contract, certificate or other instrument or document setting forth the terms and conditions applicable to an individual Award granted under the Plan, which may, in the discretion of the Company, be transmitted electronically to any Participant. Each Award Agreement shall be subject to the terms and conditions of the Plan.

(f) “Beneficial Owner” has the meaning assigned to such term in Rule 13d-3 and Rule 13d-5 under the Exchange Act, except that in calculating the beneficial ownership of any particular Person, such Person shall be deemed to have beneficial ownership of all securities that such Person has the right to acquire by conversion or exercise of other securities, whether such right is currently exercisable or is exercisable only after the passage of time. The terms “Beneficially Owns” and “Beneficially Owned” have a corresponding meaning.

(g) “Board” means the Board of Directors of the Company.

(h) “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 combined voting power of the then outstanding voting securities of the Company entitled to vote generally in the election of directors (the “Outstanding Company Voting Securities”); provided, however, that the following acquisitions shall not constitute a Change of Control: (A) any acquisition by the Company or any Affiliate, (B) any acquisition by any employee benefit plan sponsored or maintained by the Company or any Subsidiary, (C) any acquisition which complies with clauses, (A), (B) and (C) of subsection (v) of this definition or (D) in respect of an Award held by a particular Participant, any acquisition by the Participant or any group of persons including the Participant (or any entity controlled by the Participant or any group of persons including the Participant); or

(ii) If the Company has a class of securities registered pursuant to Section 12 of the Exchange Act, 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;

(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. 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;

(iv) The date which is ten (10) business days prior to the consummation of a complete liquidation or dissolution of the Company; or

(v) The consummation of a reorganization, merger, consolidation, statutory share exchange or similar form of corporate transaction involving the Company that requires the approval of the Company’s shareholders, whether for such transaction or the issuance of securities in the transaction (a “Business Combination”), unless immediately following such Business Combination: (A) more than 50% of the total voting power of (1) the entity resulting from such Business Combination (the “Surviving Company”), or (2) if applicable, the ultimate parent entity that directly or indirectly has Beneficial Ownership of sufficient voting securities eligible to elect a majority of the members of the board of directors (or the analogous governing body) of the Surviving Company (the “Parent Company”), is represented by the Outstanding Company Voting Securities that were outstanding immediately prior to such Business Combination (or, if applicable, is represented by shares into which the Outstanding Company Voting Securities were converted pursuant to such Business Combination), and such voting power among the holders thereof is in substantially the same proportion as the voting power of

the Outstanding Company Voting Securities among the holders thereof immediately prior to the Business Combination; (B) no Person (other than any employee benefit plan sponsored or maintained by the Surviving Company or the Parent Company) is or becomes the Beneficial Owner, directly or indirectly, of 50% or more of the total voting power of the outstanding voting securities eligible to elect members of the board of directors of the Parent Company (or the analogous governing body) (or, if there is no Parent Company, the Surviving Company); and (C) at least a majority of the members of the board of directors (or the analogous governing body) of the Parent Company (or, if there is no Parent Company, the Surviving Company) following the consummation of the Business Combination were Board members at the time of the Board's approval of the execution of the initial agreement providing for such Business Combination.

(i) "Code" means the Internal Revenue Code of 1986, as amended. Any reference to a section of the Code herein shall be deemed to include a reference to any regulations promulgated thereunder, and any successor or amended section of the Code.

(j) "Committee" means a committee of one or more Directors appointed by the Board to administer the Plan in accordance with Section 4 hereof.

(k) "Common Stock" means the common stock, par value \$0.001 of the Company, or such other securities of the Company as may be designated by the Administrator from time to time in substitution thereof.

(l) "Company" means ShockWave Medical, Inc., a Delaware corporation, or any successor thereto.

(m) "Consultant" means any individual or entity that performs bona fide services to the Company or an Affiliate, other than as an Employee or Director.

(n) "Director" means a member of the Board.

(o) "Disability" means, unless the applicable Award Agreement provides otherwise, that the Participant is unable to engage in any substantial gainful activity by reason of any medically determinable physical or mental impairment; *provided, however*, that for purposes of determining the term of an Incentive Stock Option, the term Disability shall have the meaning ascribed to it under Section 22(e)(3) of the Code. The determination of whether an individual has a Disability shall be determined under procedures established by the Administrator. Except in situations where the Administrator is determining Disability for purposes of the term of an Incentive Stock Option within the meaning of Section 22(e)(3) of the Code, the Administrator may rely on any determination that a Participant is disabled for purposes of benefits under any long-term disability plan maintained by the Company or any Affiliate in which a Participant participates.

(p) "Employee" means any person, including an officer or Director, employed by the Company or an Affiliate, *provided, that*, for purposes of determining eligibility to receive Incentive Stock Options, an Employee shall mean an employee of the Company or a parent or subsidiary corporation within the meaning of Section 424 of the Code. Mere service as a Director or payment of a director's fee by the Company or an Affiliate will not be sufficient to constitute "employment" by the Company or an Affiliate.

(q) "Exchange Act" means the Securities Exchange Act of 1934, as amended.

(r) “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 reduced or increased. The Administrator will determine the terms and conditions of any Exchange Program in its sole discretion.

(s) “Fair Market Value” means, as of any date, the value of the Common Stock as determined as follows. If the Common Stock is listed on any established stock exchange or a national market system, including without limitation, the New York Stock Exchange or the NASDAQ Stock Market, the Fair Market Value shall be the closing price of a share of Common Stock as quoted on such exchange or system on the day of determination (or if no sales were reported the closing price on the date immediately preceding such date). In the absence of an established market for the Common Stock, the Fair Market Value shall be determined in good faith by the Administrator and such determination shall be conclusive and binding on all persons.

(t) “Grant Date” means the date on which the Administrator adopts a resolution, or takes other appropriate action, expressly granting an Award to a Participant that specifies the key terms and conditions of the Award or, if a later effective date is set forth in such resolution, then such effective date as is set forth in such resolution.

(u) “Incentive Stock Option” means an Option that is designated by the Administrator as an incentive stock option within the meaning of Section 422 of the Code and that meets the requirements set out in the Plan.

(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) “Option” means an Incentive Stock Option or a Nonstatutory Stock Option granted pursuant to the Plan.

(x) “Optionholder” means a person to whom an Option is granted pursuant to the Plan or, if applicable, such other person who holds an outstanding Option.

(y) “Parent” means a “parent corporation,” whether now or hereafter existing, as defined in Code Section 424(e).

(z) “Participant” means an eligible person to whom an Award is granted pursuant to the Plan or, if applicable, such other person who holds an outstanding Award.

(aa) “Performance Award” means an award granted pursuant to Section 10.

(bb) “Performance Goals” means, for a Performance Period, the one or more goals established by the Administrator for the Performance Period based upon business criteria or other performance measures determined by the Administrator in its discretion.

(cc) “Performance Period” means the one or more periods of time not less than one fiscal quarter in duration, as the Administrator may select, over which the attainment of one or more Performance Goals will be measured for the purpose of determining a Participant’s right to and the payment of an Award.

(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) “Permitted Transferee” means: (i) a member of the Optionholder’s immediate family (child, stepchild, grandchild, parent, stepparent, grandparent, spouse, former spouse, sibling, niece, nephew, mother-in-law, father-in-law, son-in-law, daughter-in-law, brother-in-law, or sister-in-law, including adoptive relationships), (ii) any person sharing the Optionholder’s household (other than a tenant or employee), (iii) a trust in which these persons have more than 50% of the Beneficial Ownership interest, (iv) a foundation in which these persons (or the Optionholder) control the management of assets, and (v) any other entity in which these persons (or the Optionholder) own more than 50% of the voting interests; and (vi) such other transferees as may be permitted by the Administrator in its sole discretion.

(ff) “Person” means a person as defined in Section 13(d)(3) of the Exchange Act.

(gg) “Plan” means this ShockWave Medical, Inc. 2019 Equity Incentive Plan.

(hh) “Registration Date” means the effective date of the first registration statement that is filed by the Company and declared effective pursuant to Section 12(g) of the Exchange Act, with respect to any class of the Company’s securities.

(ii) “Restricted Stock” means Shares issued pursuant to an Award of Restricted Stock under Section 8 of the Plan, or issued pursuant to the early exercise of an Option.

(jj) “Restricted Stock Unit” means a bookkeeping entry representing an amount equal to the Fair Market Value of one Share, granted pursuant to Section 9. Each Restricted Stock Unit represents an unfunded and unsecured obligation of the Company.

(kk) “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.

(ll) “Service Provider” means an Employee, Director or Consultant.

(mm) “Share” means a share of the Common Stock, as adjusted in accordance with Section 15 of the Plan.

(nn) “Stock Appreciation Right” means the right pursuant to an Award granted under Section 7 to receive, upon exercise, an amount payable in cash or shares equal to the number of shares subject to the Stock Appreciation Right that is being exercised multiplied by the excess of (a) the Fair Market Value of a share of Common Stock on the date the Award is exercised, over (b) the exercise price specified in the Stock Appreciation Right Award Agreement.

(oo) “Subsidiary” means a “subsidiary corporation,” whether now or hereafter existing, as defined in Code Section 424(f).

### 3. Stock Subject to the Plan.

(a) Stock Subject to the Plan. Subject to the provisions of Section 15 of the Plan, the maximum aggregate number of Shares that may be subject to Awards and sold under the Plan is 2,000,430 Shares, plus up to 3,636,224 Shares subject to stock options or similar awards previously granted under the ShockWave Medical, Inc. 2009 Equity Incentive Plan, as amended (the “2009 Plan”) that expire or otherwise terminate without having been exercised in full and Shares issued pursuant to awards granted under the 2009 Plan that are forfeited to or repurchased by the Company.

(b) Automatic Share Reserve Increase. The number of Shares available for issuance under the Plan will be increased on the first day of each fiscal year of the Company beginning with the 2020 fiscal year and ending with the 2028 fiscal year, in an amount equal to the least of (i) 3% of the outstanding Shares on the last business day of the immediately preceding fiscal year or (iii) such number of Shares determined by the Board.

(c) Lapsed Awards. If an Award outstanding under the Plan expires or becomes unexercisable without having been exercised in full, is surrendered pursuant to an Exchange Program, or is forfeited to or repurchased by the Company due to the failure to vest, then the unpurchased Shares (or 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 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 become available for future distribution under the Plan; provided, however, that if Shares issued pursuant to an Award are repurchased by the Company or are forfeited to the Company due to the failure to vest, 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 not become available for future grant or sale under the Plan. To the extent that 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 15, 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 Code Section 422 and the Treasury Regulations promulgated thereunder, any Shares that become available for issuance under the Plan pursuant to Section 3(b).

(d) 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. Shares of Common Stock available for distribution under the Plan may consist, in whole or part, of authorized but unissued shares, or reacquired Common Stock.

#### 4. Administration of the Plan.

(a) Procedure.

(i) Multiple Administrative Bodies. Different persons 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, the transactions contemplated hereunder 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) in the Board's sole discretion, a Committee, which Committee will be constituted to satisfy Applicable Laws.

(b) Powers of the Administrator. Subject to the provisions of the Plan, Applicable Laws, 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 construe and interpret the Plan and apply its provisions;



(ii) to prescribe, amend and rescind rules and regulations relating to the administration of 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;

(iii) to authorize any person to execute, on behalf of the Company, any instrument required to carry out the purposes of the Plan;

(iv) to delegate its authority to one or more officers of the Company with respect to Awards that do not involve “insiders” within the meaning of Section 16 of the Exchange Act;

(v) to determine when Awards are to be granted under the Plan and the applicable Grant Date;

(vi) from time to time to select, subject to the limitations set forth in this Plan, those eligible Award recipients to whom Awards shall be granted;

(vii) to determine the number of Shares to be covered by each Award;

(viii) to determine whether each Option is to be an Incentive Stock Option or a Nonqualified Stock Option;

(ix) to approve forms of Award Agreements for use under the Plan;

(x) to determine the terms and conditions, not inconsistent with the terms of the Plan, of each Award, including but 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, any Performance Goals over any Performance Periods, 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;

(xi) to modify or amend any outstanding Awards, including for the purpose of modifying the time or manner of vesting, or the term of any outstanding Award, 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(d)); provided, however, that if any such amendment would impair a Participant’s rights or increase a Participant’s obligations under his or her Award or creates or increases a Participant’s federal income tax liability with respect to an Award, such amendment shall also be subject to the Participant’s consent;

(xii) to modify the purchase price or the exercise price of any outstanding Award, provided that if the modification effects a repricing, shareholder approval shall be required before the repricing is effective;

(xiii) to determine the duration and purpose of leaves of absences which may be granted to a Participant without constituting termination of their employment for purposes of the Plan, which periods shall be no shorter than the periods generally applicable to Employees under the Company’s employment policies;

(xiv) to make decisions with respect to outstanding Awards that may become necessary upon a change in corporate control or an event that triggers anti-dilution adjustments;

(xv) to allow Participants to satisfy withholding tax obligations in a manner prescribed in Section 16;

(xvi) 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;

(xvii) to allow a Participant to defer the receipt of the payment of cash or the delivery of Shares that otherwise would be due to such Participant under an Award;

(xviii) to interpret, administer, reconcile any inconsistency in, correct any defect in and/or supply any omission in the Plan and any instrument or agreement relating to, or Award granted under, the Plan; and

(xix) to exercise discretion to make any and all other determinations which it determines to be necessary or advisable for the administration of the Plan.

(c) Effect of Administrator's Decision. All decisions made by the Administrator pursuant to the provisions of the Plan shall be final and binding on the Company, and all Participants and any other holders of Awards, unless such decisions are determined by a court having jurisdiction to be arbitrary and capricious.

(d) Delegation. The Committee or, if no Committee has been appointed, the Board may delegate administration of the Plan to a committee or committees of one or more members of the Board, and the term "Administrator" shall apply to any person or persons to whom such authority has been delegated. The Committee shall have the power to delegate to a subcommittee any of the administrative powers the Committee is authorized to exercise (and references in this Plan to the Board, the Committee or the Administrator shall include the committee or subcommittee for the duration of such delegation), subject, however, to such resolutions, not inconsistent with the provisions of the Plan, as may be adopted from time to time by the Board. The Board may abolish the Committee at any time and revert in the Board the administration of the Plan. The members of the Committee shall be appointed by and serve at the pleasure of the Board. From time to time, the Board may increase or decrease the size of the Committee, add additional members to, remove members (with or without cause) from, appoint new members in substitution therefor, and fill vacancies, however caused, in the Committee. The Committee shall act pursuant to a vote of the majority of its members or, in the case of a Committee comprised of only two members, the unanimous consent of its members, whether present or not, or by the written consent of the majority of its members and minutes shall be kept of all of its meetings and copies thereof shall be provided to the Board. Subject to the limitations prescribed by the Plan and the Board, the Committee may establish and follow such rules and regulations for the conduct of its business as it may determine to be advisable.

(e) In addition to such other rights of indemnification as they may have as Directors or members of the Committee or otherwise, and to the extent allowed by Applicable Laws, each person who is, either individually or as a member of the Board or a Committee, covered by the term Administrator, shall be indemnified by the Company against the reasonable expenses, including attorney's fees, actually incurred in connection with any action, suit or proceeding or in connection with any appeal therein, to which the Committee may be party by reason of any action taken or failure to act under or in connection with the Plan or any Award granted under the Plan, and against all amounts paid by such person in settlement thereof (provided, however, that the settlement has been approved by the Company, which approval shall not be unreasonably withheld) or paid by such person in satisfaction of a judgment in any such action, suit or proceeding, except in relation to matters as to which it shall be adjudged in such action, suit or proceeding that such person did not act in good faith and in a manner which such person reasonably believed to be in the best interests of the Company, or in the case of a

criminal proceeding, had no reason to believe that the conduct complained of was unlawful; provided, however, that within 60 days after the institution of any such action, suit or proceeding, such person shall, in writing, offer the Company the opportunity at its own expense to handle and defend such action, suit or proceeding.

5. Eligibility. Nonstatutory Stock Options, Stock Appreciation Rights, Restricted Stock, and Restricted Stock Units may be granted to Service Providers. Incentive Stock Options may be granted only to Employees.

6. Stock Options.

(a) Grant of Options. Subject to the terms and provisions of the Plan, the Administrator, at any time and from time to time, may grant Options in such amounts as the Administrator, in its sole discretion, will determine.

(b) Option Agreement. Each Award of an Option will be evidenced by an Award Agreement that will specify the exercise price, the term of the Option, the number of Shares subject to the Option, the exercise restrictions, if any, applicable to the Option, and such other terms and conditions as the Administrator, in its sole discretion, will determine.

(c) Limitations. Each Option will be designated in the Award Agreement as either an Incentive Stock Option or a Nonstatutory Stock Option. Notwithstanding such designation, however, 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(c), 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, and calculation will be performed in accordance with Section 422 of the Code. No Incentive Stock Option may be issued more than ten years following the earlier of (i) the date of adoption or (ii) the most recent date of approval of this Plan by the Company's shareholders, except as permitted by Section 422 of the Code.

(d) Term of Option. The term of each Option will be stated in the Award Agreement; provided, however, that the term will be no more than ten (10) years from the Grant Date thereof. 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 Grant Date or such shorter term as may be provided in the Award Agreement.

(e) Option Exercise Price and Consideration.

(i) Exercise Price. The per Share exercise price for the Shares to be issued pursuant to the exercise of an Option will be determined by the Administrator, but will be no less than one hundred percent (100%) of the Fair Market Value per Share on the Grant Date. In addition, in the case of an Incentive Stock Option granted to an Employee who 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 Grant Date. Notwithstanding the foregoing provisions of this Section 6(e)(i), 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 Grant Date pursuant to a transaction described in, and in a manner consistent with, Code Section 424(a).

(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) promissory note, to the extent permitted by Applicable Laws, (4) 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 further that accepting such Shares will not result in any adverse accounting consequences to the Company, as the Administrator determines in its sole discretion; (5) consideration received by the Company under cashless exercise program (whether through a broker or otherwise) implemented by the Company in connection with the Plan; (6) by net exercise, (7) such other consideration and method of payment for the issuance of Shares to the extent permitted by Applicable Laws, or (8) any combination of the foregoing methods of payment. In making its determination as to the type of consideration to accept, the Administrator will consider if acceptance of such consideration may be reasonably expected to benefit the Company.

(f) 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 tax withholding). 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 15 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 thirty (30) days of termination, or such longer period of time as is specified in the Award Agreement (but in no event later than the expiration of the term of such Option as set forth in the Award Agreement) to the extent that the Option is vested on the date of 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 six (6) months of termination, or such longer period of time as is specified in the Award Agreement (but in no event later than the expiration of the term of such Option as set forth in the Award Agreement) to the extent the Option is vested on the date of 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 within six (6) months following the Participant's death, or within such longer period of time as is specified in the Award Agreement (but in no event later than the expiration of the term of such Option as set forth in the Award Agreement) to the extent that the Option is vested on the date of death, by the Participant's designated beneficiary, provided such beneficiary has been designated prior to the 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. 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.

(g) Transferability. (i) An Incentive Stock Option shall not be transferable except by will or by the laws of descent and distribution and shall be exercisable during the lifetime of the Optionholder only by the Optionholder. Notwithstanding the foregoing, the Optionholder may, by delivering written notice to the Administrator, in a form satisfactory to the Administrator, designate a third party who, in the event of the death of the Optionholder, shall thereafter be entitled to exercise the Option. (ii) A Nonstatutory Stock Option may, in the sole discretion of the Administrator, be transferable to a Permitted Transferee, upon written approval by the Administrator to the extent provided in the Award Agreement. If the Nonstatutory Stock Option does not provide for transferability, then the Nonstatutory Stock Option shall not be transferable except by will or by the laws of descent and distribution and shall be exercisable during the lifetime of the Optionholder only by the Optionholder. Notwithstanding the foregoing, the Optionholder may, by delivering written notice to the Company, in a form satisfactory to the Company, designate a third party who, in the event of the death of the Optionholder, shall thereafter be entitled to exercise the Option.

## 7. 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 Shares subject to any Award of Stock Appreciation Rights.

(c) Exercise Price and Other Terms. The per Share exercise price for the Shares that will determine the amount of the payment to be received upon exercise of a Stock Appreciation Right as set forth in Section 7(f) 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 Grant Date. Otherwise, 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.

(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(d) relating to the maximum term and Section 6(f) 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 Stock Appreciation Right exercise may be in cash, in Shares of equivalent value, or in some combination thereof.

(g) Transferability. Except as provided in this Section 8 or as the Administrator determines, 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.

#### 8. 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 8 or as the Administrator determines, 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 8, 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. 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.

#### 9. 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, 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 service), 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 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.

10. Performance Awards. The Administrator is authorized to grant Performance Awards to Participants with the following terms and conditions and with such additional terms and conditions, in either case not inconsistent with the provisions of the Plan, as the Administrator shall determine:

(a) Performance Awards may be denominated as a cash amount, number of Shares or a combination thereof and are Awards which may be earned upon achievement or satisfaction of performance conditions specified by the Administrator. In addition, the Administrator may specify that any other Award shall constitute a Performance Award by conditioning the right of a Participant to exercise the Award or have it settled, and the timing thereof, upon achievement or satisfaction of such Performance Goals over such Performance Periods as may be specified by the Administrator. The Administrator may use such business criteria and other measures of performance as it may deem appropriate in establishing any Performance Goals. Subject to the terms of the Plan, the Performance Goals to be achieved during any Performance Period, the length of any Performance Period, the amount of any Performance Award granted and the amount of any payment or transfer to be made pursuant to any Performance Award shall be determined by the Administrator.

(b) Each Performance Award shall include a pre-established formula, such that payment, retention or vesting of the Award is subject to the achievement during a Performance Period or Performance Periods, as determined by the Administrator, of a level or levels of, or increases in, in each case as determined by the Administrator, one or more of the following performance measures with respect to the Company: net sales; revenue; revenue growth or product revenue growth; operating income (before or after taxes); pre- or after-tax income or loss (before or after allocation of corporate overhead and bonus); net earnings; earnings per share; net income or loss (before or after taxes); return on equity; total shareholder return; return on assets or net assets; appreciation in and/or maintenance of share price; market share; gross profits; earnings or loss (including earnings or loss before taxes, before interest and taxes, or before earnings before interest, taxes, depreciation and amortization); economic value-added models or equivalent metrics; comparisons with various stock market indices; reductions in costs; cash flow or cash flow per share (before or after dividends); return on capital (including return on total capital or return on invested capital); cash flow return on investment; improvement in or attainment of expense levels or working capital levels, including cash, inventory and accounts receivable; operating margin; gross margin; cash margin; year-end cash; debt reduction; shareholder equity; operating efficiencies; market share; customer satisfaction; customer growth; employee satisfaction; research and development achievements; manufacturing achievements (including obtaining particular yields from manufacturing runs and other measurable objectives related to process development activities); regulatory achievements (including submitting or filing applications or other documents with regulatory authorities or receiving approval of any such applications or other documents and passing pre-approval inspections (whether of the Company or the Company's third-party manufacturer) and validation of manufacturing processes (whether the Company's or the Company's third-party manufacturer's)); financial ratios, including those measuring liquidity, activity, profitability or leverage; cost of capital or assets under management; financing and other capital raising transactions (including sales of the Company's equity or debt securities; factoring transactions; sales or licenses of the Company's assets, including its intellectual property, whether in a particular jurisdiction or territory or globally; or through partnering transactions); and implementation, completion or attainment of measurable objectives with respect to research, development, manufacturing, commercialization, products or projects, production volume levels, acquisitions and divestitures; factoring transactions; and recruiting and maintaining personnel. Performance criteria may be measured on an absolute (e.g., plan or budget) or relative basis, and may be established on a corporate-wide basis or with respect to one or more business units, divisions, subsidiaries or business segments. Relative performance may be measured against a group of peer companies, a financial market index or other acceptable objective and quantifiable indices. The Award Agreement may provide that if the Administrator determines that a change in the business, operations, corporate structure or capital structure of the Company, or the manner in which the Administrator conducts its business, or other events or circumstances render the performance objectives unsuitable, the Administrator may modify the performance objectives or the related minimum acceptable level of achievement, in whole or



in part, as the Administrator deems appropriate and equitable. Performance measures may vary from Performance Award to Performance Award, respectively, and from Participant to Participant, and may be established on a stand-alone basis, in tandem or in the alternative. The Administrator shall have the power to impose such other restrictions on Awards subject to this Section as it may deem necessary or appropriate.

(b) Settlement of Performance Awards shall be in cash, Shares, other Awards, other property, net settlement, or any combination thereof, in the discretion of the Administrator.

(c) The Administrator shall specify the circumstances in which, and the extent to which, Performance Awards shall be paid or forfeited in the event of a Participant's termination as a Service Provider.

11. Other Awards. The Administrator is authorized, subject to limitations under applicable law, to grant to Participants such other Awards that may be denominated or payable in, valued in whole or in part by reference to, or otherwise based on, or related to, Shares or factors that may influence the value of Shares, including convertible or exchangeable debt securities, other rights convertible or exchangeable into Shares, purchase rights for Shares, Awards with value and payment contingent upon performance of the Company or business units thereof or any other factors designated by the Administrator. The Administrator shall determine the terms and conditions of such Awards. Shares delivered pursuant to an Award in the nature of a purchase right granted under this Section shall be purchased for such consideration, paid for at such times, by such methods and in such forms, including cash, Shares, other Awards, other property, or any combination thereof, as the Administrator shall determine. Cash awards may also be granted pursuant to this Section.

12. 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, 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.

13. Leaves of Absence/Transfer 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.

14. Limited Transferability of Awards. Unless determined otherwise by the Administrator, Awards may not be sold, pledged, assigned, hypothecated, or otherwise transferred in any manner other than by will or by the laws of descent and distribution, and may be exercised, during the lifetime of the Participant, only by the Participant.

15. 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 securities that may be delivered under the Plan and/or the number, class, and price of securities covered by each outstanding Award, and the limits set forth in Sections 3 and 5 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) Merger or Change in Control.

(i) In the event of a merger or Change in Control, each outstanding Award will be treated as the Administrator determines without a Participant's consent, including, without limitation, that (A) Awards will be assumed, or substantially equivalent Awards will be substituted, by the acquiring or succeeding corporation (or an affiliate thereof) with appropriate adjustments as to the number and kind of shares and prices; (B) upon written notice to a Participant, that the Participant's Awards will terminate upon or immediately prior to the consummation of such merger or Change in Control (subject to the provisions of the following paragraph); (C) outstanding Awards will vest and become exercisable, realizable, or payable, or restrictions applicable to an Award will lapse, in whole or in part prior to or upon consummation of such merger or Change in Control, and, to the extent the Administrator determines, terminate upon or immediately prior to the effectiveness of such merger or Change in Control; (D) (1) the termination of an Award in exchange for an amount of cash and/or property, if any, equal to the amount that would have been attained upon the exercise of such Award or realization of the Participant's rights as of the date of the occurrence of the transaction (and, for the avoidance of doubt, if as of the date of the occurrence of the transaction the Administrator determines in good faith that no amount would have been attained upon the exercise of such Award or realization of the Participant's rights, then such Award may be terminated by the Company without payment), or (2) the replacement of such Award with other rights or property selected by the Administrator in its sole discretion; or (E) any combination of the foregoing. In taking any of the actions permitted under this Section 15(c), the Administrator will not be obligated to treat all Awards, all Awards held by a Participant, or all Awards of the same type, similarly.

(ii) In the event that the Company does not continue and the successor corporation does not assume or substitute for the Award (or portion thereof) then with respect to the Award (or portion thereof), 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, unless otherwise provided in an Award Agreement, 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 continued, assumed or substituted in the event of a merger or 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.

(iii) For the purposes of this subsection 15(c), an Award will be considered assumed if, following the merger or Change in Control, the Award confers the right to purchase or receive, for each Share subject to the Award immediately prior to the merger or Change in Control, the consideration (whether stock, cash, or other securities or property) received in the merger or 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 merger or 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, 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 merger or Change in Control.

(iv) Notwithstanding anything in this Section 15(c) to the contrary, unless otherwise provided in an Award Agreement, 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 in a manner that would be adverse to the Participant; 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.

(v) Notwithstanding anything in this Section 15(c) to the contrary, if a payment under an Award Agreement is subject to Code Section 409A and if the change in control definition contained in the Award Agreement does not comply with the definition of "change of control" for purposes of a distribution under Code Section 409A, then any payment of an amount that is otherwise accelerated under this Section will be delayed until the earliest time that such payment would be permissible under Code Section 409A without triggering any penalties applicable under Code Section 409A.

## 16. Tax Considerations.

(a) Withholding Requirements. Prior to the delivery of any Shares or cash pursuant to an Award (or exercise, vesting or settlement thereof, as applicable), 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, vesting or settlement thereof, as applicable).

(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) (i) paying cash, (ii) electing to have the Company withhold otherwise deliverable Shares having a Fair Market Value equal to the minimum statutory amount required to be withheld, (iii) delivering to the Company already-owned Shares having a Fair Market Value equal to the statutory amount required to be withheld, provided the delivery of such Shares will not result in any adverse accounting consequences, as the Administrator determines in its sole discretion, or (iv) selling a sufficient number of Shares otherwise deliverable to the Participant through such means as the Administrator may determine in its sole discretion (whether through a broker or

otherwise) equal to the amount required to be withheld. The amount of the withholding requirement will be deemed to include any amount which the Administrator agrees may be withheld at the time the election is made, not to exceed the amount determined by using the maximum federal, state or local marginal income tax rates applicable to the Participant with respect to the Award on the date that the amount of tax to be withheld is to be determined. 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.

17. 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.

18. Term of Plan. Unless earlier terminated under Section 19(a) below, the Plan will continue in effect for a term of ten (10) years from the later of (a) the Effective Date of the Plan, or (b) the earlier of the most recent Board or stockholder approval of an increase in the number of Shares reserved for issuance under the Plan.

19. 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.

20. 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.

(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.

21. 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.

22. 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.

**SHOCKWAVE MEDICAL, INC. 2019 EQUITY INCENTIVE PLAN**

**STOCK OPTION AGREEMENT**

Unless otherwise defined herein, the terms defined in the ShockWave Medical, Inc. 2019 Equity Incentive Plan (the "Plan") shall have the same defined meanings in this Stock Option Agreement (this "Option Agreement").

**I. NOTICE OF STOCK OPTION GRANT**

**Name:**

**Address:**

The undersigned Participant has been granted an Option to purchase Common Stock of the Company, subject to the terms and conditions of the Plan and this Option Agreement, as follows:

Date of Grant: \_\_\_\_\_

Vesting Commencement Date: \_\_\_\_\_

Exercise Price per Share: \_\_\_\_\_

Total Number of Shares Granted: \_\_\_\_\_

Total Exercise Price : \_\_\_\_\_

Type of Option: \_\_\_\_\_

Term/Expiration Date: \_\_\_\_\_

**Vesting Schedule:**

This Option shall be exercisable, in whole or in part, according to the following vesting schedule:

[Twenty-five percent (25%) of the Shares subject to the Option shall vest on the one (1) year anniversary of the Vesting Commencement Date, and one forty-eighth (1/48<sup>th</sup>) of the Shares subject to the Option shall vest each month thereafter on the same day of the month as the Vesting Commencement Date (and if there is no corresponding day, on the last day of the month), subject to Participant continuing to be a Service Provider through each such date.

Notwithstanding the foregoing, in the event of a Change in Control, and subject to Participant continuing to be a Service Provider through the date of such Change in Control, Participant will fully vest in and have the right to exercise all of the Shares subject to this Option. The Administrator will notify Participant in writing or electronically that this Option will be exercisable for a period of time determined by the Administrator in its sole discretion, and, to the extent the Administrator determines, terminate upon or immediately prior to the effectiveness of the Change in Control.]

**Termination Period:**

This Option shall be exercisable for three (3) months after Participant ceases to be a Service Provider, unless such cessation is due to Participant's death or Disability, in which case this Option shall be exercisable for twelve (12) months after Participant ceases to be a Service Provider. Notwithstanding the foregoing sentence, in no event may this Option be exercised after the Term/Expiration Date as provided above and this Option may be subject to earlier termination as provided in Section 13(c) of the Plan.

## II. AGREEMENT

1. Grant of Option. The Administrator of the Company hereby grants to the Participant named in the Notice of Stock Option Grant in Part I of this Agreement (“Participant”), an option (the “Option”) to purchase the number of Shares set forth in the Notice of Stock Option Grant, at the exercise price per Share set forth in the Notice of Stock Option Grant (the “Exercise Price”), and subject to the terms and conditions of the Plan, which is incorporated herein by reference. Subject to Section 19(c) of the Plan, in the event of a conflict between the terms and conditions of the Plan and this Option Agreement, the terms and conditions of the Plan shall prevail.

If designated in the Notice of Stock Option Grant as an Incentive Stock Option (“ISO”), this Option is intended to qualify as an Incentive Stock Option as defined in Section 422 of the Code. Nevertheless, to the extent that it exceeds the \$100,000 rule of Code Section 422(d), this Option shall be treated as a Nonstatutory Stock Option (“NSO”). Further, if for any reason this Option (or portion thereof) shall not qualify as an ISO, then, to the extent of such nonqualification, such Option (or portion thereof) shall be regarded as a NSO granted under the Plan. In no event shall the Administrator, the Company or any Parent or Subsidiary or any of their respective employees or directors have any liability to Participant (or any other person) due to the failure of the Option to qualify for any reason as an ISO.

### 2. Exercise of Option.

(a) Right to Exercise. This Option shall be exercisable during its term in accordance with the Vesting Schedule set out in the Notice of Stock Option Grant and with the applicable provisions of the Plan and this Option Agreement.

(b) Method of Exercise. This Option shall be exercisable by delivery of an exercise notice in the form attached as Exhibit A (the “Exercise Notice”) or in a manner and pursuant to such procedures as the Administrator may determine, which shall state the election to exercise the Option, the number of Shares with respect to which the Option is being exercised (the “Exercised Shares”), and such other representations and agreements as may be required by the Company. The Exercise Notice shall be accompanied by payment of the aggregate Exercise Price as to all Exercised Shares, together with any applicable tax withholding. This Option shall be deemed to be exercised upon receipt by the Company of such fully executed Exercise Notice accompanied by payment of the aggregate Exercise Price, together with any applicable tax withholding.

No Shares shall be issued pursuant to the exercise of an Option unless such issuance and such exercise comply with Applicable Laws. Assuming such compliance, for income tax purposes the Shares shall be considered transferred to Participant on the date on which the Option is exercised with respect to such Shares.

### 3. [Intentionally left blank.]

4. Lock-Up Period. Participant hereby agrees that Participant shall not offer, pledge, sell, contract to sell, sell any option or contract to purchase, purchase any option or contract to sell, grant any option, right or warrant to purchase, lend, or otherwise transfer or dispose of, directly or indirectly, any Common Stock (or other securities) of the Company or enter into any swap, hedging or other arrangement that transfers to another, in whole or in part, any of the economic consequences of ownership of any Common Stock (or other securities) of the Company held by Participant (other than those included in the registration) for a period specified by the representative of the underwriters of Common Stock (or other securities) of the Company not to exceed one hundred and eighty (180) days following the effective date of any registration statement of the Company filed under the Securities Act (or such other period as may be requested by the Company or the underwriters to accommodate regulatory restrictions on (i) the publication or other distribution of research reports and (ii) analyst recommendations and opinions, including, but not limited to, the restrictions contained in NASD Rule 2711(f)(4) or NYSE Rule 472(f)(4), or any successor provisions or amendments thereto).

Participant agrees to execute and deliver such other agreements as may be reasonably requested by the Company or the underwriters that are consistent with the foregoing or necessary to give further effect thereto. In addition, if requested by the Company or the representative of the underwriters of Common Stock (or other securities) of the Company, Participant shall provide, within ten (10) days of such request, such information as may be required by the Company or such representative in connection with the completion of any public offering of the Company's securities pursuant to a registration statement filed under the Securities Act. The obligations described in this Section 4 shall not apply to a registration relating solely to employee benefit plans on Form S-1 or Form S-8 or similar forms that may be promulgated in the future, or a registration relating solely to a Securities Exchange Commission Rule 145 transaction on Form S-4 or similar forms that may be promulgated in the future. The Company may impose stop-transfer instructions with respect to the shares of Common Stock (or other securities) subject to the foregoing restriction until the end of said one hundred and eighty (180) day (or other) period. Participant agrees that any transferee of the Option or shares acquired pursuant to the Option shall be bound by this Section 4.

5. Method of Payment. Payment of the aggregate Exercise Price shall be by any of the following, or a combination thereof, at the election of the Participant:

(a) cash;

(b) check;

(c) consideration received by the Company under a formal cashless exercise program adopted by the Company at the direction of the Administrator in connection with the Plan; or

(d) surrender of other Shares which (i) shall be valued at its Fair Market Value on the date of exercise, and (ii) must be owned free and clear of any liens, claims, encumbrances or security interests, if accepting such Shares, in the sole discretion of the Administrator, shall not result in any adverse accounting consequences to the Company.

6. Restrictions on Exercise. This Option may not be exercised until such time as the Plan has been approved by the stockholders of the Company, or if the issuance of such Shares upon such exercise or the method of payment of consideration for such shares would constitute a violation of any Applicable Law.

7. Non-Transferability of Option. This Option may not be transferred in any manner otherwise than by will or by the laws of descent or distribution and may be exercised during the lifetime of Participant only by Participant. The terms of the Plan and this Option Agreement shall be binding upon the executors, administrators, heirs, successors and assigns of Participant.

8. Term of Option. This Option may be exercised only within the term set out in the Notice of Stock Option Grant, and may be exercised during such term only in accordance with the Plan and the terms of this Option Agreement.

9. Tax Obligations.

(a) Tax Withholding. Participant agrees to make appropriate arrangements with the Company (or the Parent or Subsidiary employing or retaining Participant) for the satisfaction of all Federal, state, local and foreign income and employment tax withholding requirements applicable to the Option exercise. Participant acknowledges and agrees that the Company may refuse to honor the exercise and refuse to deliver the Shares if such withholding amounts are not delivered at the time of exercise.

(b) Notice of Disqualifying Disposition of ISO Shares. If the Option granted to Participant herein is an ISO, and if Participant sells or otherwise disposes of any of the Shares acquired pursuant to the ISO on or before the later of (i) the date two (2) years after the Date of Grant, or (ii) the date one (1) year after the date of exercise, Participant shall immediately notify the Company in writing of such disposition. Participant agrees that Participant may be subject to income tax withholding by the Company on the compensation income recognized by Participant.

(c) Code Section 409A. Notwithstanding any provision of the Plan or this Option Agreement to the contrary, this Option is intended to be exempt from Code Section 409A; provided, that the Company does not guarantee to Participant any particular tax treatment of the Option. In no event whatsoever shall the Company be liable for any additional tax, interest or penalties that may be imposed on Participant by Code Section 409A or any damages for failing to comply with Code Section 409A.

10. Entire Agreement; Governing Law. The Plan is incorporated herein by reference. The Plan and this Option Agreement constitute the entire agreement of the parties with respect to the subject matter hereof and supersede in their entirety all prior undertakings and agreements of the Company and Participant with respect to the subject matter hereof, and may not be modified adversely to the Participant's interest except by means of a writing signed by the Company and Participant. This Option Agreement is governed by the internal substantive laws but not the choice of law rules of California.

11. No Guarantee of Continued Service. PARTICIPANT ACKNOWLEDGES AND AGREES THAT THE VESTING OF SHARES PURSUANT TO THE VESTING SCHEDULE HEREOF IS EARNED ONLY BY CONTINUING AS A SERVICE PROVIDER AT THE WILL OF THE COMPANY (OR THE PARENT OR SUBSIDIARY EMPLOYING OR RETAINING PARTICIPANT) AND NOT THROUGH THE ACT OF BEING HIRED, BEING GRANTED THIS OPTION OR ACQUIRING SHARES HEREUNDER. PARTICIPANT FURTHER ACKNOWLEDGES AND AGREES THAT THIS AGREEMENT, THE TRANSACTIONS CONTEMPLATED HEREUNDER AND THE VESTING SCHEDULE SET FORTH HEREIN DO NOT CONSTITUTE AN EXPRESS OR IMPLIED PROMISE OF CONTINUED ENGAGEMENT AS A SERVICE PROVIDER FOR THE VESTING PERIOD, FOR ANY PERIOD, OR AT ALL, AND SHALL NOT INTERFERE IN ANY WAY WITH PARTICIPANT'S RIGHT OR THE RIGHT OF THE COMPANY (OR THE PARENT OR SUBSIDIARY EMPLOYING OR RETAINING PARTICIPANT) TO TERMINATE PARTICIPANT'S RELATIONSHIP AS A SERVICE PROVIDER AT ANY TIME, WITH OR WITHOUT CAUSE.



Participant acknowledges receipt of a copy of the Plan and represents that he or she is familiar with the terms and provisions thereof, and hereby accepts the Option subject to all of the terms and provisions of this Option Agreement and the Plan. Participant has reviewed the Plan and this Option Agreement in their entirety, has had an opportunity to obtain the advice of counsel prior to executing this Option Agreement and fully understands all provisions of this Option Agreement. Participant hereby agrees to accept as binding, conclusive and final all decisions or interpretations of the Administrator upon any questions arising under the Plan or this Option Agreement. Participant further agrees to notify the Company upon any change in the residence address indicated below.

PARTICIPANT

SHOCKWAVE MEDICAL, INC.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
By

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Residence Address

\_\_\_\_\_  
Title

\_\_\_\_\_  
Email Address

**EXHIBIT A**

**SHOCKWAVE MEDICAL, INC. 2019 EQUITY INCENTIVE PLAN**

**EXERCISE NOTICE**

ShockWave Medical, Inc.  
48501 Warm Springs Blvd., Ste. 108  
Fremont, CA 94539  
Attention: Corporate Secretary

1. **Exercise of Option.** Effective as of today, \_\_\_\_\_, \_\_\_\_\_, the undersigned ("Participant") hereby elects to exercise Participant's option (the "Option") to purchase \_\_\_\_\_ shares of the Common Stock (the "Shares") of ShockWave Medical, Inc. (the "Company") under and pursuant to the ShockWave Medical, Inc. 2019 Equity Incentive Plan (the "Plan") and the Stock Option Agreement dated \_\_\_\_\_ (the "Option Agreement").

2. **Delivery of Payment.** Participant herewith delivers to the Company the full purchase price of the Shares, as set forth in the Option Agreement, and any and all withholding taxes due in connection with the exercise of the Option.

3. **Representations of Participant.** Participant acknowledges that Participant has received, read and understood the Plan and the Option Agreement and agrees to abide by and be bound by their terms and conditions.

4. **Rights as Stockholder.** Until the issuance of the Shares (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 shall exist with respect to the Common Stock subject to an Award, notwithstanding the exercise of the Option. The Shares shall be issued to Participant as soon as practicable after the Option is exercised in accordance with this Option Agreement. No adjustment shall be made for a dividend or other right for which the record date is prior to the date of issuance except as provided in Section 13 of the Plan.

5. **Tax Consultation.** Participant understands that Participant may suffer adverse tax consequences as a result of Participant's purchase or disposition of the Shares. Participant represents that Participant has consulted with any tax consultants Participant deems advisable in connection with the purchase or disposition of the Shares and that Participant is not relying on the Company for any tax advice.

6. **Successors and Assigns.** The Company may assign any of its rights under this Exercise Notice to single or multiple assignees, and this Exercise Notice shall inure to the benefit of the successors and assigns of the Company. Subject to the restrictions on transfer herein set forth, this Exercise Notice shall be binding upon Participant and his or her heirs, executors, administrators, successors and assigns.

7. **Interpretation.** Any dispute regarding the interpretation of this Exercise Notice shall be submitted by Participant or by the Company forthwith to the Administrator, which shall review such dispute at its next regular meeting. The resolution of such a dispute by the Administrator shall be final and binding on all parties.

8. **Governing Law; Severability.** This Exercise Notice is governed by the internal substantive laws, but not the choice of law rules, of California. In the event that any provision hereof becomes or is declared by a court of competent jurisdiction to be illegal, unenforceable or void, this Exercise Notice shall continue in full force and effect.

9. Entire Agreement. The Plan and Option Agreement are incorporated herein by reference. This Exercise Notice, the Plan and the Option Agreement constitute the entire agreement of the parties with respect to the subject matter hereof and supersede in their entirety all prior undertakings and agreements of the Company and Participant with respect to the subject matter hereof, and may not be modified adversely to the Participant's interest except by means of a writing signed by the Company and Participant.

Submitted by:  
PARTICIPANT

Accepted by:  
SHOCKWAVE MEDICAL, INC.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
By

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Print Name

Address:  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Title

Address:  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Date Received

**SHOCKWAVE MEDICAL, INC.**  
**EMPLOYEE STOCK PURCHASE PLAN**

Section 1. *Purpose of the Plan; Effective Date.*

The purpose of this ShockWave Medical, Inc. Employee Stock Purchase Plan (the “**Plan**”) is to provide Eligible Employees (as defined below) with an opportunity to acquire an equity interest in ShockWave Medical, Inc. (the “**Company**”) by purchasing shares of the Company’s common stock, par value \$0.001 per share (the “**Stock**”). This Plan is intended to qualify under Section 423 of the Internal Revenue Code of 1986, as amended (the “**Code**”) the Plan shall be interpreted in a manner that is consistent with that intent.

This Plan is effective on the the effective date of the registration statement on Form S-1 (the “**Registration Statement**”) filed by the Company with the Securities and Exchange Commission for its initial offering of Stock to the public (the “**Effective Date**”), and, and, unless terminated earlier pursuant to Section 10, shall have a term of ten (10) years.

Section 2. *Administration of the Plan.*

(a) Administrator. The Plan shall be administered by the Board of Directors of the Company (the “**Board**”) or by the committee of the Board designated by the Board to administer the Plan (such committee, and the Board to the extent that the Board retains or exercises administrative authority over the Plan, the “**Committee**”). Unless otherwise determined by the Board, the Compensation Committee of the Board shall be the “Committee” hereunder. To the extent permitted by law, the Committee may delegate responsibilities for day-to-day administration of the Plan to one or more officers of the Company.

(b) Responsibilities. The Committee shall have the authority to construe and interpret the Plan, prescribe, amend and rescind rules relating to the Plan’s administration and take any other actions necessary or desirable for the administration of the Plan including, without limitation:

(i) determining the Participating Companies hereunder from time to time; and

(ii) adopting sub-plans applicable to particular Participating Subsidiaries or locations, with such provisions as the Committee may deem appropriate to conform with local laws, which sub-plans may be designed to be outside the scope of Section 423 of the Code. All such sub-plans shall be subject to the limitations on the amount of Stock that may be issued under the Plan and, except to the extent otherwise provided in such sub-plans, shall be subject to all of the provisions set forth herein but shall be considered separate offerings under the Plan.

The Committee may correct any defect or supply any omission or reconcile any inconsistency or ambiguity in the Plan. The decisions of the Committee shall be final and binding on all persons. All expenses of administering the Plan shall be borne by the Company.

(c) Definitions. For purposes of the Plan, “**Participating Company**” means (i) the Company and (ii) each present or future Subsidiary designated by the Committee as participating in the Plan; and “**Subsidiary**” means a “subsidiary corporation” of the Company as defined in Section 424(f) of the Code.

### Section 3. *Enrollment and Participation.*

(a) Offering Periods. An “**Offering Period**” means a period with respect to which rights to purchase Stock may be granted under the Plan, as determined pursuant to this Section 3(a). Unless and until otherwise determined by the Committee, each Offering Period shall be a period of six (6) months commencing on each September 1 and March 1 in each calendar year. The Committee may change the duration and timing of Offering Periods if such change is announced prior to the scheduled beginning of the first Offering Period to be affected; *provided, however* that no Offering Period may be longer than 27 months. Further, an Offering Period may be foreshortened in connection with a Corporate Transaction as set forth in Section 9(c) below. An “**Offering Date**” means the first day of each Offering Period. A “**Purchase Date**” means the last trading day of each Offering Period.

(b) Contribution Periods. A “**Contribution Period**” means a period, with respect to each Offering Period, during which contributions may be made toward the purchase of Stock under the Plan, as determined pursuant to this Section 3(b). Unless and until otherwise determined by the Committee, each Contribution Period shall be a period of six(6) months commencing on each September 1 and March 1 in each calendar year. The Committee may change the duration and timing of Contribution Periods if such change is announced prior to the scheduled beginning of the first Contribution Period to be affected; *provided* that no Contribution Period may be longer than 27 months. Further, a Contribution Period may be foreshortened in connection with a Corporate Transaction, as set forth in Section 9(c) below.

### (c) Eligibility and Enrollment.

(i) An “**Eligible Employee**” means any employee of a Participating Company; *provided* that the Committee may, in its discretion, from time to time (i) determine that Eligible Employees who customarily work twenty (20) hours or less per week or not more than five (5) months in any calendar year (or, in each case, such lesser period of time as may be determined by the Committee in its discretion) shall not be included in the Plan or an Offering Period and (ii) exclude employees that fall into an excludable category as described in Section 423 of the Code and the regulations thereunder. The foregoing notwithstanding, an individual shall not be considered an Eligible Employee if his or her participation in the Plan is prohibited by the law of any country that has jurisdiction over him or her or if complying with the laws of the applicable jurisdiction would cause the Plan or an Offering Period to violate Section 423 of the Code.

(ii) Any individual who, on the day preceding the first day of an Offering Period, qualifies as an Eligible Employee may elect to enroll as a participant in the Plan for such Offering Period by, prior to the commencement of such Offering Period, following the procedures specified by the Company in the manner and by the deadline specified by the Company from time to time. An Eligible Employee who has so elected to enroll in the Plan is referred to herein as a “**Participant**”. The Company shall establish an account on its books for each such Participant (a “**Plan Account**”).

(iii) Notwithstanding the foregoing, any individual who is an Eligible Employee immediately prior to the first Offering Period will be automatically enrolled in the first Offering Period. Any such Eligible Employee will be entitled to continue to participate in the first Offering Period only if such individual submits a subscription form in the form prescribed by the Company (i) no earlier than the effective date of the Form S-8 registration statement with respect to the issuance of Stock under this Plan and (ii) no later than ten (10) business days following the effective date of such S-8 registration statement or such other period of time as the Committee may determine (the “**Initial Enrollment Period**”). An Eligible Employee’s failure to submit the subscription form during the Initial Enrollment Period will result in the automatic withdrawal of such individual’s participation in the Plan for the first Offering Period.

(d) Duration of Participation. Once enrolled in the Plan, a Participant shall continue to participate in the Plan until he or she ceases to be an Eligible Employee or withdraws from the Plan under Section 5(a).

#### Section 4. *Participant Contributions.*

(a) Frequency of Payroll Deductions. A Participant may purchase shares of Stock under the Plan solely by means of payroll deductions. Payroll deductions, as designated by the Participant pursuant to Subsection (b) below, shall occur on each payday during participation in the Plan; *provided* that for the first Offering Period, payroll deductions will commence on the first payday on or following the end of the Initial Enrollment Period.

(b) Amount of Payroll Deductions. As part of the enrollment procedures described in Section 3(c) above, an Eligible Employee shall designate the portion of his or her Compensation (as defined below) that he or she elects to have withheld on each payday during the applicable Contribution Period for the purchase of Stock. Such portion shall be a whole percentage of the Eligible Employee’s Compensation, but not less than 1% nor more than 15%. For purposes of this Plan, “**Compensation**” means all base salary or wage earnings, before deduction for any deferral contributions made by the Eligible Employee to any tax-qualified or nonqualified deferred compensation plan, and exclusive of commissions, payments for incentive compensation, bonuses, overtime, shift premium and other similar compensation unless otherwise determined by the Committee on a uniform and nondiscriminatory basis; *provided* that the Committee shall have the discretion to determine the application of this definition to Participants outside the United States.

(c) Changing Withholding Rate. Unless otherwise specified by the Company prior to any Contribution Period: (i) if a Participant wishes to increase or decrease the rate of payroll withholding to be effective for the next Contribution Period, he or she may do so, subject to the limits set forth in clause (b) above, by following the procedures specified by the Company in the manner and by the deadline specified by the Company from time to time; and (ii) if a Participant wishes to decrease the rate of payroll withholding to be effective during an ongoing Contribution Period, he or she may do so one (1) time during a Contribution Period by following the procedures specified by the Company in the manner and by the deadline specified by the Company from time to time; *provided* that such decreased withholding rate shall be subject to the limits set forth in clause (b) above unless otherwise determined by the Company.

Section 5. *Withdrawal from the Plan.*

(a) Withdrawal. A Participant may elect to withdraw from the Plan by following the procedures specified by the Company in the manner and by the deadline specified by the Company from time to time. As soon as reasonably practicable thereafter, payroll deductions shall cease and the entire amount credited to the Participant's Plan Account shall be refunded to him or her in cash, without interest. No partial withdrawals shall be permitted.

(b) Re-enrollment After Withdrawal. A former Participant who has withdrawn from the Plan shall not be a Participant until he or she re-enrolls in the Plan under Section 3(c). Re-enrollment may be effective only at the commencement of the next Offering Period.

Section 6. *Change in Employment Status.*

(a) Termination of Employment. Termination of employment as an Eligible Employee for any reason, including death, shall be treated as an automatic withdrawal from the Plan under Section 5(a). A transfer of employment from one Participating Company to another Participating Company shall not be treated as a termination of employment.

(b) Leave of Absence. For purposes of the Plan, and to the extent consistent with Section 423 of the Code, employment shall not be deemed to terminate when the Participant goes on a military leave, a sick leave or another bona fide leave of absence approved by the Participating Company so long as the leave does not exceed three months or, if longer than three months, the individual's right to reemployment is provided by statute or has been agreed to by contract or in a written policy of the Company which provides for a right of reemployment following the leave of absence.

(c) Death. In the event of the Participant's death, the amount credited to his or her Plan Account shall be paid to a beneficiary designated by him or her for this purpose on the prescribed form or, if none, to the Participant's estate. Such form shall be valid only if, before the Participant's death, it was filed with the Company in accordance with the Company's procedures.

Section 7. *Plan Accounts and Purchase of Shares.*

(a) Plan Accounts. The Company shall maintain a Plan Account on its books in the name of each Participant. Whenever an amount is deducted from the Participant's Compensation under the Plan, such amount shall be credited to the Participant's Plan Account. The Company shall maintain records of all Plan Accounts, but shall have no obligation to pay interest on amounts credited thereunder or to hold such amounts in a trust or in any segregated account. Further, all such deductions received or held by the Company under the Plan may be used by the Company for any corporate purpose to the extent permitted by applicable law.

(b) Purchase Price. The "**Purchase Price**" means the price at which Participants may purchase a share of Stock under the Plan, which unless otherwise determined by the Committee, shall be the lower of:

- (i) 85% of the Fair Market Value of a share of Stock on the Purchase Date; and
- (ii) 85% of the Fair Market Value of a share of Stock on the Offering Date;

*provided* that the "Fair Market Value" as of any date shall be equal to the closing price of the Stock on any established stock exchange or a national market system as of such date, or, if no sales were reported on such date, the closing price on the last date on which sales were reported that precedes such date) or, in the absence of an established market for the Stock, as determined by the Committee in good faith on such basis as it deems appropriate (which determination shall be conclusive and binding on all persons); *provided further* that for purposes of the Offering Date for the first Offering Period, the "Fair Market Value" will be the initial price to the public as set forth in the final prospectus included within the Registration Statement.

(c) Purchase of Shares. As of each Purchase Date, each Participant's option to purchase Stock for the Offering Period shall be exercised automatically, unless the Participant has previously elected to withdraw from the Plan in accordance with Section 5(a). Subject to the limits set forth in Section 8 below, the Participant's accumulated deductions from Compensation will be used to purchase the maximum number of shares of Stock that can be purchased with the amounts in the Participant's notional Plan Account. Unless otherwise determined by the Committee with respect to all Participants, the number of shares of Stock that can be purchased by each Participant as calculated under this Section 7(c) shall be rounded down to the nearest whole number.



(d) Available Shares Insufficient. In the event that the aggregate number of shares that all Participants elect to purchase during an Offering Period exceeds the maximum number of shares remaining available for issuance under Section 9(a), then the number of shares to which each Participant is entitled shall be determined by multiplying the maximum number of shares remaining available for issuance by a fraction, the numerator of which is the number of shares that such Participant has elected to purchase and the denominator of which is the number of shares that all Participants have elected to purchase.

(e) Delivery of Shares. By enrolling in the Plan, each Participant shall be deemed to have authorized the establishment of a brokerage account on his or her behalf at a securities brokerage firm selected by the Committee. Alternatively, the Committee may provide for a Plan share account for each Participant to be established by the Company or by an outside entity selected by the Company which is not a brokerage firm. As soon as reasonably practicable after each Purchase Date, the Company shall arrange for the delivery to each Participant of the shares purchased hereunder to the Participant's brokerage or Plan share account in a form determined by the Company. Notwithstanding any other provision of the Plan, unless otherwise determined by the Committee or required by any applicable law, rule or regulation, the Company shall not deliver to any Participant certificates evidencing shares issued in connection with any purchase under the Plan, and instead such shares shall be recorded in the books of the brokerage firm selected by the Company or, as applicable, the Company, its transfer agent, stock plan administrator or such other outside entity which is not a brokerage firm.

(f) Unused Cash Balances. Following the end of any Contribution Period, any amount remaining in each Participant's Plan Account shall, at the discretion of the Committee, either be refunded to the Participant in cash, without interest, or be retained in the Participant's Plan Account for the next Contribution Period, but only to the extent representing the unused Purchase Price for fractional shares.

(g) Stockholder Approval. Any other provision of the Plan notwithstanding, no shares of Stock shall be purchased under the Plan unless and until the Company's stockholders have approved the adoption of the Plan.

#### Section 8. *Limitations on Stock Purchases Under the Plan.*

(a) Share Limit. With respect to any Offering Period, no Participant shall purchase more than 1,250 shares of Stock (or such other number of shares of Stock as may be determined by the Committee prior to the start of any Contribution Period).

(b) Dollar Limit. No Participant shall be granted a purchase right under the Plan which permits his or her rights to purchase stock under all employee stock purchase plans under Section 423 of the Code of the Company and its Subsidiaries to accrue at a rate which exceeds \$25,000 of fair market value of such stock (determined at the time the purchase right is granted) for each calendar year in which such purchase right is outstanding at any time, as determined under Section 423 of the Code and the applicable rules and regulations thereunder. If a Participant is precluded by this subsection (b) from purchasing additional Stock under the Plan, then his or her employee contributions shall automatically be discontinued and shall resume at the beginning of the earliest Contribution Period ending in the next calendar year (if he or she then is an Eligible Employee).

(c) Limit on Five Percent Holders. Any other provision of the Plan notwithstanding, no Participant shall be granted a right to purchase Stock under the Plan if such Participant, immediately after his or her election to purchase such Stock, would own, and/or hold outstanding purchase rights to purchase, stock possessing 5% or more of the total combined voting power or value of all classes of stock of the Company or any parent or Subsidiary of the Company, determined pursuant to Section 423 of the Code.

Section 9. *Stock Offered under the Plan.*

(a) Authorized Shares. The aggregate number of shares of Stock available for purchase under the Plan as of the Effective Date shall be 300,650, subject to adjustment pursuant to Section 9(b). The number of Shares available for issuance under the Plan will be increased on the first day of each fiscal year of the Company beginning with the 2020 fiscal year and ending with the 2028 fiscal year, in an amount equal to the least of (i) 1% of the outstanding Shares on the last business day of the immediately preceding fiscal year or (ii) such number of Shares determined by the Board.

(b) Antidilution Adjustments. In the event of any dividend or other distribution (whether in the form of cash, Stock, or other property), recapitalization, stock split, reverse stock split, reorganization, merger, consolidation, split-up, spin-off, combination, repurchase, or exchange of Stock or other securities of the Company, or other change in the Company's structure affecting the Stock, then, in order to prevent dilution or enlargement of the benefits or potential benefits intended to be made available under the Plan, the Committee will, in such manner as it deems equitable, adjust the aggregate number of shares of Stock offered under the Plan, the share limitation described in Section 8(a) and the price of shares that any Participant has elected to purchase shall be adjusted proportionately by the Committee.

(c) Corporate Transaction. In the event of a Corporate Transaction (as defined below), each outstanding option will be assumed or an equivalent option substituted by the successor corporation or a parent or Subsidiary of such successor corporation. If the successor corporation refuses to assume or substitute the option, the Offering Period with respect to which the option relates will be shortened by setting a new Purchase Date on which the Offering Period will end. The new Purchase Date will occur before the date of the Corporate Transaction. Prior to the new Purchase Date, the Committee will provide each Participant with written notice, which may be electronic, of the new Purchase Date and that the Participant's option will be exercised automatically on such date, unless before such time, the Participant has withdrawn from the Offering Period in accordance with Section 5(a). A "**Corporate Transaction**" means a merger, consolidation, acquisition of property or stock, separation, reorganization or other corporate event described in Section 424 of the Code.

(d) Dissolution or Liquidation. Unless otherwise determined by the Committee, in the event of a proposed dissolution or liquidation of the Company, any Offering Period and Contribution Period then in progress will be shortened by setting a new Purchase Date and the Offering Period and Contribution Period will end immediately prior to the proposed dissolution or liquidation. The new Purchase Date will be before the date of the Company's proposed dissolution or liquidation. Before the new Purchase Date, the Committee will provide each Participant with written notice, which may be electronic, of the new Purchase Date and that the Participant's option will be exercised automatically on such date, unless before such time, the Participant has withdrawn from the Offering in accordance with Section 5(a).

#### Section 10. *Amendment or Discontinuance.*

(a) The Board or the Committee may, in its sole discretion, amend, suspend or terminate the Plan at any time and for any reason, with or without notice. If the Plan is terminated, the Committee may elect to terminate all outstanding Offering Periods and Collection Periods, either immediately or once shares of Stock have been purchased on the next Purchase Date (which may, in the discretion of the Committee, be accelerated) or permit outstanding Offering Periods and Collection Periods to expire in accordance with their terms (and subject to any adjustment in accordance with Section 9(b)). If any Offering Period is terminated before its scheduled expiration, all amounts that have not been used to purchase shares of Common Stock will be returned to Participants (without interest, except as otherwise required by law) as soon as administratively practicable.

(b) Except as provided in Section 9(b), any increase in the aggregate number of shares of Stock to be issued under the Plan shall be subject to approval by a vote of the stockholders of the Company, and no amendment shall be made which shall allow a Purchase Price for offerings under the Plan to be less than the lower of (i) 85% of the Fair Market Value on the Offering Date or (ii) 85% of the Fair Market Value on the Purchase Date.

#### Section 11. *General Provisions.*

(a) Equal Rights and Privileges. Notwithstanding any provision of the Plan to the contrary and in accordance with Section 423 of the Code, all Eligible Employees who are granted options under the Plan shall have the same rights and privileges.

(b) Rights Not Transferrable. The rights of any Participant under the Plan, or any Participant's interest in any Stock or moneys to which he or she may be entitled under the Plan, shall not be transferable by voluntary or involuntary assignment or by operation of law, or in any other manner other than by beneficiary designation or the laws of descent and distribution. If any Participant in any manner attempts to transfer, assign or otherwise encumber his or her rights or interest under the Plan, other than by beneficiary designation or the laws of descent and distribution, then such act shall be treated as an election by the Participant to withdraw from the Plan under Section 5(a).

(c) No Rights as an Employee. Nothing in the Plan or in any right granted under the Plan shall confer upon any Eligible Employee or any Participant any right to continue in the employ of a Participating Company for any period of time or interfere with or otherwise restrict in any way any rights of the Participating Companies or of the Participant to terminate his or her employment at any time and for any reason, with or without cause.

(d) Rights as a Shareholder. A Participant shall have no rights as a shareholder with respect to any shares of Stock that he or she may have a right to purchase under the Plan until such shares have been purchased on the applicable Purchase Date and issued to the Participant.

(e) Compliance with Law. Shares of Stock shall not be issued under the Plan unless the issuance and delivery of such shares comply with (or are exempt from) all applicable requirements of law, including (without limitation) the Securities Act of 1933, as amended, the rules and regulations promulgated thereunder, state securities laws and regulations, and the regulations of any stock exchange or other securities market on which the Company's securities may then be traded.

(f) Applicable Law. The laws of the State of Delaware shall govern all questions concerning the construction, validity and interpretation of the Plan, without regard to such state's conflict of law rules.

(g) Shareholder Approval. The Plan shall be subject to approval by the shareholders of the Company within twelve (12) months before or after the date the Plan is adopted by the Board.

(h) Withholding. To the extent required by applicable Federal, state or local law, a Participant must make arrangements satisfactory to the Company for the payment of any withholding or similar tax obligations that arise in connection with the Plan.

(i) Severability. If any provision of the Plan shall for any reason be held to be invalid or unenforceable, such invalidity or unenforceability shall not affect any other provision hereof, and the Plan shall be construed as if such invalid or unenforceable provision were omitted.

(j) Headings. The headings of sections herein are included solely for convenience and shall not affect the meaning of any of the provisions of the Plan.

## SHOCKWAVE MEDICAL, INC.

## NON-EMPLOYEE DIRECTOR COMPENSATION PLAN

This ShockWave Medical, Inc. Non-Employee Director Compensation Plan (this “Plan”) was adopted by the Board of Directors (the “Board”) of ShockWave Medical, Inc. (the “Company”) on February [ ], 2019, and became effective on February [ ], 2019.

1. Eligibility. Each member of the Board who is not a full- or part-time officer or employee of the Company (a “Non-Employee Director”) is eligible to participate in this Plan during the period of the Non-Employee Director’s service as a member of the Board.

2. Annual Cash Fees.

a. Annual Board Member Fee. Each Non-Employee Director will earn cash compensation for service as member of the Board at an annual rate of \$35,000 (such compensation, the “Annual Board Member Fee”).

b. Annual Lead Director Fee. Any Non-Employee Director serving as “Lead Director” will earn cash compensation for such service at an annual rate of \$40,000 (such compensation, the “Annual Lead Director Fee”).

c. Annual Committee Chair Fees. Each Non-Employee Director serving as the chair of one or more of the following committees of the Board will earn cash compensation for such service at the annual rate set forth here (such compensation, the “Annual Committee Chair Fee”):

- i. \$16,000 for the chair of the Audit Committee;
- ii. \$12,000 for the chair of the Compensation Committee; and
- iii. \$8,000 for the chair of the Nominating and Governance Committee.

d. Annual Committee Member Fee. Each Non-Employee Director serving as a non-chair member of one or more of the following committees of the Board will earn cash compensation for such service at the annual rate set forth here (such compensation, the “Annual Committee Member Fee”):

- i. \$8,000 for each member of the Audit Committee;
- ii. \$6,000 for each member of the Compensation Committee; and
- iii. \$4,000 for each member of the Nominating and Governance Committee.

e. Payment. The Annual Board Member Fee, Annual Lead Director Fee, Annual Committee Chair Fee and Annual Committee Member Fee (together, the “Annual Fees”) earned by each Non-Employee Director will be paid quarterly in arrears on the last business day of each

calendar quarter (each a “Quarterly Payment Date”). In the event that a Non-Employee Director serves on the Board, as Lead Director or as a chair or member of a committee for less than an entire quarter, the portion of the applicable Annual Fees earned and payable for such quarter will be prorated based on the number of days in such quarter for which such Non-Employee Director provided such service.

3. Initial Option Award. In connection with the first offering (the “Offering”) of shares of the Company’s common stock, par value \$0.001 per share (the “Common Stock”) pursuant to a registration statement filed with the Securities and Exchange Commission (the “SEC”), certain Non-Employee Director will be eligible to receive a grant of options to acquire shares of Common Stock under the ShockWave Medical, Inc. 2019 Equity Incentive Plan (the “Equity Plan”) on the day of and following the determination of the pricing committee of the Board regarding the price at which shares of the Common Stock of the Company are to be offered to the public in the Offering (such determination, the “Pricing”) (each such award, an “Initial Award”). Non-Employee Directors who shall receive such Initial Awards shall be Frederic Moll, F.T. Jay Watkins, Colin Cahill and Antoine Papiernik. Each Initial Award will have an exercise price per share equal to the price per share of Common Stock to the public in the Offering, and will cover a number of shares of Common Stock such that the value of the award estimated using the Black-Scholes method shall be \$150,000, rounded to the nearest full share. The Initial Award shall vest in three substantially equal installments on the first three anniversaries of the closing of the Offering, in each case subject to the recipient’s continued service as a member of the Board through the applicable vesting date.

4. Cash Equivalent for Equity Award. In each case where a Non-Employee Director is an equity partner or service provider of a private equity sponsor of the Company, and such sponsor has informed the Company in writing that it does not allow its equity partners or service providers, as the case may be, to accept awards of equity for compensation for services rendered to boards of directors of its portfolio companies, then such Non-Employee Director shall be eligible to receive a cash award in lieu of any Initial Award (each, a “Cash Equivalent Award”) with a value equal to the designated value of the equity award that would otherwise be provided hereunder, but otherwise subject to the same terms and conditions applicable to such award.

5. Administration. This Plan will be administered by the Board, or if the Board so determines in its discretion, by the Compensation Committee of the Board (the “Committee”). The Board (or the Committee, as the case may be) will have the power to construe this Plan, to determine all questions hereunder, and to adopt and amend such rules and regulations for the administration of this Plan as it may deem desirable. All decisions, determinations and interpretations of the Board (or the Committee, as the case may be) with respect to this Plan will be final and binding.

6. Transfer and Assignment. The right of a Non-Employee Director to receive the payment of all or a portion of an Annual Fee or to be granted an Initial Award may not be assigned, transferred, pledged or encumbered, other than by will or the laws of descent and distribution and any attempted assignment or transfer will be null and void.

7. Governing Law. This Plan will be administered, interpreted and enforced under the internal laws of the State of Delaware without regard to conflicts of laws thereof.

8. Amendment and Termination. The Board (or the Committee, if so authorized by the Board) may amend, modify or terminate this Plan for any reason at any time; *provided*, that no amendment, modification or termination, without the consent of the applicable Non-Employee Director, will materially adversely affect any then issued and outstanding Initial Award held by such Non-Employee Director.

**Consent of Independent Registered Public Accounting Firm**

We consent to the reference to our firm under the caption “Experts” and to the use of our report dated February 8, 2019 (except for Note 14, as to which the date is February 22, 2019), in Amendment No. 1 to the Registration Statement (Form S-1 No. 333-229590) and related Prospectus of ShockWave Medical, Inc. for the registration of shares of its common stock.

/s/ Ernst & Young LLP

San Jose, California

February 22, 2019