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As confidentially submitted to the Securities and Exchange Commission on December 14, 2018. This draft registration statement has not been publicly filed with the Securities and Exchange Commission and all information herein remains confidential.

Registration No. 333-

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

FORM S-1

REGISTRATION STATEMENT
Under
The Securities Act of 1933

HOOKIPA PHARMA INC.

(Exact name of registrant as specified in its charter)

Delaware (State or other jurisdiction of incorporation or organization)	**2834** (Primary Standard Industrial Classification Code Number)	**81-5395687** (I.R.S. Employer Identification Number)

430 East 29th Street, 14th Floor
New York, New York 10016
+43 1 890 63 60
(Address, including zip code, and telephone number, including area code, of registrant's principal executive offices)

Jörn Aldag
Chief Executive Officer
HOOKIPA Pharma Inc.
430 East 29th Street, 14th Floor
New York, New York 10016
+43 1 890 63 60
(Name, address, including zip code, and telephone number, including area code, of agent for service)

Copies to:

Kingsley L. Taft, Esq. **Robert E. Puopolo, Esq.** **Seo Salimi, Esq.** **Goodwin Procter LLP** **100 Northern Avenue** **Boston, Massachusetts 02210** **(617) 570-1000**	**Reinhard Kandera** **Chief Financial Officer** **HOOKIPA Pharma Inc.** **430 East 29th Street,** **14th Floor** **New York, New York 10016** **+43 1 890 63 60**	**Ilir Mujalovic, Esq.** **Shearman & Sterling LLP** **599 Lexington Avenue** **New York, New York 10022** **(212) 848-4000**

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, as amended, check the following box. o

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

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. o

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. o

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 o | Accelerated Filer o | Non-Accelerated Filer ☒ | Smaller Reporting Company o
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 to Section 7(a)(2)(B) of the Securities Act. ☒

CALCULATION OF REGISTRATION FEE

Title of Each Class of Securities to be Registered	Proposed Maximum Aggregate Offering Price(1)	Amount of Registration Fee(2)
Common Stock, par value $0.0001 per share		

(1) Estimated solely for the purpose of computing the registration fee pursuant to Rule 457(o) under the Securities Act of 1933, as amended.

(2) Calculated pursuant to Rule 457(o) under the Securities Act of 1933, as amended, based on an estimate of the proposed maximum aggregate offering price. Includes the offering price of additional shares of common stock that the underwriters have the option to purchase.

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 that specifically states that this registration statement shall thereafter become effective in accordance with Section 8(a) of the Securities Act of 1933 as amended, or until this registration statement shall become effective on such date as the Commission, acting pursuant to said Section 8(a), may determine.

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The information in this 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 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
Preliminary Prospectus, dated , 2019

PROSPECTUS

Shares

HOOKIPA PHARMA

Common Stock

This is HOOKIPA Pharma Inc.'s initial public offering. We are selling shares of our common stock.

We expect the public offering price to be between $ and $ per share. Currently, no public market exists for the shares. After pricing of the offering, we expect that the shares will trade on the Nasdaq Global Market under the symbol "HOOK."

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

Investing in the common stock involves risks that are described in the "Risk Factors" section beginning on page 12 of this prospectus.

	Per Share	Total
Public offering price	$	$
Underwriting discount(1)	$	$
Proceeds, before expenses, to us	$	$

(1) See "Underwriting" beginning on page 183 for additional information regarding underwriting compensation.

The underwriters may also exercise their option to purchase up to an additional shares from us, at the public offering price, less the underwriting discount, for 30 days after the date of this prospectus.

Neither the Securities and Exchange Commission nor any state securities commission has approved or disapproved of these securities or determined if this prospectus is truthful or complete. Any representation to the contrary is a criminal offense.

The shares will be ready for delivery on or about , 2019.

Joint Book-Running Managers

BofA Merrill Lynch **Leerink Partners** **RBC Capital Markets**

Co-Manager

Kempen

The date of this prospectus is , 2019.

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You should rely only on the information contained in this prospectus or in any free writing prospectus we file with the Securities and Exchange Commission. Neither we nor the underwriters have authorized anyone to provide you with information other than that contained in this prospectus or any free writing prospectus prepared by or on behalf of us or to which we have referred you. We take no responsibility for, and can provide no assurance as to the reliability of, any other information that others may give you. We and the underwriters are offering to sell, and seeking offers to buy, common stock, but only under circumstances and only in jurisdictions where it is lawful to do so. The information contained in this prospectus is accurate only as of the date on the front cover page of this prospectus, or other earlier date stated in this prospectus, regardless of the time of delivery of this prospectus or of any sale of our common stock.

For investors outside the United States: We have not, and the underwriters have not, done anything that would permit this offering or possession or distribution of this prospectus in any jurisdiction where action for that purpose is required, other than in the United States. Persons outside the United States who come into possession of this prospectus must inform themselves, and observe any restrictions relating to, the offering of the shares of common stock and the distribution of this prospectus outside the United States.

This prospectus includes our trademarks and trade names, including, without limitation, VAXWAVE™ and THERAT™, which are our property and are protected under applicable intellectual property laws. This prospectus also includes trademarks and trade names that are the property of other organizations. Solely for convenience, trademarks and trade names referred to in this prospectus appear without the ® and ™ symbols, but those references are not intended to indicate that we will not assert, to the fullest extent under applicable law, our rights, or that the applicable owner will not assert its rights, to these trademarks and trade names. We do not intend our use or display of other companies' trade names or trademarks to imply a relationship with, or endorsement or sponsorship of us by, any other companies. All trademarks, trade names and service marks appearing in this prospectus are the property of their respective owners.

Unless otherwise indicated or the context otherwise requires, all references in this prospectus to "HOOKIPA Pharma," "HOOKIPA," the "Company," "we," "our," "ours," "us" or similar terms refer to HOOKIPA Pharma Inc. and our consolidated subsidiaries.

PRESENTATION OF FINANCIAL INFORMATION

Pursuant to the applicable provisions of the Fixing America's Surface Transportation Act, we are not required to file our financial information for the historical 2016 annual period because we expect to file our financial information for the year ended December 31, 2018 in the first public filing of our registration statement. Furthermore, this prospectus includes our results of operations for the nine months ended September 30, 2018 without a comparison to our results of operations for the nine months ended September 30, 2017. While the financial information for the nine months ended September 30, 2017 and 2018 is otherwise required by Regulation S-X of the Securities Act of 1933, as amended, we believe that it will not be required to be included in our registration statement at the time of the first public filing.

PROSPECTUS SUMMARY

This summary highlights information contained elsewhere in this prospectus and does not contain all of the information that you should consider in making your investment decision. Before investing in our common stock, you should carefully read this entire prospectus, including our consolidated financial statements and the related notes included elsewhere in this prospectus. You should also consider, among other things, the matters described under "Risk Factors," "Business," and "Management's Discussion and Analysis of Financial Condition and Results of Operations," in each case appearing elsewhere in this prospectus.

Overview

We are a clinical-stage biopharmaceutical company developing a new class of immunotherapeutics targeting infectious diseases and cancers based on our proprietary arenavirus platform that is designed to reprogram the body's immune system. We are using our "off-the-shelf" technologies, VaxWave and TheraT, to elicit directly within patients a powerful and durable response of antigen-specific killer T cells and antibodies, thereby activating essential immune defenses against infectious diseases and cancers. We believe that our technologies can meaningfully leverage the human immune system for prophylactic and therapeutic purposes by eliciting killer T cell response levels previously not achieved by other published immunotherapy approaches. Our lead infectious disease product candidate, HB-101, is in a randomized, double-blinded Phase 2 clinical trial in cytomegalovirus-negative patients awaiting kidney transplantation from cytomegalovirus-positive donors. Our lead oncology product candidates, HB-201 and HB-202, are in development for the treatment of human papillomavirus-positive cancers. We plan to file an investigational new drug application with the U.S. Food and Drug Administration for HB-201 and HB-202 in the first half and second half of 2019, respectively. We have also entered into a strategic partnership with Gilead Sciences, Inc. to accelerate building a pipeline of additional infectious disease product candidates in a cost efficient manner.

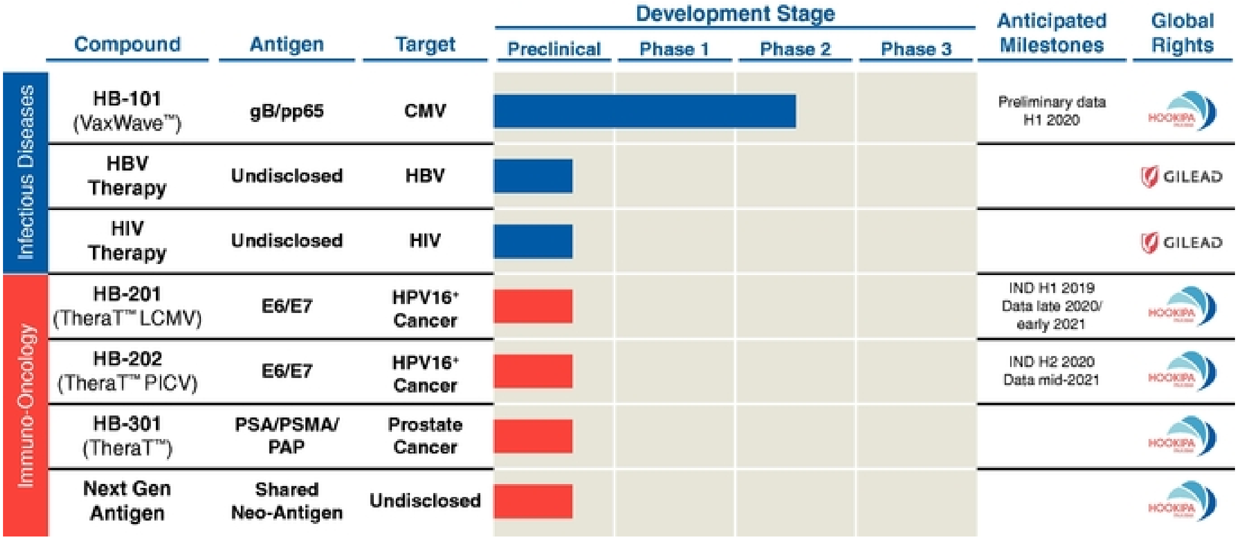
Our platform is based on engineering arenaviruses to carry and deliver virus-specific or tumor-specific genes directly in patients to dendritic cells, which are natural activators of killer T cells, also known as cytotoxic T cells, or CD8+ T cells. Arenaviruses have been used for decades as a preclinical tool to study CD8+ T cell responses. Our co-founder, Rolf Zinkernagel, was awarded a Nobel Prize in Physiology or Medicine for his arenavirus-based work on how CD8+ T cells recognize virus-infected cells. We believe that arenaviruses have several key advantages which give them the characteristics of an optimal antigen-specific immunotherapy, including:

- ability to induce a robust CD8+ T cell response by directly targeting and activating dendritic cells, which are the most efficient antigen-presenting cells of the body;
- ability to induce a robust antibody response to disease-specific target antigens;
- are not neutralized by vector-specific antibodies, thereby allowing for repeat administration that can boost immune response;
- do not require an adjuvant to stimulate the immune system; and
- have been observed to be well tolerated in preclinical studies and clinical trials.

We believe we are the first to reengineer arenaviruses for therapeutic purposes. We have created two technologies capable of delivering disease-specific antigens for the prevention and treatment of disease. Our first technology, VaxWave, is a replication-defective arenavirus which induces a strong immune response for prophylactic use against infectious disease. Our second technology, TheraT, is a replication-attenuated arenavirus which produces an even more powerful immune response that we believe is more appropriate for use in oncology. In preclinical studies, our TheraT technology was able to reprogram the immune system such that more than half of the body's CD8+ T cells focused on a specific cancer antigen target of our choice without observed serious adverse events. We have designed our platform to be modular in nature in order to allow substitution of antigens to target a broad range of infectious diseases and cancers. We have a robust intellectual property portfolio for our suite of arenaviruses with exclusive rights in issued patents and patent applications related to our VaxWave technology and exclusive and joint rights in patent applications related to our TheraT technology. These platform technologies can be used with a broad spectrum of antigens in therapeutic applications in immunotherapy ranging from infectious diseases to oncology. We believe the breadth and depth of our intellectual property is a strategic asset that has the potential to provide us with a significant competitive advantage.

We believe that our arenavirus platform approach gives us a unique and powerful way to tap into the biology of the immune system and reprogram it by instructing dendritic cells to express antigen-encoding genes that direct the immune system to the desired targets. Our product candidates are designed to deliver full-length proteins to activate T cells and B cells to produce a robust immune response through natural means, avoiding the use of artificial *ex vivo* constructs such as CAR-T cells and related approaches that bypass the immune system's normal control mechanisms. Although these latter approaches have shown clinical efficacy, they have the potential to cause life-threatening side effects, including cytokine release syndrome. In addition, we believe that our "off-the-shelf" immunotherapy is simpler, more straightforward and cost effective to manufacture and administer than CAR-T cells or other patient-derived cellular approaches.

Our Pipeline



Our lead product candidate in infectious diseases, utilizing VaxWave technology, is HB-101 for the prevention of cytomegalovirus infections. A majority of the worldwide human population is latently infected with cytomegalovirus and can transmit the infection through bodily fluids. While infection in immunocompetent persons typically presents as mild or asymptomatic, cytomegalovirus remains a major cause of morbidity and mortality in persons with a compromised immune system and in patients undergoing solid organ or hematopoietic stem cell transplants. Current therapies to prevent the transmission of cytomegalovirus during organ transplants utilize antiviral prophylactic and therapeutic strategies. However, these therapies are only partially protective in preventing viral disease while also being hampered by toxicity and resistance. HB-101 delivers two clinically validated antigens, phosphoprotein 65 to induce cytomegalovirus-specific CD8+ T cells and glycoprotein B to elicit cytomegalovirus-neutralizing antibodies.

In our Phase 1 clinical trial, HB-101 was well tolerated and elicited a strong cytomegalovirus-specific immune responses in all 42 of the treatment arm volunteers. Importantly, we observed robust CD8+ and CD4+ T cell responses as well as cytomegalovirus-neutralizing antibody responses, without meaningful vector-neutralizing antibody responses. These responses increased in a statistically significant manner upon repeat administration. The CD8+ T cell levels achieved in our trial were in the range of, or higher than, the therapeutic levels those published by third parties, in separately designed and conducted clinical trials, using adoptive T cell transfer approaches for the same antigen. We believe these results demonstrate the differentiating features of our arenavirus platform. In the fourth quarter of 2018, we commenced a Phase 2 clinical trial for HB-101 in cytomegalovirus-negative patients awaiting kidney transplantation from living cytomegalovirus-positive donors. We expect safety and immunogenicity data from the first cohorts enrolled in this trial in the first half of 2020, and preliminary efficacy data to follow in the second half of 2020.

We are developing our lead oncology product candidates, HB-201 and HB-202, both utilizing TheraT technology, for cancers caused by human papilloma virus, or HPV. These cancers account for approximately 5% of the total worldwide cancer prevalence and recent studies have shown that approximately 70% of cancers of the tonsil and tongue base and the majority of cervical and anal cancers, in addition to several other cancers including head and neck may be linked to HPV. Tumors caused by HPV are referred to as HPV-positive tumors, or HPV+, and can be characterized by their expression of proteins from the HPV genome, particularly the viral E6 and E7 proteins. These two proteins are expressed in tumors but absent in normal cells, which makes them ideal target candidates for immunotherapy, however, to date, there are no therapeutically approved agents directed against these targets.

In preclinical studies, HB-201 as a monotherapy was effective at suppressing tumor growth and eliminated up to 40% of HPV+ tumors. HB-201 generated a strong and durable T cell and antibody response with successfully treated animals demonstrating resistance to a tumor re-challenge. Based on these preliminary results, we believe that treating patients with HB-201 has the potential to both control metastatic disease and prevent relapse. We intend to file an investigational new drug application for HB-201 in treatment refractory HPV16+ cancers in the first half of 2019. Our first planned Phase 1/2 clinical trial will assess the safety and efficacy of HB-201 both as a monotherapy and in combination with a checkpoint inhibitor. Our second planned Phase 1/2 clinical trial will assess the safety and efficacy of the combination of HB-201 and HB-202 in HPV16+ cancers, with or without a checkpoint inhibitor. HB-202 similarly targets E6 and E7 of HPV16+ tumors, but uses a different arenavirus than HB-201. We believe that our preclinical studies demonstrate that the combination of HB-201 and HB-202 results in a synergistic increase in E7 immunogenicity as compared to either HB-201 or HB-202 alone. Our goal is to establish the safety of this combination approach and its superiority over monotherapy.

Collaboration with Gilead

In June 2018, we partnered with Gilead Sciences, Inc., or Gilead, a world leader in innovative therapies against infectious diseases, to develop arenavirus based therapeutics to treat hepatitis B virus, or HBV, and human immunodeficiency virus, or HIV, infections. We received a one-time upfront payment of $10.0 million upon entering into the agreement. We are also eligible to receive milestone payments based upon the achievement of specified development, regulatory, and commercial milestones potentially amounting to approximately $400 million, as well as tiered royalties ranging from high single-digit to mid-teens percentage on net sales.

Our Strategy

Our goal is to transform the prevention and treatment of infectious diseases and cancers to significantly improve the lives of patients by developing and commercializing a new class of "off-the-shelf" immunotherapeutics.

The key elements of our strategy are:

- Advance our lead infectious disease product candidate through clinical development and regulatory approval.
- Simultaneously progress our lead immuno-oncology product candidates through clinical development and regulatory approval.
- Apply our arenavirus platform to develop additional novel immuno-oncology product candidates.
- Selectively collaborate to realize the full potential of our arenavirus platform.
- Strengthen and scale our manufacturing capabilities and ultimately operate our own manufacturing facility.

Management and Investors

We are led by a team of highly experienced executives, clinicians, and scientists with focused and translational expertise in oncology, immunology, vaccinology, clinical development and commercialization. Our Chief Executive Officer, Jörn Aldag, was previously the Chief Executive Officer of uniQure N.V., a company that under his leadership pioneered the approval of the first gene therapy product. Igor Matushansky, M.D., Ph.D., our Chief Medical Officer and Global Head of Research and Development was previously Global Head of Translational Development for Oncology at Daiichi Sankyo Company, Limited. The fundamental discoveries underlying our arenavirus platform originated with our co-founders, Nobel laureate Rolf Zinkernagel, M.D., and Daniel Pinschewer, M.D., an internationally recognized arenavirus expert who serves as our Chief Scientific Officer.

We are supported by prominent biotechnology investors, including BioMedPartners, Boehringer Ingelheim Venture, Forbion Capital Partners, HBM Partners, Hillhouse Capital, Sofinnova Partners and Takeda Ventures, as well as Gilead, a leading biopharmaceutical company.

Risks Associated with Our Business

Our ability to implement our business strategy is subject to numerous risks, as more fully described in the section entitled "Risk Factors" immediately following this prospectus summary. These risks include, among others:

- We are a clinical-stage biopharmaceutical company with no approved products and a limited operating history. We have incurred significant losses since inception. We expect to incur losses for at least the next several years and may never achieve or maintain profitability.
- Even if we consummate this offering, we will require substantial additional financing and a failure to obtain this necessary capital when needed on acceptable terms, or at all, could force us to delay, limit, reduce or terminate our product development programs, commercialization efforts or other operations.
- We currently have only one product candidate, HB-101, in clinical development. A failure of this product candidate in clinical development would adversely affect our business and may require us to discontinue development of other product candidates based on the same therapeutic approach.

- If we are unable to advance our current or future product candidates into and through clinical trials, obtain marketing approval and ultimately commercialize any product candidates we develop, or experience significant delays in doing so, our business will be materially harmed.

- The regulatory approval processes of the U.S. Food and Drug Administration, the European Medicines Agency and other comparable foreign regulatory authorities are lengthy, time-consuming and inherently unpredictable, and if we are ultimately unable to obtain regulatory approval for our product candidates, our business will be substantially harmed.

- Our product candidates are based on a novel approach to the treatment of cancer, which makes it difficult to predict the time and cost of product candidate development.

- Our product candidates may cause serious adverse events, undesirable side effects or have other properties that could halt their clinical development, prevent their regulatory approval, require expansion of the trial size, limit their commercial potential or result in significant negative consequences.

- We are fully dependent on our collaboration with Gilead for the development of our HIV and HBV programs and may depend on Gilead or additional third parties for the development and commercialization of our other programs and future product candidates. Our current and future collaborators may control aspects of our clinical trials, which could result in delays or other obstacles in the commercialization of the product candidates we develop. If our collaborations are not successful, we may not be able to capitalize on the market potential of these product candidates.

- We expect to rely on third parties to manufacture our clinical product supplies, and we may rely on third parties for at least a portion of the manufacturing process of our product candidates, if approved. Our business could be harmed if those third parties fail to provide us with sufficient quantities of clinical product supplies or product candidates or fail to do so at acceptable quality levels or prices.

- Our rights to develop and commercialize our product candidates are subject, in part, to the terms and conditions of licenses granted to us by others, and, if we fail to comply with our obligations under these arrangements, we could lose such intellectual property rights or owe damages to the licensor of such intellectual property.

- If our efforts to protect the proprietary nature of the intellectual property related to our technologies are not adequate, we may not be able to compete effectively in our market.

- We have identified material weaknesses in our internal control over financial reporting. If our remediation of these material weaknesses is not effective, or if we experience additional material weaknesses in the future or otherwise fail to maintain an effective system of internal controls in the future, we may not be able to accurately report our financial condition or results of operations, which may adversely affect investor confidence in us and, as a result, the value of our common stock.

Implications of Being an Emerging Growth Company

As a company with less than $1.07 billion in revenue during our last fiscal year, we qualify as an "emerging growth company" as defined in the Jumpstart Our Business Startups Act of 2012, as amended, or the JOBS Act. As an emerging growth company, we may take advantage of specified reduced disclosure and other requirements that are otherwise applicable generally to public companies. These provisions include:

- only two years of audited financial statements in addition to any required unaudited interim financial statements with correspondingly reduced "Management's Discussion and Analysis of Financial Condition and Results of Operations" disclosure;
- reduced disclosure about our executive compensation arrangements in our periodic reports, proxy statements and registration statements;
- no non-binding advisory votes on executive compensation or golden parachute arrangements;
- exemption from the auditor attestation requirement in the assessment of our internal control over financial reporting pursuant to the Sarbanes-Oxley Act of 2002; and
- exemption from compliance with the requirement that the Public Company Accounting Oversight Board, or the PCAOB, has adopted regarding a supplement to the auditor's report providing additional information about the audit of the financial statements.

We may take advantage of these exemptions for up to five years following the completion of this offering or such earlier time that we are no longer an emerging growth company. We would cease to be an emerging growth company on the date that is the earlier of (1) the last day of the fiscal year (a) following the fifth anniversary of the date of the closing 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 under the rules of the SEC, and (2) the date on which we have issued more than $1.0 billion in nonconvertible debt during the previous three years. We may choose to take advantage of some but not all of these exemptions. We have taken advantage of reduced reporting requirements in this prospectus and may elect to take advantage of other reduced reporting requirements in future filings. Accordingly, the information contained herein may be different from the information you receive from other public companies in which you hold stock.

We have irrevocably elected to "opt out" of the exemption in Section 107 of the JOBS Act that allows for the delayed adoption of certain 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.

Corporate Information

We were originally incorporated as Hookipa Biotech AG under the laws of Austria in 2011. In February 2017, we reorganized to become a corporation under the laws of the State of Delaware as Hookipa Biotech, Inc., which was a fully-owned subsidiary of Hookipa Biotech AG. In June 2018, Hookipa Biotech, Inc. changed its name to HOOKIPA Pharma Inc. and acquired all of the shares of Hookipa Biotech AG, now Hookipa Biotech GmbH. Our principal executive offices are located at 430 East 29th Street, 14th Floor, New York, New York 10016 and our telephone number is +43 1 890 63 60. Our website address is *www.hookipapharma.com*. We have included our website address in this prospectus solely as an inactive textual reference.

THE OFFERING

Common stock offered by us	shares.
Common stock to be outstanding immediately after this offering	shares (shares if the underwriters exercise their option to purchase additional shares in full).
Underwriters' option to purchase additional shares	We have granted a 30-day option to the underwriters to purchase up to an aggregate of additional shares of common stock from us at the public offering price, less underwriting discounts and commissions, on the same terms as set forth in this prospectus.
Use of proceeds	We estimate that we will receive net proceeds from the sale of shares of our common stock in this offering of approximately $, or $ if the underwriters exercise their option to purchase additional shares in full, assuming an initial public offering price of $ per share, which is the midpoint of the price range set forth on the cover page of this prospectus, and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us. We intend to use the net proceeds from this offering, together with our existing cash and cash equivalents, to advance HB-101 through our ongoing Phase 2 clinical trial, advance HB-201 and HB-202 into and through Phase 1 clinical trials, advance HB-301 into and through a Phase 1 clinical trial, for ongoing research and development activities related to next generation programs and the remainder for working capital and other general corporate purposes. For a more complete description of our intended use of the proceeds from this offering, see "Use of Proceeds" beginning on page 68 for additional information.
Risk factors	You should carefully read the "Risk Factors" beginning on page 12 and the other information included in this prospectus for a discussion of factors that you should consider before deciding to invest in our common stock.
Proposed Nasdaq Global Market symbol	We intend to apply to list our common stock on The Nasdaq Global Market under the symbol "HOOK."

The number of shares of our common stock to be outstanding after this offering is based on shares of our common stock outstanding as of December 31, 2018, after giving effect to the automatic conversion of all outstanding shares of our preferred stock into an aggregate of shares of common stock upon closing of this offering and excludes:

- shares of our common stock issuable upon the exercise of stock options outstanding under our 2018 Stock Option and Grant Plan, or the 2018 Plan, as of December 31, 2018, at a weighted average exercise price of $ per share;
- shares of our common stock available for future issuance under our 2018 Plan as of December 31, 2018;

- shares of our common stock that will become available for future issuance under our 2019 Stock Option and Incentive Plan, which will become effective in connection with the closing of this offering; and
- shares of our common stock that will become available for future issuance under our 2019 Employee Stock Purchase Plan, which will become effective in connection with the closing of this offering.

Unless otherwise indicated, all information in this prospectus reflects or assumes the following:

- the filing of our amended and restated certificate of incorporation and the effectiveness of our amended and restated bylaws upon the closing of this offering;
- the automatic conversion of all outstanding shares of our preferred stock into an aggregate of shares of common stock upon the closing of this offering;
- no exercise of outstanding options after December 31, 2018;
- a for reverse split of our common stock effected on ; and
- no exercise by the underwriters of their option to purchase up to additional shares of common stock in this offering.

Summary Consolidated Financial Data

The following tables set forth our summary consolidated financial data for the period indicated. We have derived the consolidated statement of operations data for the year ended December 31, 2017 from our audited consolidated financial statements and related notes appearing at the end of this prospectus. The consolidated statement of operations data for the nine months ended September 30, 2018 and the consolidated balance sheet data as of September 30, 2018 have been derived from our unaudited consolidated financial statements and related notes appearing at the end of this prospectus and have been prepared on the same basis as the audited consolidated financial statements. In the opinion of management, unaudited data reflects all adjustments, consisting only of normal recurring adjustments, necessary for a fair statement of the financial information in those statements. Our historical results are not necessarily indicative of the results that may be expected in the future, and our results for any interim period are not necessarily indicative of results that may be expected for any full year. You should read the following summary consolidated financial data together with our consolidated financial statements and the related notes appearing at the end of this prospectus and the "Selected Consolidated Financial Data" and "Management's Discussion and Analysis of Financial Condition and Results of Operations" sections of this prospectus.

(in thousands, except share and per share data)	Year ended December 31, 2017	Nine months ended September 30, 2018 (unaudited)
Consolidated Statements of Operations Data:		
Revenue from collaboration and licensing	$ —	$ 2,549
Operating expenses:		
Research and development	(9,772)	(17,350)
General and administrative	(4,385)	(4,175)
Total operating expenses	(14,157)	(21,525)
Loss from operations	(14,157)	(18,976)
Other income (expense):		
Grant income	2,069	5,217
Interest income and expense, net	(606)	(578)
Other income and expenses, net	(25)	19
Total other income (expense), net	1,438	4,658
Net loss	(12,723)	(14,345)
Net loss attributable to common shareholders	$ (12,723)	$ (14,345)
Net loss per share attributable to common stockholders—basic and diluted(1)	$ (162.47)	$ (183.18)
Weighted average common shares outstanding—basic and diluted(1)	78,311	78,311
Pro forma net loss per share attributable to common shareholders—basic and diluted (unaudited)(1)		$ (10.23)
Pro forma weighted average common shares outstanding—basic and diluted (unaudited)(1)		1,401,817

(1) See Note 13 to our consolidated financial statements appearing at the end of this prospectus for further details on the calculation of basic and diluted net loss per share attributable to

common shareholders and on the calculation of pro forma basic and diluted net loss per share attributable to common shareholders.

	As of September 30, 2018		
	Actual	Pro Forma(2)	Pro Forma As Adjusted(3)(4)
		(unaudited) (in thousands)	
Consolidated Balance Sheet Data:			
Cash and cash equivalents	$ 55,792	$	$
Working capital(1)	50,258		
Total assets	66,543		
Redeemable convertible preferred stock	104,774		
Accumulated deficit	58,090		
Total stockholders' equity (deficit)	(58,106)		

(1) We define working capital as current assets less current liabilities.

(2) The pro forma balance sheet data give effect to the automatic conversion of all outstanding shares of our preferred stock into an aggregate of shares of common stock upon the closing of this offering.

(3) Reflects the pro forma adjustments described in footnote (2) above and gives further effect to our issuance and sale of shares of our common stock in this offering at an assumed initial public offering price of $ per share, which is the midpoint of the price range set forth on the cover page of this prospectus, after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us.

(4) Each $1.00 increase (decrease) in the assumed initial public offering price of $ per share, which is the midpoint of the price range set forth on the cover page of this prospectus, would increase (decrease) the pro forma as adjusted amount of each of cash and cash equivalents, working capital, total assets and total stockholders' equity by $ 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 estimated underwriting discounts and commissions and estimated offering expenses payable by us. We may also increase or decrease the number of shares we are offering. Each increase (decrease) of 1,000,000 shares in the number of shares offered by us, as set forth on the cover page of this prospectus, would increase (decrease) the pro forma as adjusted amount of each of cash and cash equivalents, working capital, total assets and total stockholders' equity by $ million, assuming no change in the assumed initial public offering price per share and after deducting 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 the other information in this prospectus, including our financial statements and the related notes and "Management's Discussion and Analysis of Financial Condition and Results of Operations," before deciding whether to invest in our common stock. The occurrence of any of the events or developments described below could harm our business, financial condition, results of operations and growth prospects. In such an event, the market price of our common stock could decline and you may lose all or part of your investment. Additional risks and uncertainties not presently known to us or that we currently deem immaterial also may impair our business operations.

Risks Related to Our Financial Position and Capital Needs

We are a clinical-stage biopharmaceutical company with no approved products and a limited operating history. We have incurred significant losses since inception. We expect to incur losses for at least the next several years and may never achieve or maintain profitability.

We are a clinical-stage biopharmaceutical company with no approved products and a limited operating history. Investment in biopharmaceutical product development is highly speculative because it entails substantial upfront capital expenditures and significant risk that any potential product candidate will fail to demonstrate adequate efficacy or an acceptable safety profile, gain regulatory approval and become commercially viable. We have no products approved for commercial sale and have not generated any revenue from product sales. To date, we have devoted substantially all of our resources to organizing and staffing our company, business planning, raising capital, undertaking preclinical studies and clinical trials of our product candidates, securing related intellectual property rights and conducting discovery, research and development activities for our programs. As a result, we are not profitable and have incurred losses in each period since our inception in 2011. For the year ended December 31, 2017, we reported a net loss of $12.7 million, and for the nine months ended September 30, 2018, we reported a net loss of $14.3 million. As of September 30, 2018, we had an accumulated deficit of $58.1 million. We expect to continue to incur significant losses for the foreseeable future. We anticipate that our expenses will increase substantially if, and as, we:

- pursue the clinical and preclinical development of our current and future product candidates;
- leverage our technologies to advance product candidates into preclinical and clinical development;
- seek regulatory approvals for product candidates that successfully complete clinical trials, if any;
- attract, hire, and retain additional clinical, quality control and scientific personnel;
- expand our operational, financial and management systems and increase personnel, including personnel to support our clinical development, manufacturing and commercialization efforts and our operations as a public company;
- establish our manufacturing capabilities through third parties or by ourselves and scale-up manufacturing to provide adequate supply for clinical trials and commercialization;
- expand and protect our intellectual property portfolio;
- establish a sales, marketing, medical affairs and distribution infrastructure to commercialize any products for which we may obtain marketing approval and intend to commercialize on our own or jointly;
- acquire or in-license other product candidates and technologies; and

- incur additional legal, accounting and other expenses in operating our business, including the additional costs associated with operating as a public company.

Even if we succeed in commercializing one or more of our product candidates, we will continue to incur substantial research and development and other expenditures to develop and market additional product candidates and we may never generate revenue that is significant or large enough to achieve profitability. We may also encounter unforeseen expenses, difficulties, complications, delays and other unknown factors that may adversely affect our business. The size of our future net losses will depend, in part, on the rate of future growth of our expenses and our ability to generate revenue. Our prior losses and expected future losses have had and will continue to have an adverse effect on our stockholders' equity and working capital.

If we do achieve profitability, we may not be able to sustain or increase profitability on a quarterly or annual basis. Accordingly, our failure to become and remain profitable would decrease the value of our company and could impair our ability to raise capital, maintain our research and development efforts, expand our business or continue our operations. A decline in the value of our company also could cause you to lose all or part of your investment.

Even if we consummate this offering, we will require substantial additional financing and a failure to obtain this necessary capital when needed on acceptable terms, or at all, could force us to delay, limit, reduce or terminate our product development programs, commercialization efforts or other operations.

Since our inception, we have invested a significant portion of our efforts and financial resources in research and development activities for our VaxWave and TheraT technologies and our product candidates derived from these technologies. Preclinical studies and clinical trials and additional research and development activities will require substantial funds to complete. We believe that we will continue to expend substantial resources for the foreseeable future in connection with the development of our current product candidates and programs, any future product candidates we may choose to pursue, when we begin to develop our own manufacturing capabilities and other corporate uses. These expenditures will include costs associated with conducting preclinical studies and clinical trials, obtaining regulatory approvals, and manufacturing and supply, as well as marketing and selling any products approved for sale. Our expenses could increase beyond our current expectations if other unanticipated costs arise or if the U.S. Food and Drug Administration, or the FDA, the European Medicines Agency, or EMA, or other comparable foreign regulatory authorities requires us to perform clinical trials and other studies in addition to those that we currently anticipate. Because the outcome of any preclinical study or clinical trial is highly uncertain, we cannot reasonably estimate the actual amounts necessary to successfully complete the development and commercialization of our current or future product candidates. If we are unable to raise capital when needed or on acceptable terms, we would be forced to delay, reduce or terminate our research and development programs or future commercialization efforts.

As of September 30, 2018, we had approximately $55.8 million in cash and cash equivalents. We estimate that the net proceeds from this offering will be approximately $ million after deducting the estimated offering expenses payable by us. Based on our research and development plans, we expect that the net proceeds from this offering, together with our existing cash and cash equivalents, will enable us to fund our operating expenses and capital expenditure requirements for at least the next months. This estimate is based on assumptions that may prove to be wrong, and we could use our available capital resources sooner than we expect. Changes may occur beyond our control that would cause us to consume our available capital before that time, including changes in and progress of our development activities and changes in regulation. Our future capital requirements depend on many factors, including:

- the scope, progress, results and costs of researching and developing our current and future product candidates and programs, and of conducting preclinical studies and clinical trials;
- the number and development requirements of other product candidates that we may pursue, and other indications for our current product candidates that we may pursue;
- the stability, scale and yields of our future manufacturing process as we scale-up production and formulation of our product candidates for later stages of development and commercialization;
- the timing of, and the costs involved in, obtaining regulatory and marketing approvals and developing our ability to establish sales and marketing capabilities, if any, for our current and future product candidates we develop if clinical trials are successful;
- the success of our collaboration with Gilead Sciences, Inc., or Gilead;
- our ability to establish and maintain collaborations, strategic licensing or other arrangements and the financial terms of such agreements;
- the cost of commercialization activities for our current and future product candidates that we may develop, whether alone or with a collaborator;
- the costs involved in preparing, filing, prosecuting, maintaining, expanding, defending and enforcing patent claims, including litigation costs and the outcome of such litigation;
- the timing, receipt and amount of sales of, or royalties on, our future products, if any; and
- the emergence of competing oncology and infectious disease therapies and other adverse market developments.

We do not have any committed external source of funds or other support for our development efforts.

Raising additional capital may cause dilution to our stockholders, restrict our operations or require us to relinquish proprietary rights.

Until we can generate sufficient product and royalty revenue to finance our cash requirements, which we may never do, we expect to finance our future cash needs through a combination of public or private equity offerings, debt financings, collaborations, strategic alliances, licensing arrangements and other marketing or distribution arrangements and grant funding.

If we raise additional capital through public or private equity offerings, the terms of these securities may include liquidation or other preferences that adversely affect our stockholders' rights. Further, to the extent that we raise additional capital through the sale of common stock or securities convertible or exchangeable into common stock, your ownership interest will be diluted. If we raise additional capital through debt financing, we would be subject to fixed payment obligations and 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. If we raise additional capital through marketing and distribution arrangements or other collaborations, strategic alliances or licensing arrangements with third parties, we may have to relinquish certain valuable rights to our product candidates, technologies, future revenue streams or research programs or grant licenses on terms that may not be favorable to us.

If we are unable to raise additional funds through equity or debt financings when needed, we may be required to delay, reduce or terminate our product development or future commercialization efforts or grant rights to third parties to develop and market product candidates that we would otherwise prefer to develop and market ourselves.

If we engage in future acquisitions or strategic partnerships, this may increase our capital requirements, dilute our stockholders if we issue equity securities, cause us to incur debt or assume contingent liabilities, and subject us to other risks.

We may evaluate various acquisitions and strategic partnerships, including acquiring complementary products, intellectual property rights, technologies, or businesses. Any potential acquisition or strategic partnership may entail numerous risks, including:

- increased operating expenses and cash requirements;
- the assumption of additional indebtedness or contingent liabilities;
- the issuance of our equity securities;
- assimilation of operations, intellectual property and products of an acquired company, including difficulties associated with integration;
- the diversion of our management's attention from our existing product programs and initiatives in pursuing such a strategic merger or acquisition;
- retention of key employees, the loss of key personnel, and uncertainties in our ability to maintain key business relationships;
- risks and uncertainties associated with the other party to such a transaction, including the prospects of that party and their existing products or product candidates and regulatory approvals; and
- our inability to generate revenue from acquired technology or products sufficient to meet our objectives in undertaking the acquisition.

In addition, if we undertake acquisitions, we may incur large one-time expenses and acquire intangible assets that could result in significant future amortization expense.

We have obtained funding from an agency of the Austrian government that contains certain covenants that may restrict our operations.

In the past, we have contracted numerous funding agreements with an agency of the Austrian government to partially finance our research and development programs, such as personnel costs, material costs, third-party services, travel expenses and research and development infrastructure use. These funding agreements include both below market rate loans and grants, which are subject to various criteria linked to certain terms and conditions as well as certain costs attributable to the respective funded research and development program. We have committed to reporting obligations and to obtain the approval for significant changes in the cost structure of the funded research and development programs. If we were to breach these contractual obligations, we may be held liable by the agency of the Austrian government for damages incurred by such agencies resulting from the breach of contract and we could be required to reimburse in full the funding granted by such agencies.

Further, pursuant to the general terms of each grant, the agency is entitled to re-evaluate the funding granted to us in case of a fundamental change in our ownership structure if such change no longer ensures that the purpose of the funding can be achieved. Any such re-evaluation could negatively impact the funding that we receive or have received from the agency or that we may receive in the future from other agencies of the Austrian government.

Risks Related to Our Business and Industry

We currently have only one product candidate, HB-101, in clinical development. A failure of this product candidate in clinical development would adversely affect our business and may require us to discontinue development of other product candidates based on the same therapeutic approach.

We recently initiated a Phase 2 clinical trial for HB-101 and it is currently our only clinical development-stage product candidate. Although we have other programs in preclinical development and we intend to develop additional product candidates in the coming years, it will take additional investment and time for such product candidates to reach the same stage of development as HB-101, and there can be no assurance that they will ever do so. If we are required to discontinue development of HB-101, or if it fails to receive regulatory approval or achieve sufficient market acceptance, if approved, we could be prevented from or significantly delayed in achieving profitability and may be required to delay or abandon the development of our other programs.

If we are unable to advance our current or future product candidates into and through clinical trials, obtain marketing approval and ultimately commercialize any product candidates we develop, or experience significant delays in doing so, our business will be materially harmed.

All of our product candidates are in early stages of development, including our lead product candidate, HB-101, that recently commenced a Phase 2 clinical trial, and as such will require extensive preclinical and clinical testing. We cannot predict with any certainty if or when we might submit an investigational new drug application, or IND, or biologics license application, or BLA, for regulatory approval for any of our product candidates or whether any such IND or BLA will be accepted for review by the FDA, or subsequently whether any such IND will go into effect or BLA will be approved upon review.

Our ability to generate product revenues, which we do not expect to occur for several years, if ever, will depend heavily on the successful development and eventual commercialization of the product candidates we develop, which may never occur. Before we are able to generate any revenues from product sales, our current product candidates, and any future product candidates we develop, will require additional preclinical and clinical development, management of clinical, preclinical and manufacturing activities, marketing approval in the United States and other markets, demonstrating effectiveness to pricing and reimbursement authorities, obtaining sufficient manufacturing supply for both clinical development and commercial production, building of a commercial organization, and substantial investment and significant marketing efforts. The success of our current and future product candidates will depend on several factors, including the following:

- successful completion of preclinical studies and clinical trials;
- sufficiency of our financial and other resources to complete the necessary preclinical studies and clinical trials;
- acceptance of investigational new drug applications, or INDs, for our planned clinical trials or future clinical trials;
- successful enrollment and completion of clinical trials;
- successful data from our clinical program that support an acceptable risk-benefit profile of our product candidates in the intended populations;
- receipt and maintenance of regulatory and marketing approvals from applicable regulatory authorities;
- scale-up of our manufacturing processes and formulation of our product candidates for later stages of development and commercialization;

- establishing our own manufacturing capabilities or agreements with third-party manufacturers for clinical supply for our clinical trials and commercial manufacturing, if our product candidate is approved;
- entry into collaborations to further the development of our product candidates;
- obtaining and maintaining patent and trade secret protection or regulatory exclusivity for our product candidates;
- successfully launching commercial sales of our product candidates, if and when approved;
- acceptance of the product candidate's benefits and uses, if and when approved, by patients, the medical community and third-party payors;
- the prevalence and severity of adverse events experienced with our product candidates;
- maintaining a continued acceptable safety profile of the product candidates following approval;
- effectively competing with other therapies;
- obtaining and maintaining healthcare coverage and adequate reimbursement from third-party payors; and
- qualifying for, maintaining, enforcing and defending intellectual property rights and claims.

We do not have complete control over many of these factors, including certain aspects of clinical development and the regulatory submission process, potential threats to our intellectual property rights and the manufacturing, marketing, distribution and sales efforts of any future collaborator. If we are not successful with respect to one or more of these factors in a timely manner or at all, we could experience significant delays or an inability to successfully commercialize the product candidates we develop, which would materially harm our business.

The regulatory approval processes of the FDA, the EMA and other comparable foreign regulatory authorities are lengthy, time-consuming and inherently unpredictable, and if we are ultimately unable to obtain regulatory approval for our product candidates, our business will be substantially harmed.

The time required to obtain approval from the FDA, the EMA and other comparable foreign regulatory authorities is unpredictable but typically takes many years following the commencement of clinical trials and depends upon numerous factors, including the substantial discretion of the regulatory authorities. In addition, approval policies, regulations, or the type and amount of clinical data necessary to gain approval may change during the course of a product candidate's clinical development and may vary among jurisdictions. We have not obtained regulatory approval for any product candidate and it is possible that none of our current or future product candidates will ever obtain regulatory approval.

Our current and future product candidates could fail to receive regulatory approval for many reasons, including the following:

- the FDA, the EMA or other comparable foreign regulatory authorities may disagree with the design or implementation of our clinical trials;
- we may be unable to demonstrate to the satisfaction of the FDA, the EMA or other comparable foreign regulatory authorities that a product candidate is safe, pure and potent or effective for its proposed indication;
- the results of clinical trials may not meet the level of statistical significance required by the FDA, the EMA or other comparable foreign regulatory authorities for approval;

- we may be unable to demonstrate that a product candidate's clinical and other benefits outweigh its safety risks;
- the FDA, the EMA or other comparable foreign regulatory authorities may disagree with our interpretation of data from clinical trials or preclinical studies;
- the data collected from clinical trials of our product candidates may not be sufficient to support the submission of a BLA to the FDA, or similar foreign submission to the EMA or other comparable foreign regulatory authority, to obtain approval in the United States, the European Union or elsewhere;
- the FDA, the EMA or other comparable foreign regulatory authorities may find deficiencies with or fail to approve the manufacturing processes or facilities of third-party manufacturers with which we contract for clinical and commercial supplies; and
- the approval policies or regulations of the FDA, the EMA or other comparable foreign regulatory authorities may significantly change in a manner rendering our clinical data insufficient for approval.

This lengthy approval process as well as the unpredictability of clinical trial results may result in our failing to obtain regulatory approval to market any product candidate we develop, which would significantly harm our business, results of operations and prospects.

We have conducted, and intend to conduct, clinical trials of certain of our product candidates outside the United States. Although the FDA may accept data from clinical trials conducted outside the United States, acceptance of this data is subject to certain conditions imposed by the FDA, including compliance with all applicable U.S. laws and regulations. For example, the clinical trial must be well designed and conducted and performed by qualified investigators in accordance with good clinical practice, or GCP, including review and approval by an independent ethics committee and informed consent from subjects. The study population must also adequately represent the U.S. population, and the data must be applicable to the U.S. population and U.S. medical practice in ways that the FDA deems clinically meaningful. In general, the patient population for any clinical trials conducted outside of the United States must be representative of the population for whom we intend to label the product in the United States. There can be no assurance the FDA will accept data from trials conducted outside of the United States.

The FDA, the EMA and other comparable foreign regulatory authorities have substantial discretion in the approval process, and determining when or whether regulatory approval will be obtained for any product candidate that we develop. Even if we believe the data collected from future clinical trials of our product candidates are promising, such data may not be sufficient to support approval by the FDA, the EMA or any other comparable foreign regulatory authorities.

Even if we were to obtain approval, regulatory authorities may approve any of our product candidates for fewer or more limited indications than we request, may not approve the price we intend to charge for our products, may grant approval contingent on the performance of costly post-marketing clinical trials, or may approve a product candidate with a label that does not include the labeling claims necessary or desirable for the successful commercialization of that product candidate. Any of the foregoing scenarios could materially harm the commercial prospects for our product candidates.

Our clinical trials may fail to demonstrate adequately the safety and efficacy of any of our product candidates, which would prevent or delay regulatory approval and commercialization.

Before obtaining regulatory approvals for the commercial sale of our product candidates, including HB-101 and any other future product candidates, we must demonstrate through lengthy, complex and expensive preclinical testing and clinical trials that our product candidates are both safe and effective for use in each target indication. Clinical testing is expensive and can take many years to complete, and its outcome is inherently uncertain. Failure can occur at any time during the clinical trial process, and, because our product candidates are in an early stage of development, there is a high risk of failure and we may never succeed in developing marketable products.

Clinical trials that we may conduct may not demonstrate the efficacy and safety necessary to obtain regulatory approval to market our product candidates. In some instances, there can be significant variability in safety or efficacy results between different clinical trials of the same product candidate due to numerous factors, including changes in trial procedures set forth in protocols, differences in the size and type of the patient populations, changes in and adherence to the clinical trial protocols and the rate of dropout among clinical trial participants. If the results of our ongoing or future clinical trials are inconclusive with respect to the efficacy of our product candidates, if we do not meet the clinical endpoints with statistical and clinically meaningful significance, or if there are safety concerns associated with our product candidates, we may be delayed in obtaining marketing approval, if at all.

Any inability to successfully complete preclinical and clinical development could result in additional costs to us or impair our ability to generate revenue from future drug sales and regulatory and commercialization milestones. Clinical trial delays could also shorten any periods during which we may have the exclusive right to commercialize our product candidates, if approved, or allow our competitors to bring comparable products to market before we do, which could impair our ability to successfully commercialize our product candidates and may harm our business, financial condition, results of operations and prospects.

Even if the trials are successfully completed, clinical data are often susceptible to varying interpretations and analyses, and we cannot guarantee that the FDA, the EMA, or other comparable foreign regulatory authorities will interpret the results as we do, and more trials could be required before we submit our product candidates for approval. We cannot guarantee that the FDA, the EMA or other comparable foreign regulatory authorities will view our product candidates as having efficacy even if positive results are observed in our planned clinical trials. To the extent that the results of the trials are not satisfactory to the FDA, the EMA or other comparable foreign regulatory authorities for support of a marketing application, approval of our product candidates may be significantly delayed, or we may be required to expend significant additional resources, which may not be available to us, to conduct additional trials in support of potential approval of our product candidates.

Our preclinical programs may experience delays or our product candidates may never advance to clinical trials, which would adversely affect our ability to obtain regulatory approvals or commercialize these product candidates on a timely basis or at all, which would have an adverse effect on our business.

Our product candidates HB-201, HB-202, HB-301 and all of our next generation product candidates are still in the preclinical development stage, and the risk of failure of preclinical programs is high. Before we can commence clinical trials for a product candidate, we must complete extensive preclinical testing and studies to obtain regulatory clearance to initiate human clinical trials, including based on INDs in the United States and clinical trial applications, or CTAs, in Europe. We cannot be certain of the timely completion or outcome of our preclinical testing and studies and cannot predict if the FDA, the EMA or other regulatory authorities will accept our proposed clinical programs or if the outcome of our preclinical testing and studies will ultimately support the further development of our product candidates. As a result, we cannot be sure that submission of INDs or similar applications will result in the FDA, the EMA or other comparable foreign regulatory authorities allowing clinical trials to begin.

Interim, top line and preliminary data from our clinical trials that we announce or publish from time to time may change as more patient data become available and are subject to regulatory audit and verification procedures that could result in material changes in the final data.

From time to time, we may publish interim, top line or preliminary data from our clinical trials. We may decide to conduct an interim analysis of the data after a certain number or percentage of patients have been enrolled, or after only a part of the full follow-up period but before completion of the trial. Similarly, we may report top line or preliminary results of primary and key secondary endpoints before the final trial results are completed. Preliminary, top line and interim data from our clinical trials may change as more patient data or analyses become available. Preliminary, top line or interim data from our clinical trials are not necessarily predictive of final results and are subject to the risk that one or more of the clinical outcomes may materially change as patient enrollment continues, more patient data become available and we issue our final clinical trial report. These data also remain subject to verification procedures that may result in the final data being materially different from the preliminary data we previously published. As a result, preliminary, interim and top line data should be viewed with caution until the final data are available. Material adverse changes in the final data compared to the interim data could significantly harm our business prospects.

Results of earlier studies and trials of our product candidates may not be predictive of future trial results.

Success in preclinical studies and early clinical trials does not ensure that later clinical trials will be successful. Product candidates in later stages of clinical trials may fail to show the desired safety and efficacy traits despite having progressed through preclinical studies and initial clinical trials. Even if we are able to commence clinical trials, issues may arise that could suspend or terminate such clinical trials. A number of companies in the biotechnology and pharmaceutical industries have suffered significant setbacks in clinical trials, even after positive results in earlier preclinical studies or clinical trials. These setbacks have been caused by, among other things, preclinical findings made while clinical trials were underway and safety or efficacy observations made in clinical trials, including previously unreported adverse events. Notwithstanding any potential promising results in earlier studies and trials, we cannot be certain that we will not face similar setbacks. In addition, the results of our preclinical animal studies, including our oncology mouse studies and animal studies, may not be predictive of the results of outcomes in human clinical trials. For example, our oncology product candidates that are in preclinical development may demonstrate different chemical and biological properties in patients than they do in laboratory animal studies or may interact with human biological systems in unforeseen or harmful ways.

Our TheraT technology has never been tested in humans and could therefore prove to be unsafe.

TheraT is an attenuated but replicating viral vector technology. Safety and toxicity studies have so far only been conducted in animal species. If our first clinical trial for HB-201 causes unexpected side effects that are not tolerable in the treatment of the relevant patient group, the further development of the product candidate and any other potential products based on the TheraT technology may be significantly limited or become impossible.

Our product candidates are based on a novel approach to the treatment of cancer, which makes it difficult to predict the time and cost of product candidate development.

We have concentrated all of our research and development efforts on product candidates based on our VaxWave and TheraT technologies, and our future success depends on the successful development of this therapeutic approach. Our VaxWave and TheraT technologies utilize arenaviruses to activate CD8+ T cells and induce pathogen-neutralizing antibodies. There are no approved products that utilize the arenavirus. Because our VaxWave and TheraT technologies are novel, regulatory agencies may lack experience with product candidates such as HB-101 and HB-201, which may lengthen the regulatory review process, increase our development costs and delay or prevent commercialization of our product candidates. We have not yet succeeded and may not succeed in demonstrating safety and efficacy for any of our product candidates in ongoing or later-stage clinical trials or in obtaining marketing approval thereafter.

In addition, our vectors are live, gene-modified organisms for which the FDA, the EMA and other comparable foreign regulatory authorities and other public health authorities, such as the Centers of Disease Control and Prevention and hospitals involved in clinical studies, have established additional safety and contagion rules and procedures, which could establish additional hurdles for the development, manufacture or use of our vectors. These hurdles may lead to delays in the conduct of clinical trials or in obtaining regulatory approvals for further development, manufacturing or commercialization of our product candidates. We may also experience delays in transferring our process to commercial partners, which may prevent us from completing our clinical trials or commercializing our product candidates on a timely or profitable basis, if at all.

Since the number of patients that we plan to dose in some of our planned clinical trials is small, the results from such clinical trials, once completed, may be less reliable than results achieved in larger clinical trials, which may hinder our efforts to obtain regulatory approval for our product candidates.

A trial design that is considered appropriate for regulatory approval includes a sufficiently large sample size with appropriate statistical power, as well as proper control of bias, to allow a meaningful interpretation of the results. In our planned Phase 1 trial for HB-201, we expect to enroll 20 patients and future trials for HB-201 or other product candidates may similarly enroll a small number of patients. The preliminary results of trials with smaller sample sizes, such as our planned Phase 1 trial for HB-201, can be disproportionately influenced by the impact the treatment had on a few individuals, which limits the ability to generalize the results across a broader community, making the trial results less reliable than trials with a larger number of patients. As a result, there may be less certainty that such product candidates would achieve a statistically significant effect in any future clinical trials. If we conduct any future clinical trials, we may not achieve a statistically significant result or the same level of statistical significance, if any, that would have been possible to achieve in a larger trial.

Our product candidates may cause serious adverse events, undesirable side effects or have other properties that could halt their clinical development, prevent their regulatory approval, require expansion of the trial size, limit their commercial potential or result in significant negative consequences.

Undesirable side effects caused by our product candidates could cause us or regulatory authorities, including institutional review boards, or IRBs, to interrupt, delay or halt clinical trials and could result in a more restrictive label or the delay or denial of regulatory approval by the FDA, the EMA or other comparable foreign regulatory authorities. Further, clinical trials by their nature utilize a sample of the potential patient population. With a limited number of subjects and limited duration of exposure, rare and severe side effects of our product candidates may only be uncovered with a significantly larger number of patients exposed to the drug. Because of our dose escalation design for our clinical trials, undesirable side effects could also result in an expansion in the size of our clinical trials, increasing the expected costs and timeline of our clinical trials. Additionally, results of our trials could reveal a high and unacceptable severity and prevalence of side effects or unexpected characteristics. If we do observe severe side effects in our clinical trials, our ongoing clinical trials may be halted or put on clinical hold prior to completion if there is an unacceptable safety risk for patients.

If unacceptable toxicities arise in the development of our product candidates, we could suspend or terminate our trials or the FDA, the EMA or other comparable foreign regulatory authorities, or local regulatory authorities such as IRBs, could order us to cease clinical trials. Competent national health authorities, such as the FDA, could also deny approval of our product candidates for any or all targeted indications. Even if the side effects presented do not preclude the product from obtaining or maintaining marketing approval, treatment-related side effects could also affect patient recruitment or the ability of enrolled patients to complete the trial or result in potential product liability claims. In addition, these side effects may not be appropriately recognized or managed by the treating medical staff. We expect to have to train medical personnel using our product candidates, if approved, to understand the side effect profile of these technologies for both our planned clinical trials and upon any commercialization of any product candidates, if approved. Inadequate training in recognizing or managing the potential side effects of our technologies could result in patient deaths. Any of these occurrences may harm our business, financial condition and prospects significantly.

If we encounter difficulties enrolling patients in our clinical trials, our clinical development activities could be delayed or otherwise adversely affected.

We may experience difficulties in patient enrollment in our clinical trials for a variety of reasons. The timely completion of clinical trials in accordance with their protocols depends, among other things, on our ability to enroll a sufficient number of patients who remain in the trial until its conclusion. The enrollment of patients depends on many factors, including:

- the patient eligibility criteria defined in the protocol;
- the size of the patient population required for analysis of the trial's primary endpoints;
- the proximity of patients to trial sites;
- the design of the trial;
- our ability to recruit clinical trial investigators with the appropriate competencies and experience;
- clinicians' and patients' perceptions as to the potential advantages of the product candidate being studied in relation to other available therapies, including any new products that may be approved for the indications we are investigating;
- our ability to obtain and maintain patient consents; and
- the risk that patients enrolled in clinical trials will drop out of the trials before the manufacturing and infusion of our product candidates or trial completion.

In addition, our clinical trials will compete with other clinical trials for product candidates that are in the same therapeutic areas as our product candidates or similar areas, and this competition will reduce the number and types of patients available to us because some patients who might have opted to enroll in our trials may instead opt to enroll in a trial being conducted by one of our competitors. Since the number of qualified clinical investigators is limited, we expect to conduct some of our clinical trials at the same clinical trial sites that some of our competitors use, which will reduce the number of patients who are available for our clinical trials at such clinical trial sites. Moreover, because our product candidates represent a departure from more commonly used methods for the treatment of infectious diseases and cancers, potential patients and their doctors may be inclined to use conventional therapies, such as chemotherapy and hematopoietic stem cell transplantation, rather than enroll patients in any future clinical trial. Additionally, because some of our clinical trials will be in patients with relapsed or refractory cancer, the patients are typically in the late stages of the disease and may experience disease progression independent from our product candidates, making them unevaluable for purposes of the trial and requiring additional enrollment.

Delays in patient enrollment may result in increased costs or may affect the timing or outcome of our ongoing and planned clinical trials, which could prevent completion or commencement of these trials and adversely affect our ability to advance the development of our product candidates.

We have limited experience as a company conducting clinical trials or managing a manufacturing facility for our product candidates.

We have limited experience as a company in conducting clinical trials. In part because of this lack of experience, we cannot be certain that our ongoing clinical trial will be completed on time or if the planned clinical trials will begin or be completed on time, if at all. Large-scale trials would require significant additional financial and management resources and reliance on third-party clinical investigators, contract research organizations, or CROs, or consultants. Relying on third-party clinical investigators or CROs may force us to encounter delays that are outside of our control.

We do not have our own manufacturing facility for the production of clinical trial material or future commercial products and therefore depend on third-party contract manufacturing organizations, or CMOs, and their know-how for production of our product candidates. Because of our limited control of our third-party manufacturers and in part because of our inexperience, our third-party manufacturers may fail to produce our product in a reliable and consistent manner and in sufficient quality and quantity. We have encountered problems with our third-party manufacturers in the past, including delays and low yields, and there can be no assurance that we will not encounter similar or other difficulties in the future.

As we continue to progress our product candidates into and through clinical trials, we intend to operate our own manufacturing facility, which will require significant resources, and we have limited experience as a company in expanding or managing a manufacturing facility. In part because of this lack of experience, we cannot be certain that our manufacturing facility will be completed on time, if at all, or if the planned clinical trials will begin or be completed on time, if at all. In addition, if we switch from one manufacturing facility to our own manufacturing facility for one or more of our product candidates in the future, we may need to conduct additional studies to bridge our modified product candidates to earlier versions. Failure to successfully create and operate our proposed manufacturing facility could adversely affect the commercial viability of our product candidates.

The market opportunities for our oncology product candidates may be limited to those patients who are ineligible for or have failed prior treatments.

Cancer therapies are characterized as first line, second line, or third line, and the FDA often approves new therapies initially only for a particular line of use. When cancer is detected early enough, first line therapy is sometimes adequate to cure the cancer or prolong life without a cure. Whenever first line therapy, usually chemotherapy, antibody drugs, tumor-targeted small molecules, hormone therapy, radiation therapy, surgery, or a combination of these, proves unsuccessful, second line therapy may be administered. Second line therapies often consist of more chemotherapy, radiation, antibody drugs, tumor-targeted small molecules, or a combination of these. Third line therapies can include hematopoietic stem cell transplantation in certain cancers, chemotherapy, antibody drugs, and small molecule tumor-targeted therapies, more invasive forms of surgery, and new revolutionary technologies. We expect to initially seek approval of our product candidates in most instances at least as a third line therapy, for use in patients with relapsed or refractory metastatic cancer. Subsequently, for those product candidates that prove to be sufficiently safe and beneficial, if any, we would expect to seek approval as a second line therapy and potentially as a first line therapy, but there is no guarantee that our product candidates, even if approved as a third or subsequent line of therapy, would be approved for an earlier line of therapy, and, prior to any such approvals, we may have to conduct additional clinical trials.

If the market opportunities for our product candidates are smaller than we believe they are, even assuming approval of a drug candidate, our business may suffer.

Our projections of both the number of people who have the infectious diseases and cancers we are targeting, as well as the subset of people with these infectious diseases and cancers in a position to receive a particular line of therapy and who have the potential to benefit from treatment with our product candidates, are based on our beliefs and estimates. These estimates have been derived from a variety of sources, including scientific literature, commissioned reports, surveys of clinics, patient foundations or market research, and may prove to be incorrect. Further, new therapies may change the estimated incidence or prevalence of these cancers. The number of patients may turn out to be lower than expected. Additionally, the potentially addressable patient population for our product candidates may be limited or may not be amenable to treatment with our product candidates. Even if we obtain significant market share for our product candidates within our addressable patient population, because the potential target populations are small, we may never achieve profitability without obtaining regulatory approval for additional indications, including use as first or second line therapy.

Even if we obtain regulatory approval of our product candidates, the products may not gain market acceptance among physicians, patients, hospitals, cancer treatment centers and others in the medical community.

The use of an arenavirus for the treatment of infectious diseases and tumors is a recent development and may not become broadly accepted by physicians, patients, hospitals, cancer treatment centers and others in the medical community. Various factors will influence whether our product candidates, if approved, are accepted in the market, including:

- the clinical indications for which our product candidates are approved;
- physicians, hospitals, cancer treatment centers and patients considering our product candidates as a safe and effective treatment;
- the potential and perceived advantages of our product candidates over alternative treatments;
- the prevalence and severity of any side effects;
- the prevalence and severity of any side effects for virus-based therapeutic products, in particular, other prime-boost therapies;
- product labeling or product insert requirements of the FDA or other regulatory authorities;
- limitations or warnings contained in the labeling approved by the FDA;
- the timing of market introduction of our product candidates as well as competitive products;
- the cost of treatment in relation to alternative treatments;
- the availability of adequate coverage, reimbursement and pricing by third-party payors and government authorities;
- relative convenience and ease of administration, including as compared to alternative treatments and competitive therapies; and
- the effectiveness of our sales and marketing efforts.

In addition, although we are not utilizing fully replication competent live virus vectors, our TheraT technology uses a replication attenuated vector and adverse publicity due to the ethical and social controversies surrounding the therapeutic use of such technologies, and reported side effects from any clinical trials using these technologies or the failure of such trials to demonstrate that these therapies are safe and effective may limit market acceptance of our product candidates. If our product candidates are approved but fail to achieve market acceptance among physicians, patients, hospitals, cancer treatment centers or others in the medical community, we will not be able to generate significant revenue.

We are developing, and in the future may develop, other product candidates, in combination with other therapies, which exposes us to additional risks.

Our HB-201 and HB-202 product candidates are being developed to be used in combination with nivolumab, a currently approved cancer therapy. In the future, we may develop other product candidates to be used with one or more currently approved cancer therapies. Even if any product candidate we develop were to receive marketing approval or be commercialized for use in combination with other existing therapies, we would continue to be subject to the risks that the FDA or similar regulatory authorities outside of the United States could revoke approval of the therapy used in combination with our product candidate or that safety, efficacy, manufacturing or supply issues could arise with these existing therapies. Combination therapies are commonly used for the treatment of cancer, and we would be subject to similar risks if we develop any of our product candidates for use in combination with other drugs or for indications other than cancer. This could result in our own products being removed from the market or being less successful commercially.

We may also evaluate our future product candidates in combination with one or more other cancer therapies that have not yet been approved for marketing by the FDA or similar regulatory authorities outside of the United States. We will not be able to market any product candidate we develop in combination with any such unapproved cancer therapies that do not ultimately obtain marketing approval.

If the FDA or similar regulatory authorities outside of the United States do not approve these other drugs or revoke their approval of, or if safety, efficacy, manufacturing, or supply issues arise with, the drugs we choose to evaluate in combination with any product candidate we develop, we may be unable to obtain approval.

Negative developments in the field of immuno-oncology and virus-based therapies could damage public perception of any of our product candidates and negatively affect our business.

The commercial success of TheraT-based product candidates will depend in part on public acceptance of the use of cancer immunotherapies. Adverse events in clinical trials of HB-201 or our other TheraT-based product candidates or in clinical trials of others developing similar products and the resulting publicity, as well as any other negative developments in the field of immuno-oncology that may occur in the future, including in connection with competitor therapies, could result in a decrease in demand for any TheraT-based product candidates that we may develop. These events could also result in the suspension, discontinuation, or clinical hold of or modification to our clinical trials. If public perception is influenced by claims that the use of cancer immunotherapies is unsafe, whether related to our therapies or those of our competitors, our product candidates may not be accepted by the general public or the medical community and potential clinical trial subjects may be discouraged from enrolling in our clinical trials. In addition, responses by national or state governments to negative public perception may result in new legislation or regulations that could limit our ability to develop or commercialize any product candidates, obtain or maintain regulatory approval or otherwise achieve profitability. More restrictive statutory regimes, government regulations or negative public opinion would have an adverse effect on our business, financial condition, prospects and results of operations and may delay or impair the development and commercialization of our product candidates or demand for any products we may develop. As a result, we may not be able to continue or may be delayed in conducting our development programs.

Our product candidates consist of a modified virus. Adverse developments in clinical trials of other immunotherapy products based on viruses, like oncolytic viruses, may result in a disproportionately negative effect for our VaxWave and TheraT technologies as compared to other products in the field of infectious disease and immuno-oncology that are not based on viruses. Future negative developments in the biopharmaceutical industry could also result in greater governmental regulation, stricter labeling requirements and potential regulatory delays in the testing or approvals of our products. Any increased scrutiny could delay or increase the costs of obtaining marketing approval for our product candidates.

We may not be successful in our efforts to identify and successfully commercialize additional product candidates.

Part of our strategy involves identifying novel product candidates. We have developed a pipeline of product candidates and intend to pursue clinical development of additional product candidates utilizing our VaxWave and TheraT technologies. The process by which we identify product candidates may fail to yield product candidates for clinical development for a number of reasons, including those discussed in these risk factors and also:

- we may not be able to assemble sufficient resources to acquire or discover additional product candidates;
- competitors may develop alternatives that render our potential product candidates obsolete or less attractive;
- potential product candidates we develop may nevertheless be covered by third parties' patents or other exclusive rights;
- potential product candidates may, on further study, be shown to have harmful side effects, toxicities or other characteristics that indicate that they are unlikely to be products that will receive marketing approval and achieve market acceptance;
- potential product candidates may not be effective in treating their targeted diseases or symptoms;
- the market for a potential product candidate may change so that the continued development of that product candidate is no longer reasonable;
- a potential product candidate may not be capable of being produced in commercial quantities at an acceptable cost, or at all; or
- the regulatory pathway for a potential product candidate is highly complex and difficult to navigate successfully or economically.

Developing, obtaining regulatory approval for and commercializing additional product candidates will require substantial additional funding beyond the net proceeds of this offering and is prone to the risks of failure inherent in medical product development. We cannot provide you any assurance that we will be able to successfully advance any of these additional product candidates through the development process.

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

We may choose to focus our efforts on and allocate resources to a potential product candidate that ultimately proves to be unsuccessful, or to license or purchase a marketed product that does not meet our financial expectations. As a result, we may fail to capitalize on viable commercial products or profitable market opportunities, be required to forego or delay pursuit of opportunities with other product candidates or other diseases that may later prove to have greater commercial potential, or relinquish valuable rights to such product candidates through collaboration, licensing or other royalty arrangements in cases in which it would have been advantageous for us to retain sole development and commercialization rights. Our spending on current and future research and development programs and product candidates for specific indications may not yield any commercially viable products. If we are unable to evaluate the commercial potential or target market for a particular product candidate, identify and successfully commercialize additional suitable product candidates, this would adversely impact our business strategy and our financial position.

We face significant competition from other biotechnology and pharmaceutical companies, and our operating results will suffer if we fail to compete effectively.

The biopharmaceutical industry is characterized by intense competition and rapid innovation. Our competitors may be able to develop other products or drugs that are able to achieve similar or better results. Our potential competitors include major multinational pharmaceutical companies, established biotechnology companies, specialty pharmaceutical companies and universities and other research institutions. Many of our competitors have substantially greater financial, technical and other resources, such as larger research and development staff and experienced marketing and manufacturing organizations and well-established sales forces. In addition, many of these competitors are active in seeking patent protection and licensing arrangements in anticipation of collecting royalties for use of technology that they have developed. Smaller or early-stage companies may also prove to be significant competitors, particularly through collaborative arrangements with large, established companies. Established pharmaceutical companies may also invest heavily to accelerate discovery and development of novel therapeutics or to in-license novel therapeutics that could make the product candidates that we develop obsolete. Mergers and acquisitions in the biotechnology and pharmaceutical industries may result in even more resources being concentrated in our competitors. Competition may increase further as a result of advances in the commercial applicability of technologies and greater availability of capital for investment in these industries. Our competitors, either alone or with collaborative partners, may succeed in developing, acquiring or licensing on an exclusive basis drug or biologic products that are more effective, safer, more easily commercialized or less costly than our product candidates or may develop proprietary technologies or secure patent protection that we may need for the development of our technologies and products. We believe the key competitive factors that will affect the development and commercial success of our product candidates are efficacy, safety, tolerability, reliability, convenience of use, price and reimbursement.

Specifically, we face significant competition in cytomegalovirus management, companies such as Helocyte, Inc., VBI Vaccines, Inc., Moderna, Inc., SL VaxiGen, Inc., Merck & Co., GlaxoSmithKline plc and Pfizer, Inc. In immuno-oncology for human papilloma virus-16 positive, or HPV16+, cancers, we face competition from companies such as Kite Pharma, a Gilead company, Advaxis, Inc., ISA Pharmaceuticals B.V., in collaboration with Regeneron Pharmaceuticals, Inc. and BioNtech AG. Even if we obtain regulatory approval of our product candidates, the availability and price of our competitors' products could limit the demand and the price we are able to charge for our product candidates. In addition, other immuno-oncology companies are developing the following technologies, including, but not limited to, neoantigens, bispecific antibodies, engineered cell therapies and tumor specific antigens in areas outside of cytomegalovirus and HPV16+ cancers.

We may not be able to implement our business plan if the acceptance of our product candidates is inhibited by price competition or the reluctance of physicians to switch from existing methods of treatment to our product candidates, or if physicians switch to other new drug or biologic products or choose to reserve our product candidates for use in limited circumstances. For additional information regarding our competition, see "Business—Competition."

If product liability lawsuits are brought against us, we may incur substantial liabilities and may be required to limit commercialization of our product candidates.

We face an inherent risk of product liability as a result of the clinical testing of our product candidates and will face an even greater risk if we commercialize any products. For example, we may be sued if our product candidates cause or are perceived to cause injury or are found to be otherwise unsuitable during clinical testing, manufacturing, marketing or sale. Any such product liability claims 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. Claims could also be asserted under state consumer protection acts. If we cannot successfully defend ourselves against product liability claims, we may incur substantial liabilities or be required to limit commercialization of our product candidates. Even successful defense would require significant financial and management resources. Regardless of the merits or eventual outcome, liability claims may result in:

- our inability to commercialize any product candidate;
- decreased demand for our product candidates or products that we may develop;
- reputational damage;
- withdrawal of clinical trial participants and inability to continue clinical trials;
- 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
- a decline in our share price.

Failure to obtain or retain sufficient product liability insurance at an acceptable cost to protect against potential product liability claims could prevent or inhibit the commercialization of products we develop, alone or with corporate collaborators. Although we have clinical trial insurance, our insurance policies also have various exclusions, and we may be subject to a product liability claim for which we have no coverage. In the future, we may be unable to maintain this insurance coverage, or we may not be able to obtain additional or replacement insurance at a reasonable cost, if at all. 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. Even if our agreements with any future corporate collaborators entitle us to indemnification against losses, such indemnification may not be available or adequate should any claim arise.

A variety of risks associated with operating our business internationally could materially adversely affect our business.

We plan to seek regulatory approval of our product candidates outside of the United States and, accordingly, we expect that we, and any potential collaborators in those jurisdictions, will be subject to additional risks related to operating in foreign countries, including:

- differing regulatory requirements in foreign countries;

- 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 and 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 Foreign Corrupt Practices Act of 1977, or FCPA, Office of Foreign Assets Control Anti-Money Laundering Program as required by the Bank Secrecy Act and its implementing regulations, or comparable foreign laws;
- 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;
- production shortages resulting from any events affecting raw material supply or manufacturing capabilities abroad; and
- business interruptions resulting from geo-political actions, including war and terrorism.

These and other risks associated with our planned international operations may materially adversely affect our ability to attain or maintain profitable operations.

We currently have no marketing and sales organization and have no experience in marketing products. If we are unable to establish marketing and sales capabilities or enter into agreements with third parties to market and sell our product candidates, if approved, we may not be able to generate product revenue.

We currently have no sales, marketing or distribution capabilities and have no experience in marketing products. Our operations to date have been limited to organizing and staffing our company, business planning, raising capital, undertaking preclinical studies and clinical trials of product candidates, securing related intellectual property rights and conducting discovery, research and development activities for our programs. We intend to develop an in-house marketing organization and sales force, which will require significant capital expenditures, management resources and time. We will have to compete with other biotechnology and pharmaceutical companies to recruit, hire, train and retain marketing and sales personnel. There are risks involved with both establishing our own sales and marketing capabilities and entering into arrangements with third parties to perform these services. For example, recruiting and training a sales force is expensive and time-consuming and could delay any product launch. If the commercial launch of a product candidate for which we recruit a sales force and establish marketing capabilities is delayed or does not occur for any reason, we would have prematurely or unnecessarily incurred these commercialization expenses. This may be costly, and our investment would be lost if we cannot retain or reposition our sales and marketing personnel. In addition, there can be no assurance that we will be able to develop in-house sales and distribution capabilities or establish or maintain relationships with third-party collaborators to commercialize any product in the United States or overseas.

Insurance policies are expensive and protect us only from some business risks, which leaves us exposed to significant uninsured liabilities.

We do not carry insurance for all categories of risk that our business may encounter. Some of the policies we currently maintain include general liability, employment practices liability, property, umbrella, and directors' and officers' insurance.

Insurance coverage is becoming increasingly expensive and in the future we may not be able to maintain insurance coverage at a reasonable cost or in sufficient amounts to protect us against losses due to liability. We do not carry specific biological or hazardous waste insurance coverage, and our property, casualty and general liability insurance policies specifically exclude coverage for damages and fines arising from biological or hazardous waste exposure or contamination. Accordingly, in the event of contamination or injury, we could be held liable for damages or be penalized with fines in an amount exceeding our resources, and our clinical trials or regulatory approvals could be suspended.

We also expect that operating as a public company will make it more difficult and more expensive for us to obtain director and officer liability insurance, and we may be required to accept reduced policy limits and coverage or incur substantially higher costs to obtain the same or similar coverage. As a result, it may be more difficult for us to attract and retain qualified people to serve on our board of directors, our board committees or as executive officers. We do not know, however, if we will be able to maintain existing insurance with adequate levels of coverage. Any significant uninsured liability may require us to pay substantial amounts, which would adversely affect our cash position and results of operations.

Exchange rate fluctuations may materially affect our results of operations and financial conditions.

Owing to the international scope of our operations, fluctuations in exchange rates, particularly between the U.S. dollar and the euro, may adversely affect us. Although we are incorporated in Delaware in the United States, we have significant research and development operations in Austria, and source third-party manufacturing, consulting and other services in the European Union. As a result, our business and the price of our common stock may be affected by fluctuations in foreign exchange rates, which may have a significant impact on our results of operations and cash flows from period to period. Currently, we do not have any exchange rate hedging arrangements in place.

Risks Related to Our Reliance on Third Parties

We are fully dependent on our collaboration with Gilead for the development of our HIV and hepatitis B virus programs and may depend on Gilead or additional third parties for the development and commercialization of our other programs and future product candidates. Our current and future collaborators may control aspects of our clinical trials, which could result in delays or other obstacles in the commercialization of the product candidates we develop. If our collaborations are not successful, we may not be able to capitalize on the market potential of these product candidates.

In June 2018, we entered into a research collaboration and license agreement with Gilead, or the Collaboration Agreement, which is focused on researching, developing and commercializing therapies for the treatment, cure, diagnosis and prevention of HIV and hepatitis B virus, or HBV. Pursuant to the Collaboration Agreement, we granted Gilead a worldwide exclusive license to research, develop, manufacture and commercialize vaccine products for HIV and HBV using our VaxWave and TheraT technologies. The collaboration involves a complex allocation of rights, provides for milestone payments to us based on the achievement of specified clinical development, regulatory and commercial milestones, and provides us with royalty-based revenue if certain product candidates are successfully commercialized. Gilead is solely responsible for the preclinical and clinical development of the programs. Our lack of control over the clinical development under the Collaboration Agreement could result in delays or other difficulties in the development and commercialization of product candidates, which may prevent completion of intended IND filings in a timely fashion, if at all. Additionally, Gilead has the right to terminate the Collaboration Agreement at any time for convenience. In the event Gilead terminates the Collaboration Agreement, we would be prevented from receiving any milestone payments, royalty payments and other benefits under that agreement, which would have a materially adverse effect on our results of operations. We cannot provide any assurance with respect to the success of the Collaboration Agreement.

In the future, we may form or seek other strategic alliances, joint ventures, or collaborations, or enter into additional licensing arrangements with third parties that we believe will complement or augment our development and commercialization efforts with respect to product candidates we develop.

Our current collaboration with Gilead poses, and potential future collaborations involving our product candidates may pose, the following risks to us:

- collaborators have significant discretion in determining the efforts and resources that they will apply to these collaborations;
- collaborators may not perform their obligations as expected;
- collaborators may not pursue development and commercialization of any product candidates that achieve regulatory approval or may elect not to continue or renew development or commercialization programs or license arrangements based on clinical trial results, changes in the collaborators' strategic focus or available funding, or external factors, such as a strategic transaction that may divert resources or create competing priorities;
- collaborators may delay clinical trials, provide insufficient funding for a clinical trial program, stop a clinical trial or abandon a product candidate, repeat or conduct new clinical trials or require a new formulation of a product candidate for clinical testing;
- collaborators could independently develop, or develop with third parties, including technology we in-license, products that compete directly or indirectly with our products or product candidates;
- product candidates discovered in collaboration with us may be viewed by our collaborators as competitive with their own product candidates or products, which may cause collaborators to cease to devote resources to the commercialization of our product candidates;
- collaborators may fail to comply with applicable regulatory requirements regarding the development, manufacture, distribution or marketing of a product candidate or product;
- collaborators may not properly enforce, maintain or defend our intellectual property rights or may use our proprietary information in a way that gives rise to actual or threatened litigation that could jeopardize or invalidate our intellectual property or proprietary information or expose us to potential litigation, or other intellectual property proceedings;
- collaborators may infringe the intellectual property rights of third parties, which may expose us to litigation and potential liability;
- disputes may arise between a collaborator and us that cause the delay or termination of the research, development or commercialization of the product candidate, or that result in costly litigation or arbitration that diverts management attention and resources;
- if a present or future collaborator of ours were to be involved in a business combination, the continued pursuit and emphasis on our product development or commercialization program under such collaboration could be delayed, diminished or terminated;
- collaboration agreements may restrict our right to independently pursue new product candidates. For example, under the Collaboration Agreement, we are prohibited from,

directly or indirectly, researching, developing, manufacturing or commercializing product candidates targeted to HIV or HBV; and

- collaborations may be terminated by the collaborator, and, if terminated, we may suffer reputational harm, find it more difficult to attract new collaborators and be required to raise additional capital to pursue further development or commercialization of the applicable product candidates.

As a result, if we enter into additional collaboration agreements and strategic partnerships or license our intellectual property, 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, which could delay our timelines or otherwise adversely affect our business. We also 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 collaborations or strategic partnership agreements related to any product candidate we develop could delay the development and commercialization of our other product candidates, which would harm our business prospects, financial condition, and results of operations.

We may seek to establish additional collaborations, and, if we are not able to establish them on commercially reasonable terms, we may have to alter our development and commercialization plans.

The advancement of our product candidates and development programs and the potential commercialization of our current and future product candidates will require substantial additional cash to fund expenses. For some of our programs, we may decide to collaborate with additional biotechnology and pharmaceutical companies with respect to development and potential commercialization. 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. We will likely have limited control over the amount and timing of resources that our collaborators dedicate to the development or commercialization of any product candidates we may seek to develop with them. We cannot predict the success of any collaboration that we have entered into or will enter into.

We face significant competition in seeking appropriate strategic partners and the negotiation process is time-consuming and complex. Whether we reach a definitive agreement for other collaborations will depend, among other things, upon our assessment of the collaborator's resources and expertise, the terms and conditions of the proposed collaboration and the proposed collaborator's evaluation of a number of factors. Those factors may include the design or results of clinical trials, the progress of our clinical trials, the likelihood of approval by the FDA or similar regulatory authorities outside the United States, the potential market for the subject product candidate, the costs and complexities of manufacturing and delivering such product candidate to patients, the potential of competing products, the existence of uncertainty with respect to our ownership of technology, which can exist if there is a challenge to such ownership without regard to the merits of the challenge and industry and market conditions generally. The collaborator may also consider alternative product candidates or technologies for similar indications that may be available to collaborate on and whether such a collaboration could be more attractive than the one with us for our product candidate. Further, we may not be successful in our efforts to establish a strategic partnership or other alternative arrangements for future product candidates because they may be deemed to be at too early of a stage of development for collaborative effort and third parties may not view them as having the requisite potential to demonstrate safety and efficacy.

We may also be restricted under existing collaboration agreements from entering into future agreements on certain terms with potential collaborators. For example, under the Collaboration Agreement, we have granted worldwide exclusive rights to Gilead for using our technologies to develop treatments for HIV and HBV, and during the term of the agreement we will be restricted from granting similar rights to other parties. This exclusivity could limit our ability to enter into strategic collaborations with future collaborators.

In addition, there have been a significant number of recent business combinations among large pharmaceutical companies that have resulted in a reduced number of potential future collaborators.

We may not be able to negotiate collaborations on a timely basis, on acceptable terms, or at all. If we are unable to do so, we may have to curtail the development of the product candidate for which we are seeking to collaborate, reduce or delay its development program or one or more of our other development programs, delay its potential commercialization or reduce the scope of any sales or marketing activities, or increase our expenditures and undertake development or commercialization activities at our own expense. If we elect to increase our expenditures to fund development or commercialization activities on our own, we may need to obtain additional capital, which may not be available to us on acceptable terms or at all. If we fail to enter into collaborations or do not have sufficient funds, we may not be able to further develop our product candidates or bring them to market and generate product revenue.

We rely and will continue to rely on third parties to conduct our clinical trials. If these third parties do not properly and successfully carry out their contractual duties or meet expected deadlines, we may not be able to obtain regulatory approval of or commercialize our product candidates.

We depend and will continue to depend upon independent investigators and collaborators, such as medical institutions, CROs, CMOs and strategic partners to conduct our preclinical studies and clinical trials under agreements with us. We expect to have to negotiate budgets and contracts with CROs, trial sites and CMOs which may result in delays to our development timelines and increased costs. We will rely heavily on these third parties over the course of our clinical trials, and we control only certain aspects of their activities. As a result, we have less direct control over the conduct, timing and completion of these clinical trials and the management of data developed through clinical trials than would be the case if we were relying entirely upon our own staff.

Nevertheless, we are responsible for ensuring that each of our studies is conducted in accordance with applicable protocol, legal and regulatory requirements and scientific standards, and our reliance on third parties does not relieve us of our regulatory responsibilities. We and these third parties are required to comply with good clinical practices, or GCPs, which are regulations and guidelines enforced by the FDA and comparable foreign regulatory authorities for product candidates in clinical development. Regulatory authorities enforce these GCPs through periodic inspections of trial sponsors, principal investigators and trial sites. If we or any of these third parties fail to comply with applicable GCP regulations, the clinical data generated in our clinical trials may be deemed unreliable and the FDA or comparable foreign regulatory authorities may require us to perform additional clinical trials before approving our marketing applications. We cannot assure you that, upon inspection, such regulatory authorities will determine that any of our clinical trials comply with the GCP regulations. In addition, our clinical trials must be conducted with biologic product produced under current good manufacturing practices, or cGMP, regulations and will require a large number of test patients. Our failure or any failure by these third parties to comply with these regulations or to recruit a sufficient number of patients may require us to repeat clinical trials, which would delay the regulatory approval process. Moreover, our business may be implicated if any of these third parties violates federal or state fraud and abuse or false claims laws and regulations or healthcare privacy and security laws.

Any third parties conducting our clinical trials are and will not be our employees and, except for remedies available to us under our agreements with such third parties, we cannot control whether or not they devote sufficient time and resources to our ongoing, clinical and nonclinical programs. These third parties may also have relationships with other commercial entities, including our competitors, for whom they may also be conducting clinical studies or other drug development activities, which could affect their performance on our behalf. If these third parties do not successfully carry out their contractual duties or obligations or meet expected deadlines, if they need to be replaced or if the quality or accuracy of the clinical data they obtain is compromised due to the failure to adhere to our clinical protocols or regulatory requirements or for other reasons, our clinical trials may be extended, delayed or terminated and we may not be able to complete development of, obtain regulatory approval of or successfully commercialize our product candidates. As a result, our financial results and the commercial prospects for our product candidates would be harmed, our costs could increase and our ability to generate revenue could be delayed.

Switching or adding third parties to conduct our clinical trials involves substantial cost and requires extensive management time and focus. In addition, there is a natural transition period when a new third party commences work. As a result, delays occur, which can materially impact our ability to meet our desired clinical development timelines.

We expect to rely on third parties to manufacture our clinical product supplies, and we may rely on third parties for at least a portion of the manufacturing process of our product candidates, if approved. Our business could be harmed if those third parties fail to provide us with sufficient quantities of clinical product supplies or product candidates or fail to do so at acceptable quality levels or prices.

We do not currently own any facility that may be used as our clinical-scale manufacturing and processing facility and must currently rely on outside vendors to manufacture our product candidates. We have not yet caused our product candidates to be manufactured or processed on a commercial scale and may not be able to do so for any of our product candidates.

The manufacture of biological drug products is complex and requires significant expertise and capital investment, including the development of advanced manufacturing techniques and process controls. Manufacturers of biologic products often encounter difficulties in production, particularly in scaling up or out, validating the production process and assuring high reliability of the manufacturing process, including the absence of contamination. These problems include logistics and shipping, difficulties with production costs and yields, quality control, including lot consistency, stability of the product, product testing, operator error and availability of qualified personnel, as well as compliance with strictly enforced federal, state and foreign regulations. Furthermore, if contaminants are discovered in our supply of our product candidates or in the manufacturing facilities, such manufacturing facilities may need to be closed for an extended period of time to investigate and remedy the contamination. We cannot assure you that any stability failures or other issues relating to the manufacture of our product candidates will not occur in the future.

Although we do intend to develop our own manufacturing facility, we currently rely on third parties as part of our manufacturing process and may, in any event, never be successful in developing our own manufacturing facility. Our reliance on a limited number of third-party manufacturers exposes us to the following risks:

- the production process for our product candidates is complex and requires specific know-how that only a limited number of CMOs can provide, as a result, we compete with other companies in the field for the scarce capacities of these organizations and may not be able to secure sufficient manufacturing capacity when needed;

- we may be unable to identify manufacturers on acceptable terms or at all because the number of potential manufacturers is limited and the FDA and comparable foreign regulatory authorities must inspect any manufacturers for cGMP compliance as part of our marketing application;

- a new manufacturer would have to be educated in, or develop substantially equivalent processes for, the production of our product candidates;
- manufacturers may have little or no experience with viral vector products and therefore may require a significant amount of support from us in order to implement and maintain the infrastructure and processes required to manufacture our product candidates;
- manufacturers might be unable to timely manufacture our product candidates or produce the quantity and quality required to meet our clinical and commercial needs, if any;
- manufacturers may not be able to execute our manufacturing procedures and other logistical support requirements appropriately;
- manufacturers may not perform as agreed, may not devote sufficient resources to our product candidates or may not remain in the contract manufacturing business for the time required to supply our clinical trials or to successfully produce, store, and distribute our products, if any;
- manufacturers are subject to ongoing periodic unannounced inspection by the FDA and corresponding state and foreign agencies to ensure strict compliance with cGMP and other government regulations and corresponding foreign standards, of which we do not have control over;
- we may not own, or may have to share, the intellectual property rights to any improvements made by our third-party manufacturers in the manufacturing process for our product candidates;
- manufacturers could breach or terminate their agreements with us;
- raw materials and components used in the manufacturing process, particularly those for which we have no other source or supplier, may not be available timely or may not be suitable or acceptable for use due to material or component defects;
- manufacturers and critical suppliers may be subject to inclement weather, as well as natural or man-made disasters; and
- manufacturers may have unacceptable or inconsistent product quality success rates and yields, and we have no direct control over our contract manufacturers' ability to maintain adequate quality control, quality assurance and qualified personnel.

Each of these risks could delay or prevent the completion of our clinical trials or the approval of any of our product candidates by the FDA and comparable foreign regulatory authorities, result in higher costs or adversely impact commercialization of our product candidates. In addition, we will rely on third parties to perform certain specification tests on our product candidates prior to delivery to patients. If these tests are not appropriately done and test data are not reliable, patients could be put at risk of serious harm and the FDA and comparable foreign regulatory authorities could place significant restrictions on our company until deficiencies are remedied.

If our third-party manufacturers use hazardous and biological materials in a manner that causes injury or violates applicable law, we may be liable for damages.

Our research and development activities involve the controlled use of potentially hazardous substances, including chemical and biological materials, by our manufacturers. Our manufacturers are subject to federal, state and local laws and regulations in the United States governing the use, manufacture, storage, handling and disposal of medical and hazardous materials. Although we believe that our manufacturers' procedures for using, handling, storing and disposing of these materials comply with legally prescribed standards, we cannot completely eliminate the risk of contamination or injury resulting from medical or hazardous materials. As a result of any such contamination or injury, we may incur liability or local, city, state or federal authorities may curtail the use of these materials and interrupt our business operations. In the event of an accident, we could be held liable for damages or penalized with fines, and the liability could exceed our resources. We do not have any insurance for liabilities arising from medical or hazardous materials. Compliance with applicable environmental laws and regulations is expensive, and current or future environmental regulations may impair our research, development and production efforts, which could harm our business, prospects, financial condition or results of operations.

Risks Related to Government Regulation

Even if we receive regulatory approval of our product candidates, we will be subject to ongoing regulatory obligations and continued regulatory review, which may result in significant additional expense and we may be subject to penalties if we fail to comply with regulatory requirements or experience unanticipated problems with our product candidates.

Any regulatory approvals that we receive for our product candidates will require surveillance to monitor the safety and efficacy of the product candidate. The FDA may also require a risk evaluation and mitigation strategy in order to approve our product candidates, which could entail requirements for a medication guide, physician communication plans or additional elements to ensure safe use, such as restricted distribution methods, patient registries and other risk minimization tools. In addition, if the FDA, the EMA or another comparable foreign regulatory authority approves our product candidates, the manufacturing processes, labeling, packaging, distribution, adverse event reporting, storage, advertising, promotion, import, export and recordkeeping for any such approved product candidates will be subject to extensive and ongoing regulatory requirements. These requirements include submissions of safety and other post-marketing information and reports, registration, as well as continued compliance with cGMPs and GCPs for any clinical trials that we conduct post-approval. Later discovery of previously unknown problems with our product candidates, including adverse events of unanticipated severity or frequency, or with our third-party manufacturers or manufacturing processes, or our or our distributors', licensees' or co-marketers' failure to comply with changes to regulatory requirements, may result in, among other things:

- restrictions on the marketing or manufacturing of our product candidates, withdrawal of the product from the market or voluntary or mandatory product recalls;
- fines, warning or untitled letters or holds on clinical trials;
- suspension of any ongoing clinical trials;
- refusal by the FDA, the EMA or other comparable foreign regulatory authorities to approve pending applications or supplements to approved applications filed by us or suspension or revocation of license approvals;
- product seizure or detention, refusal to permit the import or export of our product candidates, or request that we initiate a product recall;
- injunctions or the imposition of civil or criminal penalties or monetary fines; and
- requiring us to conduct additional clinical trials, change our product labeling or submit additional applications for marketing authorization.

The FDA's, the EMA's and other comparable foreign regulatory authorities' policies may change and additional government regulations may be enacted that could prevent, limit or delay regulatory approval of our product candidates. We cannot predict the likelihood, nature or extent of government regulation that may arise from future legislation or administrative action, either in the United States or abroad. If we are slow or unable to adapt to changes in existing requirements or the adoption of new requirements or policies, or if we are not able to maintain regulatory compliance, we may lose any marketing approval that we may have obtained and we may not achieve or sustain profitability.

If any of these events occurs, our ability to commercialize such product candidate may be impaired, and we may incur substantial additional expense to comply with regulatory requirements, which could adversely affect our business, financial condition and results of operations.

The impact of recent healthcare reform legislation and other changes in the healthcare industry and in healthcare spending on us is currently unknown, and may adversely affect our business model.

In the United States and some foreign jurisdictions, there have been a number of legislative and regulatory changes and proposed changes regarding the healthcare system that could prevent or delay marketing approval of our product candidates, restrict or regulate post-approval activities and affect our ability, or the ability of our collaborators, to profitably sell any products for which we obtain marketing approval. We expect that current laws, as well as other healthcare reform measures that may be adopted in the future, may result in more rigorous coverage criteria and in additional downward pressure on the price that we, or our collaborators, may receive for any approved products.

For example, legislative and regulatory changes have been proposed and adopted since the Patient Protection and Affordable Care Act, as amended by the Health Care and Education Reconciliation Act of 2010, or collectively, the ACA, was enacted in 2010. These changes include, among other things, aggregate reductions to Medicare Part B payments to providers of up to 2% per fiscal year, which became effective on April 1, 2013 and will remain in effect through 2027 unless additional congressional action is taken. Additionally, the American Taxpayer Relief Act of 2012, among other things, further reduced Medicare payments to several providers and increased the statute of limitations period for the government to recover overpayments to providers from three to five years. Changes imposed by recent legislative actions are further described in the section of this prospectus titled "Business—Government Regulation."

While Congress has not passed repeal legislation to date, the 2017 Tax Cuts and Jobs Act includes a provision repealing the individual insurance coverage mandate included in the Affordable Care Act, effective January 1, 2019. Since January 20, 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. Further, on June 14, 2018, the U.S. Court of Appeals for the Federal Circuit ruled that the federal government was not required to pay to third-party payors more than $12 billion in ACA risk corridor payments that they argued were owed to them. The effects of this gap in reimbursement on third-party payors, the viability of the ACA marketplace, providers, and our business, are not yet known.

Recent regulatory changes may also affect our business. In 2016, the Centers for Medicare and Medicaid Services, or CMS, issued a final rule regarding the Medicaid drug rebate program. The final rule, effective April 1, 2016, among other things, extended manufacturer rebate obligations to U.S. territories, revised the manner in which the "average manufacturer price" is to be calculated by manufacturers participating in the program, and implements certain amendments to the Medicaid rebate statute created under the ACA. In 2017, CMS issued a final Medicare rule limiting payment for outpatient drugs purchased by hospitals under the 340B program. In addition, CMS has recently proposed regulations that would give states greater flexibility in setting benchmarks for insurers in the individual and small group marketplaces, which may have the effect of relaxing the essential health benefits required under the ACA for plans sold through such marketplaces. In addition, increased scrutiny by the U.S. Congress of the FDA's approval process may significantly delay or prevent marketing approval, as well as subject us to more stringent product labeling and post-marketing testing and other requirements.

Moreover, there have been a number of other legislative and regulatory changes in recent years aimed at the biopharmaceutical industry. For instance, the Drug Quality and Security Act imposes obligations on manufacturers of biopharmaceutical products related to product tracking and tracing. Among the requirements of this legislation, manufacturers are required to provide certain information regarding the product to individuals and entities to which product ownership is transferred, will be required to label products with a product identifier, and are required keep certain records regarding the product. The transfer of information to subsequent product owners by manufacturers will eventually be required to be done electronically. Manufacturers are also required to verify that purchasers of the manufacturers' products are appropriately licensed. Further, manufacturers have product investigation, quarantine, disposition, and FDA and trading partner notification responsibilities related to counterfeit, diverted, stolen, and intentionally adulterated products that could result in serious adverse health consequences or death to humans, as well as products that are the subject of fraudulent transactions or which are otherwise unfit for distribution such that they would be reasonably likely to result in serious health consequences or death.

We expect federal, state and national healthcare reform measures that may be adopted in the United States or other foreign jurisdictions in the future may result in more rigorous coverage criteria, increased regulatory burdens and operating costs, decreased net revenue from our pharmaceutical products, decreased potential returns from our development efforts, and in additional downward pressure on the price that we receive for any approved product. Compliance with new requirements may increase our operational expenses and impose significant administrative burdens. As a result of these and other new proposals, we may need to change our current manner of operation, which could have a material adverse effect on our business, financial condition, and results of operations. Any reduction in reimbursement from Medicare or other government healthcare programs may result in a similar reduction in payments from private payors.

The implementation of cost containment measures or other healthcare reforms may prevent us from being able to generate revenue, attain profitability or commercialize our products. Legislative and regulatory proposals may also impact our regulatory and commercial prospects, expand post-approval requirements, and restrict sales and promotional activities. We cannot predict the extent to which our business may be affected by these or other potential future legislative or regulatory developments, whether regulations, guidance or interpretations will be changed, or what the impact of such changes on the marketing approvals of our product candidates, if any, may be. Such future price controls or other changes in pricing regulation or negative publicity related to the pricing of pharmaceutical drugs generally could restrict the amount that we are able to charge for our future products, which would adversely affect our anticipated revenue and results of operations.

We may pursue breakthrough therapy designation from the FDA for our product candidates but such designation may not lead to a faster development or regulatory review or approval process, and it would not increase the likelihood that our product candidates will receive marketing approval.

We may in the future seek breakthrough therapy designation for some of our product candidates. A breakthrough therapy is defined as a drug that is intended, alone or in combination with one or more other drugs, to treat a serious or life-threatening disease or condition, and preliminary clinical evidence indicates that the drug may demonstrate substantial improvement over existing therapies on one or more clinically significant endpoints. For compounds that have been designated as breakthrough therapies, interaction and communication between the FDA and the sponsor of the trial can help to identify the most efficient path for clinical development while minimizing the number of patients placed in ineffective control regimens. Drugs designated as breakthrough therapies by the FDA are also eligible for accelerated approval.

Designation as a breakthrough therapy is within the discretion of the FDA. Accordingly, even if we believe one of our product candidates meets the criteria for designation as a breakthrough therapy, the FDA may disagree and instead determine not to make such designation. We cannot be sure that any evaluation we may make of our product candidates as qualifying for breakthrough therapy designation will meet the FDA's expectations. In any event, the receipt of a breakthrough therapy designation for a product candidate may not result in a faster development process, review or approval compared to drugs considered for approval under conventional FDA procedures and does not assure ultimate approval by the FDA. In addition, even if one or more of our product candidates qualify as breakthrough therapies, the FDA may later decide that such product candidates no longer meet the conditions for qualification or decide that the time period for FDA review or approval will not be shortened.

We may seek Fast Track Designation by the FDA for a product candidate that we develop, and we may be unsuccessful. If we are successful, the designation may not actually lead to a faster development or regulatory review or approval process.

We may seek Fast Track Designation for the product candidates we develop. If a product is intended for the treatment of a serious or life-threatening condition and preclinical or clinical data demonstrate the potential to address an unmet medical need for this condition, the product sponsor may apply for Fast Track Designation. The FDA has broad discretion whether or not to grant this designation, so even if we believe a particular product candidate is eligible for this designation, we cannot assure you that the FDA would decide to grant it. Even if we do receive Fast Track Designation, we may not experience a faster development process, review or approval compared to conventional FDA procedures. The FDA may rescind the Fast Track Designation if it believes that the designation is no longer supported by data from our clinical development program.

We may seek Orphan Drug Designation for product candidates we develop, and we may be unsuccessful or may be unable to maintain the benefits associated with Orphan Drug Designation, including the potential for market exclusivity.

As part of our business strategy, we may seek Orphan Drug Designation for any product candidates we develop, and we may be unsuccessful. Regulatory authorities in some jurisdictions, including the United States and Europe, may designate drugs for relatively small patient populations as orphan drugs. Under the Orphan Drug Act, the FDA may designate a drug as an orphan drug if it is a drug intended to treat a rare disease or condition, which is generally defined as a patient population of fewer than 200,000 individuals annually in the United States, or a patient population greater than 200,000 in the United States where there is no reasonable expectation that the cost of developing the drug will be recovered from sales in the United States. In the United States, Orphan Drug Designation entitles a party to financial incentives such as opportunities for grant funding towards clinical trial costs, tax advantages and user-fee waivers.

Similarly, in Europe, the European Commission grants Orphan Drug Designation after receiving the opinion of the EMA Committee for Orphan Medicinal Products on an Orphan Drug Designation application. Orphan Drug Designation is intended to promote the development of drugs that are intended for the diagnosis, prevention or treatment of life-threatening or chronically debilitating conditions affecting not more than 5 in 10,000 persons in Europe and for which no satisfactory method of diagnosis, prevention, or treatment has been authorized (or the product would be a significant benefit to those affected). Additionally, designation is granted for drugs intended for the diagnosis, prevention, or treatment of a life-threatening, seriously debilitating or serious and chronic condition and when, without incentives, it is unlikely that sales of the drug in Europe would be sufficient to justify the necessary investment in developing the drug. In Europe, Orphan Drug Designation entitles a party to a number of incentives, such as protocol assistance and scientific advice specifically for designated orphan medicines, and potential fee reductions depending on the status of the sponsor.

Generally, if a drug with an Orphan Drug Designation subsequently receives the first marketing approval for the indication for which it has such designation, the drug is entitled to a period of marketing exclusivity, which precludes the EMA or the FDA from approving another marketing application for the same drug and indication for that time period, except in limited circumstances. The applicable period is seven years in the United States and ten years in Europe. The European exclusivity period can be reduced to six years if a drug no longer meets the criteria for Orphan Drug Designation or if the drug is sufficiently profitable such that market exclusivity is no longer justified.

Even if we obtain orphan drug exclusivity for a product candidate, that exclusivity may not effectively protect the product candidate from competition because different therapies can be approved for the same condition and the same therapies can be approved for different conditions but used off-label. Even after an orphan drug is approved, the FDA can subsequently approve the same drug for the same condition if the FDA concludes that the later drug is clinically superior in that it is shown to be safer, more effective or makes a major contribution to patient care. In addition, a designated orphan drug may not receive orphan drug exclusivity if it is approved for a use that is broader than the indication for which it received orphan designation. Moreover, orphan drug exclusive marketing rights in the United States may be lost if the FDA later determines that the request for designation was materially defective or if the manufacturer is unable to assure sufficient quantity of the drug to meet the needs of patients with the rare disease or condition. Orphan Drug Designation neither shortens the development time or regulatory review time of a drug nor gives the drug any advantage in the regulatory review or approval process. While we may seek Orphan Drug Designation for applicable indications for our current and any future product candidates, we may never receive such designations. Even if we do receive such designations, there is no guarantee that we will enjoy the benefits of those designations.

Our business operations and current and future relationships with investigators, health care professionals, consultants, third-party payors and customers will be subject, directly or indirectly, to federal and state healthcare fraud and abuse laws, false claims laws, health information privacy and security laws, and other healthcare laws and regulations. If we are unable to comply, or have not fully complied, with such laws, we could face substantial penalties.

Although we do not currently have any products on the market, if we obtain FDA approval for our product candidates, and begin commercializing those products in the United States, our operations may be directly, or indirectly through our prescribers, customers and third-party payors, subject to various U.S. federal and state healthcare laws and regulations, including, without limitation, the U.S. federal Anti-Kickback Statute, the U.S. federal civil and criminal false claims laws and the Physician Payments Sunshine Act and regulations. Healthcare providers, physicians and others play a primary role in the recommendation and prescription of any products for which we obtain marketing approval. These laws may impact, among other things, our current business operations, including our clinical research activities, and proposed sales, marketing and education programs and constrain the business of financial arrangements and relationships with healthcare providers, physicians and other parties through which we market, sell and distribute our products for which we obtain marketing approval. In addition, we may be subject to patient data privacy and security regulation by both the U.S. federal government and the states in which we conduct our business. Finally, we may be subject to additional healthcare, statutory and regulatory requirements and enforcement by comparable foreign regulatory authorities in jurisdictions in which we conduct our business. The laws that may affect our ability to operate include:

- the U.S. federal Anti-Kickback Statute, which prohibits, among other things, persons or entities from knowingly and willfully soliciting, offering, receiving or paying any remuneration (including any kickback, bribe, or certain rebates), directly or indirectly, overtly or covertly, in cash or in kind, to induce or reward either the referral of an individual for, or the purchase, lease, order or recommendation of, any good, facility, item or service, for which payment may be made, in whole or in part, under U.S. federal and state healthcare programs such as Medicare and Medicaid. A person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation;

- the U.S. federal false claims and civil monetary penalties laws, including the civil False Claims Act, which, among other things, impose criminal and civil penalties, including through civil whistleblower or qui tam actions, against individuals or entities for knowingly presenting, or causing to be presented, to the U.S. federal government, claims for payment or approval that are false or fraudulent, knowingly making, using or causing to be made or used, a false record or statement material to a false or fraudulent claim, or from knowingly making a false statement to avoid, decrease or conceal an obligation to pay money to the U.S. federal government. In addition, the government may assert that a claim including items and services resulting from a violation of the U.S. federal Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the False Claims Act;

- the U.S. federal Health Insurance Portability and Accountability Act of 1996, or HIPAA, which imposes criminal and civil liability for, among other things, knowingly and willfully executing, or attempting to execute, a scheme to defraud any healthcare benefit program, or knowingly and willfully falsifying, concealing or covering up a material fact or making any materially false statement, in connection with the delivery of, or payment for, healthcare benefits, items or services; similar to the U.S. federal Anti-Kickback Statute, a person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation;

- HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act of 2009, or HITECH, and its implementing regulations, and as amended again by the Modifications to the HIPAA Privacy, Security, Enforcement and Breach Notification Rules Under HITECH and the Genetic Information Nondiscrimination Act; Other Modifications to the HIPAA Rules, commonly referred to as the Final HIPAA Omnibus Rule, published in January 2013, which imposes certain obligations, including mandatory contractual terms, with respect to safeguarding the privacy, security and transmission of individually identifiable health information without appropriate authorization by covered entities subject to the Final HIPAA Omnibus Rule, i.e. health plans, healthcare clearinghouses and healthcare providers, as well as their business associates that perform certain services for or on their behalf involving the use or disclosure of individually identifiable health information;

- the U.S. Federal Food, Drug and Cosmetic Act, which prohibits, among other things, the adulteration or misbranding of drugs, biologics and medical devices; the U.S. federal legislation commonly referred to as Physician Payments Sunshine Act, enacted as part of the ACA, and its implementing regulations, which requires certain manufacturers of drugs, devices, biologics and medical supplies that are reimbursable under Medicare, Medicaid, or the Children's Health Insurance Program to report annually to the CMS information related to certain payments and other transfers of value to physicians (defined to include doctors, dentists, optometrists, podiatrists and chiropractors) and teaching hospitals, as well as ownership and investment interests held by the physicians described above and their immediate family members;

- federal consumer protection and unfair competition laws, which broadly regulate marketplace activities and activities that potentially harm consumers;

- analogous state laws and regulations, including: state anti-kickback and false claims laws, which may apply to our business practices, including, but not limited to, research, distribution, sales and marketing arrangements and claims involving healthcare items or services reimbursed by any third-party payor, including private insurers; state laws that require pharmaceutical companies to comply with the pharmaceutical industry's voluntary compliance guidelines and the relevant compliance guidance promulgated by the U.S. federal government, or otherwise restrict payments that may be made to healthcare providers and other potential referral sources; and

- European and other foreign law equivalents of each of the laws, including reporting requirements detailing interactions with and payments to healthcare providers.

The scope and enforcement of each of these laws is uncertain and subject to rapid change in the current environment of healthcare reform, especially in light of the lack of applicable precedent and regulations. Federal and state enforcement bodies have recently increased their scrutiny of interactions between healthcare companies and healthcare providers, which has led to a number of investigations, prosecutions, convictions and settlements in the healthcare industry. Ensuring business arrangements comply with applicable healthcare laws, as well as responding to possible investigations by government authorities, can be time- and resource- consuming and can divert a company's attention from the business.

Ensuring that our internal operations and future business arrangements with third parties comply with applicable healthcare laws and regulations will involve substantial costs. It is possible that governmental authorities will conclude that our business practices do not comply with current or future statutes, regulations, agency guidance or case law involving applicable fraud and abuse or other healthcare laws and regulations. If our operations are found to be in violation of any of the laws described above or any other governmental laws and regulations that may apply to us, we may be subject to significant penalties, including civil, criminal and administrative penalties, damages, fines, exclusion from U.S. government funded healthcare programs, such as Medicare and Medicaid, or similar programs in other countries or jurisdictions, disgorgement, individual imprisonment, contractual damages, reputational harm, diminished profits, additional reporting requirements and oversight if we become subject to a corporate integrity agreement or similar agreement to resolve allegations of non-compliance with these laws and the delay, reduction, termination or restructuring of our operations. Further, defending against any such actions can be costly and time-consuming, and may require significant financial and personnel resources. Therefore, even if we are successful in defending against any such actions that may be brought against us, our business may be impaired. If any of the physicians or other providers or entities with whom we expect to do business is found to not be in compliance with applicable laws, they may be subject to criminal, civil or administrative sanctions, including exclusions from government funded healthcare programs and imprisonment. If any of the above occur, our ability to operate our business and our results of operations could be adversely affected.

Obtaining and maintaining regulatory approval of our product candidates in one jurisdiction does not mean that we will be successful in obtaining regulatory approval of our product candidates in other jurisdictions.

Obtaining and maintaining regulatory approval of a product candidate in one jurisdiction does not guarantee that we will be able to obtain or maintain regulatory approval for that product candidate in any other jurisdiction, while a failure or delay in obtaining regulatory approval in one jurisdiction may have a negative effect on the regulatory approval process in others. For example, in order to market and sell our drugs in the European Union and many other jurisdictions, we, and any collaborators we may have in the future, must obtain separate marketing approvals and comply with numerous and varying regulatory requirements. The approval procedure varies among countries and can involve additional testing. The time required to obtain approval may differ substantially from that required to obtain FDA approval. The marketing approval process outside of the United States generally includes all of the risks associated with obtaining FDA approval. In addition, in many countries outside of the United States, it is required that the drug be approved for reimbursement before the drug can be approved for sale in that country. In some cases, the price that we intend to charge for our products is also subject to regulatory approval. We, and any collaborators we may have in the future, may not obtain approvals from regulatory authorities outside of the United States on a timely basis, if at all. The regulatory approval process and other regulations we may be subject to in other jurisdictions in which we may operate are further described in the section of this prospectus titled "Business—Government Regulation."

European data collection is governed by restrictive regulations governing the use, processing and cross-border transfer of personal information.

The collection and use of personal health data in the European Union is governed by the provisions of the Data Protection Directive, and as of May 2018 the General Data Protection Regulation, or GDPR. These directive impose several requirements relating to the consent of the individuals to whom the personal data relates, the information provided to the individuals, notification of data processing obligations to the competent national data protection authorities and the security and confidentiality of the personal data. The Data Protection Directive and GDPR also impose strict rules on the transfer of personal data out of the European Union to the United States. Failure to comply with the requirements of the Data Protection Directive, the GDPR, and the related national data protection laws of the European Union Member States may result in fines and other administrative penalties. The GDPR introduces new data protection requirements in the European Union and substantial fines for breaches of the data protection rules. The GDPR regulations may impose additional responsibility and liability in relation to personal data that we process and we may be required to put in place additional mechanisms ensuring compliance with these and/or new data protection rules. This may be onerous and adversely affect our business, financial condition, prospects and results of operations.

Our business activities may be subject to the Foreign Corrupt Practices Act and similar anti-bribery and anti-corruption laws.

Our business activities may be subject to the FCPA and similar anti-bribery or anti-corruption laws, regulations or rules of other countries in which we operate, including the U.K. Bribery Act. The FCPA generally prohibits offering, promising, giving, or authorizing others to give anything of value, either directly or indirectly, to a non-U.S. government official in order to influence official action, or otherwise obtain or retain business. The FCPA also requires public companies to make and keep books and records that accurately and fairly reflect the transactions of the corporation and to devise and maintain an adequate system of internal accounting controls. The anti-bribery provisions of the FCPA are enforced primarily by the Department of Justice, or DOJ, and the Securities and Exchange Commission, or the SEC, is involved with enforcement of the books and records provisions of the FCPA and may suspend or bar issuers from trading securities on U.S. exchanges for violations of the FCPA's accounting provisions. Recently the SEC and DOJ have increased their FCPA enforcement activities with respect to pharmaceutical companies. Our business is heavily regulated and therefore involves significant interaction with public officials, including officials of non-U.S. governments. Additionally, in many other countries, the health care providers who prescribe pharmaceuticals are employed by their government, and the purchasers of pharmaceuticals are government entities; therefore, our dealings with these prescribers and purchasers are subject to regulation under the FCPA.

There is no certainty that all of our employees, agents, contractors, or collaborators, or those of our affiliates, will comply with all applicable laws and regulations, particularly given the high level of complexity of these laws. Violations of these laws and regulations could result in fines, criminal sanctions against us, our officers, or our employees, the closing down of our facilities, requirements to obtain export licenses, cessation of business activities in sanctioned countries, implementation of compliance programs, and prohibitions on the conduct of our business. Any such violations could include prohibitions on our ability to offer our products in one or more countries and could materially damage our reputation, our brand, our international expansion efforts, our ability to attract and retain employees, and our business, prospects, operating results, and financial condition.

Comprehensive tax reform legislation could adversely affect our business and financial condition.

On December 22, 2017, President Trump signed into law the Tax Cuts and Jobs Act, or TCJA, that significantly reforms the Internal Revenue Code of 1986, as amended. The TCJA, among other things, contains significant changes to corporate taxation, including reduction of the corporate tax rate from a top marginal rate of 35% to a flat rate of 21%; limitation of the tax deduction for interest expense; limitation of the deduction for net operating losses and elimination of net operating loss carrybacks, in each case, for losses arising in taxable years beginning after December 31, 2017 (though any such tax losses may be carried forward indefinitely); and modifying or repealing many business deductions and credits, including reducing the business tax credit for certain clinical testing expenses incurred in the testing of certain drugs for rare diseases or conditions generally referred to as "orphan drugs". We continue to examine the impact this tax reform legislation may have on our business. However, the effect of the TCJA on us and our affiliates, whether adverse or favorable, is uncertain and may not become evident for some period of time. You are urged to consult your tax adviser regarding the implications of the TCJA on an investment in our common stock.

Our ability to utilize our foreign net operating loss carryforwards may be limited by GILTI taxation introduced through the tax reform.

We have incurred substantial losses during our operating history. We do not anticipate generating revenue from sales of products for the foreseeable future, if ever, and we may never achieve profitability. To the extent that we continue to generate taxable losses, unused losses will carry forward to offset future taxable income, if any, until such unused losses expire. The tax reform legislation introduced section 951A, a new tax on so-called "global intangible low-taxed income," or GILTI. GILTI applies to income of a controlled foreign corporation, or CFC, that is not otherwise subpart F income. Our Austrian subsidiary falls under the category of a CFC and GILTI taxation may therefore apply when use of foreign net operating loss carryforwards reduce our foreign income tax to a low level. Tax benefits from the use of our foreign net operating loss carryforwards could be partially offset by U.S. GILTI taxation, which could have an adverse effect on our future results of operations.

Risks Related to Our Intellectual Property

Our rights to develop and commercialize our product candidates are subject, in part, to the terms and conditions of licenses granted to us by others, and, if we fail to comply with our obligations under these arrangements, we could lose such intellectual property rights or owe damages to the licensor of such intellectual property.

We are dependent on patents, know-how and proprietary technology, both our own and licensed from others. We license patents related to our VaxWave and TheraT technologies and certain other intellectual property rights from third parties, including from the University of Geneva, the University of Basel and the University of Zurich and expect in the future to be party to other material license or collaboration agreements. These agreements typically impose numerous obligations, such as diligence and payment obligations, including in relation to allocation of revenues received from any sublicenses we grant that leverage the licensed patents. If we fail to comply with our obligations under these agreements, our licensors may have the right to terminate our licenses, in which event we might not be able to develop, manufacture or market any product that is covered by the intellectual property we in-license from such licensor and may face other penalties. See "Business—License Agreements" for additional information regarding our license agreements. These licenses do and future licenses may include provisions that impose obligations and restrictions on us. This could delay or otherwise negatively impact a transaction that we may wish to enter into.

Disputes may also arise between us and our licensors regarding the license agreements we have with them, including:

- the scope of rights granted under the license agreement and other interpretation-related issues;
- our right to sublicense patent and other rights to third parties under collaborative development relationships and the amount of fees payable as a result of sublicensing arrangements;
- our diligence obligations with respect to the use of the licensed technology in relation to our development and commercialization of our product candidates, and what activities satisfy those diligence obligations; and
- the ownership of inventions and know-how resulting from the joint creation or use of intellectual property by our licensors and us and our partners.

If disputes prevent or impair our ability to maintain our current licensing arrangements on acceptable terms, we may be unable to successfully develop and commercialize the affected product candidates.

We are generally also subject to all of the same risks with respect to protection of intellectual property that we license as we are for intellectual property that we own, which are described below. If we or our licensors fail to adequately protect this intellectual property, our ability to commercialize products could suffer.

If our efforts to protect the proprietary nature of the intellectual property related to our technologies are not adequate, we may not be able to compete effectively in our market.

We rely upon a combination of patents, confidentiality agreements, trade secret protection and license agreements to protect the intellectual property related to our technologies. Such means may afford only limited protection of our intellectual property and may not: (i) prevent our competitors from duplicating our technology or product candidates; (ii) prevent our competitors from gaining access to our proprietary technology; or (iii) permit us to gain or maintain a competitive advantage. We face the risk of potential unauthorized disclosure or misappropriation of our intellectual property by the third parties to which we grant access to such intellectual property, which may reduce our trade secret protection and allow our potential competitors to access and exploit our proprietary technology. These third parties also may use our proprietary information and intellectual property in such a way as to invite litigation or other intellectual property-related proceedings that could jeopardize or invalidate our proprietary information and intellectual property. Any disclosure to or misappropriation by third parties of our confidential proprietary information could enable competitors to quickly duplicate or surpass our technological achievements, thus eroding our competitive position in our market.

Our success depends in large part on our ability to obtain and maintain patent protection with respect to our VaxWave technology, including our HB-101 product candidate, obtain patent protection with respect to our TheraT technology, including our HB-201, HB-202 and HB-301 product candidates, the vaccine product candidates we are developing with Gilead for HBV and HIV, and other proprietary product candidates. Although we own or license from others certain patent applications that cover the foregoing technologies and product candidates, we do not currently own or license from others issued patents covering all of the foregoing. Our reliance on patent applications carries certain risks associated with pending patent applications prior to the issuance of patents, as described below. If we do not adequately obtain and protect our intellectual property rights, competitors may be able to erode, negate or preempt any competitive advantage we may have, which could harm our business and ability to achieve profitability. To protect our proprietary position, we file patent applications in the United States and abroad related to our product candidates that are important to our business. The patent application and approval process is expensive and time-consuming and we may not be able to file and prosecute all necessary or desirable patent applications at a reasonable cost or in a timely manner. We cannot predict:

- if and when patents will issue from our patent applications;
- the degree and range of protection any patents that we obtain will afford us against competitors, including whether third parties will find ways to invalidate or otherwise circumvent our patents;
- whether or not others will obtain patents claiming aspects similar to those covered by our patents and patent applications; or
- whether we will need to initiate litigation or administrative proceedings related to obtaining, protecting or enforcing our patents, which may be costly whether we win or lose.

We cannot be certain that the claims in our pending patent applications covering composition of matter of our product candidates will be considered patentable by the U.S. Patent and Trademark Office, or USPTO, or by patent offices in foreign countries, or that the claims in any of our issued patents will be considered patentable by courts in the United States or foreign countries. Certain of our issued patents and pending applications are method of use patents, which protect the use of a product for a specified method. This type of patent does not prevent a competitor from making and marketing a product that is identical to our product for an indication that is outside the scope of the patented method. Moreover, even if competitors do not actively promote their product for our targeted indications, physicians may prescribe these products "off-label." Although off-label prescriptions may induce or contribute to the infringement of method of use patents, the practice is common and such infringement is difficult to prevent or prosecute.

The patent position of biopharmaceutical companies generally is highly uncertain, involves complex legal and factual questions, and has been the subject of much litigation in recent years. As a result, the issuance, scope, validity, enforceability, and commercial value of our patent rights may be uncertain. The patent applications that we own or in-license may fail to result in issued patents with claims that cover our product candidates or uses thereof in the United States or in other foreign countries. Even if patents do successfully issue from such applications, third parties may challenge the validity, enforceability or scope thereof, which may result in such patents being narrowed, invalidated or held unenforceable. If our patents are rendered invalid or unenforceable, or narrowed in scope, the patent coverage afforded our products could be impaired. Such impairment could significantly impede our ability to market our products, negatively affect our competitive position and harm our business and operating results. In addition, changes in either the patent laws or interpretation of the patent laws in the United States and other countries may diminish the value of our patents or narrow the scope of our patent protection. In addition, the laws of foreign countries may not protect our rights to the same extent or in the same manner as the laws of the United States. For example, patent laws in various jurisdictions, including significant commercial markets such as Europe, restrict the patentability of methods of treatment of the human body more than United States law does. Furthermore, even if they are unchallenged, our patents and patent applications may not adequately protect our intellectual property or prevent others from designing around our patent protection. No assurances can be given that third parties will not create new products or methods that achieve similar results without infringing upon patents we own. If these developments were to occur, it could have an adverse effect on our sales or market position. If the breadth or strength of protection provided by the patent applications we hold with respect to our product candidates is threatened, it could dissuade companies from collaborating with us to develop, and threaten our ability to commercialize, our product candidates.

Further, if we encounter delays in our clinical trials, the period of time during which we could market our product candidates under patent protection would be reduced. Since patent applications in the United States and most other countries are confidential for a period of time after filing, we cannot be certain that we were the first to file any patent application related to our product candidates. Furthermore, for U.S. applications in which all claims are entitled to a priority date before March 16, 2013, an interference proceeding can be provoked by a third-party or instituted by the USPTO, to determine who was the first to invent any of the subject matter covered by the patent claims of our applications. Various post grant review proceedings, such as *inter partes* review and post grant review, are available for any interested third party to challenge the patentability of claims issued in patents to us. These procedures are relatively new and can be unpredictable. It is also possible for third parties to file observations with various patent offices during the patent application process. In our European patent application directed to our VaxWave technology, an unknown third party submitted such an observation. Despite that submission, the European Patent Office proceeded to grant our patent.

In addition to the protection afforded by patents, we seek to rely on trade secret protection, confidentiality agreements, and license agreements to protect proprietary know-how that is not patentable, processes for which patents are difficult to enforce and any other elements of our product discovery and development processes that involve proprietary know-how, information, or technology that is not covered by patents. Although we require all of our employees to assign their inventions to us, and require all of our employees, consultants, advisors and any third parties who have access to our proprietary know-how, information, or technology to enter into confidentiality agreements, we cannot be certain that our trade secrets and other confidential proprietary information will not be disclosed or that competitors will not otherwise gain access to our trade secrets or independently develop substantially equivalent information and techniques. Furthermore, the laws of some foreign countries do not protect proprietary rights to the same extent or in the same manner as the laws of the United States. As a result, we may encounter significant problems in protecting and defending our intellectual property both in the United States and abroad. If we are unable to prevent unauthorized material disclosure of our intellectual property to third parties, we will not be able to establish or maintain a competitive advantage in our market, which could materially adversely affect our business, operating results and financial condition.

Third-party claims of intellectual property infringement may prevent or delay our product discovery and development efforts.

Our commercial success depends in part on our avoiding infringement of the patents and proprietary rights of third parties. There is a substantial amount of litigation involving patents and other intellectual property rights in the biotechnology and pharmaceutical industries, as well as administrative proceedings for challenging patents, including interference, reexamination, and post grant review proceedings before the USPTO or oppositions and other comparable proceedings in foreign jurisdictions. Numerous U.S. and foreign issued patents and pending patent applications, which are owned by third parties, exist in the fields in which we are developing our product candidates. As the biotechnology and pharmaceutical industries expand and more patents are issued, the risk increases that our product candidates may give rise to claims of infringement of the patent rights of others.

Third parties may assert that we are employing their proprietary technology without authorization. Generally, conducting clinical trials and certain other development activities in the United States is not considered an act of infringement. If and when HB-101 or another product candidate is approved by the FDA, a third party may then seek to enforce its patent by filing a patent infringement lawsuit against us. While we are aware of certain third party patents and applications that relate to similar subject matter as our technologies, we do not believe that any patent claims that could otherwise materially adversely affect commercialization of our product candidates, if approved, are valid and enforceable. We may be incorrect in this belief, or we may not be able to prove it in a litigation. In this regard, patents issued in the United States by law enjoy a presumption of validity that can be rebutted only with evidence that is "clear and convincing," a heightened standard of proof. There may be third-party patents of which we are currently unaware which cover materials, formulations, methods of manufacture or methods for treatment related to the use or manufacture of our product candidates. Because patent applications can take many years to issue, there may be currently pending patent applications which may later result in issued patents that our product candidates may infringe. In addition, third parties may obtain patents in the future and claim that use of our technologies infringes upon these patents. Moreover, we may fail to identify relevant patents or incorrectly conclude that a patent is invalid, not enforceable, exhausted, or not infringed by our activities. If any third-party patents were held by a court of competent jurisdiction to cover the manufacturing process of our product candidates, constructs or molecules used in or formed during the manufacturing process, or any final product itself, the holders of any such patents may be able to block our ability to commercialize the product candidate unless we obtained a license under the applicable patents, or until such patents expire or they are determined to be held invalid or unenforceable. Similarly, if any third-party patent were held by a court of competent jurisdiction to cover aspects of our formulations, processes for manufacture or methods of use, including combination therapy or patient selection methods, the holders of any such patent may be able to block our ability to develop and commercialize the product candidate unless we obtained a license, which may not be available on commercially reasonable terms, if at all, or until such patent expires or is determined to be invalid or unenforceable. If we are unable to obtain a necessary license to a third-party patent on commercially reasonable terms, or at all, our ability to commercialize our product candidates may be impaired or delayed, which could in turn significantly harm our business.

Parties making claims against us may seek and obtain injunctive or other equitable relief, which could effectively block our ability to further develop and commercialize our product candidates. Defense of these claims, regardless of their merit, could involve substantial litigation expense and would be a substantial diversion of employee resources from our business. In the event of a successful claim of infringement against us, we may have to pay substantial damages, including treble damages and attorneys' fees for willful infringement, obtain one or more licenses from third parties, pay royalties or redesign our infringing products, which may be impossible or require substantial time and monetary expenditure. We cannot predict whether any such license would be available at all or whether it would be available on commercially reasonable terms. Furthermore, even in the absence of litigation, we may need or may choose to obtain licenses from third parties to advance our research or allow commercialization of our product candidates. We may fail to obtain any of these licenses at a reasonable cost or on reasonable terms, if at all. In that event, we would be unable to further develop and commercialize our product candidates, which could harm our business significantly.

We may not be successful in obtaining or maintaining necessary rights to product components and processes for our development pipeline through acquisitions and in-licenses.

Presently we have rights to certain intellectual property, through licenses from third parties and under patent applications that we own or will own, related to HB-101 and certain other product candidates. Because additional product candidates may require the use of proprietary rights held by third parties, such as the rights to use certain antigens, specific to future disease targets, the growth of our business will likely depend in part on our ability to acquire, in-license or use these proprietary rights. In addition, while we have patent rights directed to certain VaxWave and TheraT technologies we may not be able to obtain intellectual property to all uses of VaxWave and TheraT technologies. Our product candidates may also require specific formulations to work effectively and efficiently and these rights may be held by others. Similarly, efficient production or delivery of our product candidates may also require specific compositions or methods, and the rights to these may be owned by third parties. We may be unable to acquire or in-license any compositions, methods of use, processes or other third-party intellectual property rights from third parties that we identify. Even if we are able to obtain a license to use such intellectual property, it may be non-exclusive, which would not restrict the licensor party from giving our competitors access to the same technologies licensed to us. In that event, we may be required to expend significant time and resources to develop or license replacement technology. Moreover, the specific antigens that will be used with our product candidates may be covered by the intellectual property rights of others.

The licensing and acquisition of third-party intellectual property rights is a competitive area, and companies, which may be more established, or have greater resources than we do, may also be pursuing strategies to license or acquire third-party intellectual property rights that we may consider necessary or attractive in order to commercialize our product candidates. More established companies may have a competitive advantage over us due to their size, cash resources and greater clinical development and commercialization capabilities.

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

Competitors may infringe our patents or the patents of our licensors. To counter infringement or unauthorized use, we may be required to file infringement claims, which can be expensive and time-consuming. In addition, in an infringement proceeding, a court may decide that one or more of our patents is not valid or is unenforceable, or may refuse to stop the other party from using the technology at issue on the grounds that our patents do not cover the technology in question. An adverse result in any litigation or defense proceedings could put one or more of our patents at risk of being invalidated, held unenforceable, or interpreted narrowly and could put our patent applications at risk of not issuing. Defense of these claims, regardless of their merit, would involve substantial litigation expense and would be a substantial diversion of employee resources from our business. In the event of a successful claim of infringement against us, we may have to pay substantial damages, including treble damages and attorneys' fees for willful infringement, obtain one or more licenses from third parties, pay royalties or redesign our infringing products, which may be impossible or require substantial time and monetary expenditure.

Post-grant proceedings, including interference proceedings, provoked by third parties or brought by the USPTO may be necessary to determine the validity or priority of inventions with respect to our patents or those of our licensors. An unfavorable outcome could result in a loss of our current patent rights and could require us to cease using the related technology or to attempt to license rights to it from the prevailing party. Our business could be harmed if the prevailing party does not agree to a license on commercially reasonable terms or at all. Litigation or post-grant proceedings may result in a decision adverse to our interests and, even if we are successful, may result in substantial costs and distract our management and other employees. We may not be able to prevent, alone or with our licensors, misappropriation of our trade secrets or confidential information, particularly in countries where the laws may not protect those rights as fully as in the United States.

Furthermore, because of the substantial amount of discovery required in connection with intellectual property litigation, there is a risk that some of our confidential information could be compromised by disclosure during this type of litigation. In addition, there could be public announcements of the results of hearings, motions or other interim proceedings or developments. If securities analysts or investors perceive these results to be negative, it could have a substantial adverse effect on the price of our common stock.

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

Periodic maintenance fees on any issued patent are due to be paid to the USPTO and foreign patent agencies in several stages over the lifetime of the patent. The USPTO and various foreign governmental patent agencies require compliance with a number of procedural, documentary, fee payment and other similar provisions during the patent application process. While an inadvertent lapse can in many cases be cured by payment of a late fee or by other means in accordance with the applicable rules, there are situations in which noncompliance can result in abandonment or lapse of the patent or patent application, resulting in partial or complete loss of patent rights in the relevant jurisdiction. Noncompliance events that could result in abandonment or lapse of a patent or patent application include, but are not limited to, failure to respond to official actions within prescribed time limits, non-payment of fees and failure to properly legalize and submit formal documents. In such an event, our competitors might be able to enter the market, which would have a material adverse effect on our business.

Issued patents covering our product candidates could be found invalid or unenforceable if challenged in court or the USPTO.

If we or one of our licensing partners initiate legal proceedings against a third party to enforce a patent covering one of our product candidates, the defendant could counterclaim that such patent is invalid and/or unenforceable. In patent litigation in the United States, defendant counterclaims alleging invalidity and/or unenforceability are commonplace, and there are numerous grounds upon which a third party can assert invalidity or unenforceability of a patent. Third parties may also raise similar claims before administrative bodies in the United States or abroad, even outside the context of litigation. Such mechanisms include re-examination, *inter partes* review, post grant review, and equivalent proceedings in foreign jurisdictions (e.g., opposition proceedings). Such proceedings could result in revocation or amendment to our patents in such a way that they no longer cover our product candidates. 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, our patent counsel and the patent examiner were unaware during prosecution. If a defendant were to prevail on a legal assertion of invalidity and/or unenforceability, we would lose at least part, and perhaps all, of the patent protection on our product candidate. Such a loss of patent protection could have a material adverse impact on our business.

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

As is the case with other biopharmaceutical companies, our success is heavily dependent on intellectual property, particularly patents. Obtaining and enforcing patents in the biotechnology or pharmaceutical industry involve both technological and legal complexity, and is therefore costly, time-consuming and inherently uncertain. In addition, the United States continues to adapt to wide-ranging patent reform legislation that became effective starting in 2012. Moreover, recent U.S. Supreme Court rulings have narrowed the scope of patent protection available in certain circumstances and weakened the rights of patent owners in certain situations. In addition to increasing uncertainty with regard to our ability to obtain patents in the future, this combination of events has created uncertainty with respect to the value of patents, once obtained. Furthermore, the specific content of patents and patent applications that are necessary to support and interpret patent scope is highly uncertain due to the complex nature of the relevant legal, scientific, and factual issues. Changes in either patent laws or interpretations of patent laws in the United States and other countries may diminish the value of our intellectual property or narrow the scope of our patent protection. Depending on decisions by the U.S. Congress, the federal courts, and the USPTO, the laws and regulations governing patents could change in unpredictable ways that would weaken our ability to obtain new patents or to enforce our existing patents and patents that we might obtain in the future. Changes in the laws and regulations governing patents in other jurisdictions could similarly have an adverse effect on our ability to obtain and effectively enforce our patent rights.

We have less robust intellectual property rights in certain foreign jurisdictions and may not be able to protect our intellectual property rights throughout the world.

Certain of our key patent families have been filed in the United States, as well as in numerous jurisdictions outside the United States. However, our intellectual property rights in certain jurisdictions outside the United States may be less robust. Filing, prosecuting and defending patents on product candidates in all countries throughout the world would be prohibitively expensive. In addition, the laws of some foreign countries do not protect intellectual property rights to the same extent as federal and state laws in the United States. Consequently, we may not be able to prevent third parties from practicing our inventions in certain 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 may export otherwise infringing products to territories where we have patent protection. 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. Most of our patent portfolio is at the very early stage. We will need to decide whether and in which jurisdictions to pursue protection for the various inventions in our portfolio prior to applicable deadlines.

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, particularly those relating to biopharmaceutical products, which could make it difficult for us to stop the infringement of our patents or marketing of competing products in violation of our proprietary rights generally. Proceedings to enforce our patent rights in foreign jurisdictions could result in substantial costs and divert our efforts and attention from other aspects of our business, could put our patents at risk of being invalidated or interpreted narrowly and our patent applications at risk of not issuing and could provoke third parties to assert claims against us. We may not prevail in any lawsuits that we initiate and the damages or other remedies awarded, if any, may not be commercially meaningful. Accordingly, our efforts to enforce our intellectual property rights around the world may be inadequate to obtain a significant commercial advantage from the intellectual property that we develop or license.

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

We generally enter into confidentiality and intellectual property assignment agreements with our employees, consultants, and contractors. These agreements generally provide that inventions conceived by an employee, consultant, or contractor, as applicable, in the course of rendering services to us will be our exclusive property. However, those agreements may not be honored and may not effectively assign intellectual property rights to us. We may face claims by third parties that our agreements with employees, contractors or consultants obligating them to assign intellectual property to us are ineffective or in conflict with prior or competing contractual obligations of assignment, which could result in ownership disputes regarding intellectual property we have developed or will develop and interfere with our ability to capture the commercial value of such intellectual property. Moreover, there may be some circumstances, where we are unable to negotiate for such ownership rights. Disputes regarding ownership or inventorship of intellectual property can also arise in other contexts, such as collaborations and sponsored research. We may be subject to claims that former collaborators or other third parties have an ownership interest in our patents or other intellectual property. If we are subject to a dispute challenging our rights in or to patents or other intellectual property, such a dispute could be expensive and time-consuming. If we are unsuccessful, we could lose valuable rights in intellectual property that we regard as our own.

We may be subject to claims that our employees, consultants or contractors have wrongfully used or disclosed confidential information of third parties.

We have received confidential and proprietary information from third parties. In addition, we employ individuals who were previously employed at other biotechnology or pharmaceutical companies. We may be subject to claims that we or our employees, consultants or contractors have inadvertently or otherwise used or disclosed confidential information of these third parties or our employees' former employers or our consultants' or contractors' current or former clients or customers. Litigation may be necessary to defend against these claims. Even if we are successful in defending against these claims, litigation could result in substantial cost and be a distraction to our management and employees from their normal responsibilities. If we are not successful, in addition to paying monetary damages, we could lose access or exclusive access to valuable intellectual property and personnel.

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

The degree of future protection afforded by our intellectual property rights, whether owned or in-licensed, is uncertain because intellectual property rights have limitations, and may not adequately protect our business, provide a barrier to entry against our competitors or potential competitors, or permit us to maintain our competitive advantage. Moreover, if a third party has intellectual property rights that cover the practice of our technologies, we may not be able to fully exercise or extract value from our intellectual property rights. The following examples are illustrative:

- pending patent applications that we own or license may not lead to issued patents;
- patents, should they issue, that we own or license, may not provide us with any competitive advantages, or may be challenged and held invalid or unenforceable;
- others may be able to develop and/or practice technology that is similar to our technology or aspects of our technology but that is not covered by our owned or in-licensed patents, should any such patents issue;
- third parties may compete with us in jurisdictions where we do not pursue and obtain patent protection;
- we, or our licensors, might not have been the first to make the inventions covered by a pending patent application that we own or license;
- we, or our licensors, might not have been the first to file patent applications covering a particular invention;
- others may independently develop similar or alternative technologies without infringing our intellectual property rights;
- we may not be able to obtain and/or maintain necessary licenses on reasonable terms or at all;
- third parties may assert an ownership interest in our intellectual property and, if successful, such disputes may preclude us from exercising exclusive rights, or any rights at all, over that intellectual property;

- we may not be able to maintain the confidentiality of our trade secrets or other proprietary information;
- we may not develop or in-license additional proprietary technologies that are patentable; and
- the patents of others may have an adverse effect on our business.

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

Risks Related to Employee Matters, Managing Our Growth and Other Risks

We are highly dependent on our key personnel, and if we are not successful in attracting and retaining highly qualified personnel, we may not be able to successfully implement our business strategy.

We are highly dependent on members of our executive team. The loss of the services of any of them may adversely impact the achievement of our objectives. Although we have formal employment agreements with our executive officers, any of our executive officers could leave our employment at any time, or within a contractual termination period that is too short to find an adequate replacement. We currently do not have "key person" insurance on any of our employees. The loss of the services of one or more of our current employees might impede the achievement of our research, development and commercialization objectives.

Recruiting and retaining qualified employees, consultants and advisors for our business, including scientific and technical personnel, also will be critical to our success. We primarily conduct our operations at our facility in Vienna, Austria. This region is headquarters to many other biopharmaceutical companies and many academic and research institutions. Competition for skilled personnel is intense and the turnover rate can be high. We may not be able to attract and retain personnel on acceptable terms given the competition among numerous biotechnology and pharmaceutical companies and academic institutions for skilled individuals. In addition, failure to succeed in preclinical studies, clinical trials or applications for marketing approval may make it more challenging to recruit and retain qualified personnel.

To induce valuable employees to join and remain at our company, in addition to salary and cash incentives, we have provided, and intend to continue to provide, stock options that vest over time. The value of these equity grants that vest over time to our employees may be significantly affected by movements in the fair market value of our capital stock that are beyond our control, and may at any time be insufficient to counteract more lucrative offers from other companies.

Moreover, many of our employees have become or will soon become vested in a substantial amount of our common stock or a number of common stock options. Our employees may be more likely to leave us if the shares they own have significantly appreciated in value relative to the original purchase prices of the shares, or if the exercise prices of the options that they hold are significantly below the market price of our common stock, particularly after the expiration of the lock-up agreements described herein.

Accordingly, our future success depends on our ability to continue to attract and retain current and additional executive officers and other key employees. The inability to recruit, or the loss of services of certain executives, key employees, consultants or advisors, may impede the progress of our research, development and commercialization objectives and have a material adverse effect on our business, financial condition, results of operations and prospects.

We will need to grow the size of our organization, and we may experience difficulties in managing this growth.

As of September 30, 2018, we had 52 full-time employees. As our development and commercialization plans and 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, as well as additional facilities to expand our operations. 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, including the clinical and FDA review process for our product candidates, 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 commercialize our product candidates 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 its attention away from day-to-day activities in order to devote a substantial amount of time to managing these growth activities. Due to our limited financial resources and the limited experience of some members of our management team in managing a public company, we may not be able to effectively manage the expansion of our operations or recruit and train additional qualified personnel. The physical expansion of our operations may also lead to significant costs. If we are not able to effectively expand our organization by hiring new employees and expanding our groups of consultants and contractors, or we are not able to effectively build out new facilities to accommodate this expansion, we may not be able to successfully implement the tasks necessary to further develop and commercialize our product candidates and, accordingly, may not achieve our research, development and commercialization goals.

We currently rely, and for the foreseeable future will continue to rely, in substantial part on certain independent organizations, advisors and consultants to provide certain services, including substantially all aspects of regulatory approval, clinical trial management and manufacturing. Our independent organizations, advisors and consultants may be employed by employers other than us and may have commitments under consulting or advisory contracts with other entities. There can be no assurance that the services of independent organizations, advisors and consultants will continue to be available to us on a timely basis when needed, or that we can find qualified replacements. In addition, if we are unable to effectively manage our outsourced activities or if the quality or accuracy of the services provided by consultants is compromised for any reason, our clinical trials may be extended, delayed or terminated, and we may not be able to obtain regulatory approval of our product candidates or otherwise advance our business. There can be no assurance that we will be able to manage our existing consultants or find other competent outside contractors and consultants on economically reasonable terms, or at all.

If we enter into additional collaboration agreements and strategic partnerships or license our product candidates, 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, which could delay our timelines or otherwise adversely affect our business. We also 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 collaborations or strategic partnership agreements related to our product candidates could delay the development and commercialization of our product candidates in certain geographies for certain indications, which would harm our business prospects,

Our internal computer systems, or those used by our third-party CROs or other contractors or consultants, may fail or suffer security breaches, which could result in a material disruption of the development programs of our product candidates.

We and these third parties rely extensively on information technology systems to conduct and manage our business. Despite the implementation of security measures, our internal computer systems and those of our current and future CROs and other contractors and consultants are vulnerable to damage from computer viruses and unauthorized access. The risk of a security breach or disruption, particularly through cyber attacks or cyber intrusion, including by computer hackers, foreign governments, and cyber terrorists, has generally increased as the number, intensity and sophistication of attempted attacks and intrusions from around the world have increased. If such an event were to occur and cause interruptions in our operations, it could result in a material disruption of our development programs and our business operations, such as the loss of clinical trial data from completed or future clinical trials. Such loss could result in delays in our regulatory approval efforts and significantly increase our costs to recover or reproduce the data. Likewise, we rely on third parties for the manufacture of our product candidates and to conduct clinical trials, and similar events relating to their computer systems could also have a material adverse effect on our business. Any breach in our information technology systems could lead to the unauthorized access, disclosure and use of non-public information, including information from our patient registry or other patient information, which is protected by HIPAA, and other laws. Any such access, disclosure, or other loss of information could result in legal claims or proceedings, liability under laws that protect the privacy of personal information, damage to our reputation and the further development and commercialization of our product candidates could be delayed.

In addition, our ability to obtain clinical supplies of our product candidates could be disrupted if the operations of these suppliers are affected by a man-made or natural disaster or other business interruption. Damage or extended periods of interruption to our third-party collaborators', including Gilead's, corporate, development or research facilities due to fire, natural disaster, power loss, communications failure, unauthorized entry or other events could cause them to cease or delay development.

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

We are exposed to the risk of employee fraud or other illegal activity by our employees, independent contractors, consultants, commercial partners and vendors. Misconduct by these parties could include intentional, reckless and negligent conduct that fails to: comply with the regulations of the FDA and other comparable foreign regulatory bodies, provide true, complete and accurate information to the FDA and other comparable foreign regulatory bodies, comply with manufacturing standards we have established, comply with healthcare fraud and abuse laws in the United States and similar foreign fraudulent misconduct laws or report financial information or data accurately or to disclose unauthorized activities to us. If we obtain FDA approval of any of our product candidates and begin commercializing those products in the United States, our potential exposure under such laws and regulations will increase significantly, and our costs associated with compliance with such laws and regulations are also likely to increase. These laws may impact, among other things, our current activities with principal investigators and research patients, as well as proposed and 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 commission(s), certain customer incentive programs and other business arrangements generally.

Effective upon the completion of this offering, we will adopt a code of business conduct and ethics, but it is not always possible to identify and deter employee misconduct, and the precautions we take to detect and prevent inappropriate conduct 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.

Violations of or liabilities under environmental, health and safety laws and regulations could subject us to fines, penalties or other costs that could have a material adverse effect on the success of our business.

We are subject to numerous environmental, health and safety laws and regulations, including those governing laboratory procedures, the handling, use, storage, treatment and disposal of hazardous materials and wastes and the cleanup of contaminated sites. Our operations involve the use of potentially hazardous and flammable materials, including chemicals and biological materials. Our operations also produce hazardous waste products. We could incur substantial costs as a result of violations of or liabilities under environmental requirements in connection with our operations or property, including fines, penalties and other sanctions, investigation and cleanup costs and third-party claims. Although we generally contract with third parties for the disposal of hazardous materials and wastes from our operations, we cannot eliminate the risk of contamination or injury from these materials. In the event of contamination or injury resulting from our use of hazardous materials, we could be held liable for any resulting damages, and any liability could exceed our resources. Furthermore, environmental laws and regulations are complex, change frequently and have tended to become more stringent. We cannot predict the impact of changes to applicable laws and regulations and cannot be certain of our future compliance. In addition, we may incur substantial costs in order to comply with current or future environmental, health and safety laws and regulations. These current or future laws and regulations may impair our research, development or production efforts.

Although we maintain workers' compensation insurance to cover us for costs and expenses we may incur due to injuries to our employees resulting from the use of hazardous materials, this insurance may not provide adequate coverage against potential liabilities. We do not maintain insurance for environmental liability or toxic tort claims that may be asserted against us in connection with our storage or disposal of biological, hazardous or radioactive materials.

Risks Related to This Offering and Ownership of Our Common Stock

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

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

If you purchase our common stock in this offering, you will incur immediate and substantial dilution in the book value of your shares.

The initial public offering price will be 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 $ per share, based on the assumed initial public offering price of $ per share, which is the midpoint of the price range set forth on the cover page of this prospectus. Further, investors purchasing common stock in this offering will contribute approximately % of the total amount invested by stockholders since our inception, but will own only approximately % of the total number of shares of our common stock outstanding after 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 and the exercise of stock options granted to our employees. To the extent that outstanding stock options are exercised, there will be further dilution to new investors. As a result of the dilution to investors purchasing common stock 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 "Dilution."

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

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

- the commencement, enrollment or results of the clinical trials of our product candidates or any future clinical trials we may conduct, or changes in the development status of our product candidates;
- any delay in our regulatory filings for our product candidates and any adverse development or perceived adverse development with respect to the applicable regulatory authority's review of such filings, including without limitation the FDA's issuance of a "refusal to file" letter or a request for additional information;
- adverse results or delays in clinical trials;
- our decision to initiate a clinical trial, not to initiate a clinical trial or to terminate an existing clinical trial;
- adverse regulatory decisions, including failure to receive regulatory approval of our product candidates;
- changes in laws or regulations applicable to our products, including but not limited to clinical trial requirements for approvals;
- adverse developments concerning our manufacturers;
- our inability to obtain adequate product supply for any approved product or inability to do so at acceptable prices;
- our inability to establish collaborations if needed;
- our failure to commercialize our product candidates;
- additions or departures of key scientific or management personnel;
- unanticipated serious safety concerns related to the use of our product candidates;
- 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;
- our ability to effectively manage our growth;
- the size and growth of our initial cancer target markets;

- our ability to successfully treat additional types of cancers or at different stages;
- actual or anticipated variations in quarterly operating results;
- our cash position;
- our failure to meet the estimates and projections of the investment community or that we may otherwise provide to the public;
- publication of research reports about us or our industry, or immunotherapy in particular, or positive or negative recommendations or withdrawal of research coverage by securities analysts;
- changes in the market valuations of similar companies;
- overall performance of the equity markets;
- sales of our common stock by us or our stockholders in the future;
- trading volume of our common stock;
- changes in accounting practices;
- ineffectiveness of our internal controls;
- disputes or other developments relating to proprietary rights, including patents, litigation matters and our ability to obtain patent protection for our technologies;
- significant lawsuits, including patent or stockholder litigation;
- general political and economic conditions; and
- other events or factors, many of which are beyond our control.

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

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

Prior to this offering, our executive officers, directors, and 5% stockholders beneficially owned approximately % of our voting stock as of , and, assuming the sale by us of shares of common stock in this offering, based on an assumed initial public offering price of $ per share, which is the midpoint of the price range set forth on the cover page of this prospectus, that same group will hold approximately % of our outstanding voting stock (assuming no exercise of the underwriters' option to purchase additional shares). These stockholders may be able to determine all matters requiring stockholder approval. For example, these stockholders may be able to control elections of directors, amendments of our organizational documents, or approval of any merger, sale of assets, or other major corporate transaction. This may prevent or discourage unsolicited acquisition proposals or offers for our common stock that you may feel are in your best interest as one of our stockholders.

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, as amended, or the JOBS Act, enacted in April 2012. For as long as we continue to be an emerging growth company, we may take advantage of exemptions from various reporting requirements that are applicable to other public companies that are not emerging growth companies, including not being required to comply with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act of 2002, as amended, or the Sarbanes-Oxley Act, being permitted to present only two years of audited financial statements and a correspondingly reduced "Management's Discussion and Analysis of Financial Condition and Results of Operations" disclosure, as well as 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 (1) 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 million as of the prior June 30th, and (2) the date on which we have issued more than $1.0 billion in non-convertible debt during the prior three-year period.

Even after we no longer qualify as an emerging growth company, we may still qualify as a "smaller reporting company," which would allow us to take advantage of many of the same exemptions from disclosure requirements including not being required to comply with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act and reduced disclosure obligations regarding executive compensation in this prospectus and our periodic reports and proxy statements. We cannot predict if investors will find our common stock less attractive because we may rely on these exemptions. If some investors find our common stock less attractive as a result, there may be a less active trading market for our common stock and our stock price may be more volatile.

Under the JOBS Act, emerging growth companies can also delay adopting new or revised accounting standards until such time as those standards apply to private companies. We have irrevocably elected not to avail ourselves of this 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. As a result, changes in rules of U.S. generally accepted accounting principles or their interpretation, the adoption of new guidance or the application of existing guidance to changes in our business could significantly affect our financial position and results of operations.

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, or 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, 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 establishment and maintenance of effective disclosure and financial controls and changes in corporate governance practices.

Further, in July 2010, the Dodd-Frank Wall Street Reform and Consumer Protection Act, or the Dodd-Frank Act, was enacted. There are significant corporate governance and executive compensation related provisions in the Dodd-Frank Act that require the SEC to adopt additional rules and regulations in these areas such as "say on pay" and proxy access. Recent legislation permits emerging growth companies to implement many of these requirements over a longer period and up to five years from the pricing of this offering. We intend to take advantage of this new legislation but cannot guarantee that we will not be required to implement these requirements sooner than budgeted 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.

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

If our existing stockholders sell, or indicate an intention to sell, substantial amounts of our common stock in the public market after the lock-up and other legal restrictions on resale discussed in this prospectus lapse, the trading price of our common stock could decline. Based on the number of shares of common stock outstanding as of December 31, 2018 upon the closing of this offering, we will have outstanding a total of shares of common stock. Of these shares, only the shares of common stock sold in this offering by us, plus any shares sold upon exercise of the underwriters' option to purchase additional shares, will be freely tradable without restriction in the public market immediately following this offering, unless purchased by our affiliates. Merrill Lynch, Pierce, Fenner & Smith Incorporated and Leerink Partners LLC, however, may, in their sole discretion, permit our officers, directors, and other stockholders who are subject to these lock-up agreements to sell shares prior to the expiration of the lock-up agreements.

The lock-up agreements pertaining to this offering will expire 180 days from the date of this prospectus. In addition, shares of common stock that are either subject to outstanding options or reserved for future issuance under our 2019 Stock Option Incentive Plan will become eligible for sale in the public market to the extent permitted by the provisions of various vesting schedules, the lock-up agreements and Rule 144 and Rule 701 under the Securities Act of 1933, as amended, or the Securities Act. If these additional shares of common stock are sold, or if it is perceived that they will be sold, in the public market, the trading price of our common stock could decline.

After this offering, the holders of shares of our common stock, based on an assumed initial public offering price of $ per share, which is the midpoint of the price range set forth on the cover page of this prospectus, as of December 31, 2018 will be entitled to rights with respect to the registration of their shares under the Securities Act, subject to the 180-day lock-up agreements described above. See "Description of Capital Stock—Registration Rights." Registration of these shares under the Securities Act would result in the shares becoming freely tradable without restriction under the Securities Act, except for shares held by affiliates, as defined in Rule 144 under the Securities Act. Any sales of securities by these stockholders could have a material adverse effect on the trading price of our common stock.

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

Our management will have broad discretion in the application of the net proceeds from this offering, including for any of the purposes described in the section entitled "Use of Proceeds," and you will not have the opportunity as part of your investment decision to assess whether the net proceeds 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 or maintain the value of your investment. We expect to use the net proceeds from this offering, together with our existing cash and cash equivalents, to advance the development of our clinical and preclinical product candidates and to fund working capital, including general operating expenses. The failure by our management to apply these funds effectively could harm our business. Pending their use, we may invest the net proceeds from this offering in short-term, investment-grade, interest-bearing securities. These investments may not yield a favorable return to our stockholders. If we do not invest or apply the net proceeds from this offering in ways that enhance stockholder value, we may fail to achieve expected financial results, which could cause our stock price to decline.

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.

Our quarterly and annual operating results may fluctuate significantly in the future, which makes it difficult for us to predict our future operating results. From time to time, we may enter into license or collaboration agreements with other companies that include development funding and significant upfront and milestone payments and/or royalties, which may become an important source of our revenue. Accordingly, our revenue may depend on development funding and the achievement of development and clinical milestones under current and any potential future license and collaboration agreements and, if approved, sales of our product candidates. These upfront and milestone payments may vary significantly from period to period and any variance could cause a significant fluctuation in our operating results from one period to the next.

Further, our operating results may fluctuate due to a variety of other factors, many of which are outside of our control and may be difficult to predict, including the following:

- the timing and cost of, and level of investment in, research and development activities relating to our current and any future product candidates, which will change from time to time;
- the timing and outcomes of clinical trials for our current and any other future product candidates;
- the cost of manufacturing our current and any future product candidates, which may vary depending on FDA guidelines and requirements, the quantity of production and the terms of our agreements with manufacturers;
- our ability to adequately support our future growth;
- potential unforeseen business disruptions that increase our costs or expenses;
- future accounting pronouncements or changes in our accounting policies; and
- the changing and volatile global economic environment.

The cumulative effect 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, or if the forecasts we provide to the market are below the expectations of analysts or investors, the price of our common stock could decline substantially. The price of our common stock could decline even when we have met any previously publicly stated revenue and/or earnings guidance we may provide.

We do not intend to pay dividends on our common stock so any returns will be limited to the value of our 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 return to stockholders will therefore be limited to the appreciation of their stock, which may never occur.

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

Our amended and restated certificate of incorporation and amended and restated bylaws, which are to become effective upon the closing of this offering and upon the effectiveness of the registration statement of which this prospectus is a part, respectively, will contain provisions that could delay or prevent a change of control of our company or changes in our board of directors that our stockholders might consider favorable. Some of these provisions include:

- a board of directors divided into three classes serving staggered three-year terms, such that not all members of the board will be elected at one time;
- a prohibition on stockholder action through written consent, which requires that all stockholder actions be taken at a meeting of our stockholders;

- a requirement that special meetings of stockholders be called only by the chairman of the board of directors, the chief executive officer, or by a majority of the total number of authorized directors;
- advance notice requirements for stockholder proposals and nominations for election to our board of directors;
- a requirement that no member of our board of directors may be removed from office by our stockholders except for cause and, in addition to any other vote required by law, upon the approval of not less than two-thirds of all outstanding shares of our voting stock then entitled to vote in the election of directors;
- a requirement of approval of not less than two-thirds of all outstanding shares of our voting stock to amend any bylaws by stockholder action or to amend specific provisions of our certificate of incorporation; and
- the authority of the board of directors to issue preferred stock on terms determined by the board of directors without stockholder approval and which preferred stock may include rights superior to the rights of the holders of common stock.

In addition, because we are incorporated in Delaware, we are governed by the provisions of Section 203 of the Delaware General Corporate Law, which may prohibit certain business combinations with stockholders owning 15% or more of our outstanding voting stock. These anti-takeover provisions and other provisions in our amended and restated certificate of incorporation and amended and restated bylaws could make it more difficult for stockholders or potential acquirors to obtain control of our board of directors or initiate actions that are opposed by the then-current board of directors and could also delay or impede a merger, tender offer or proxy contest involving our company. These provisions could also discourage proxy contests and make it more difficult for you and other stockholders to elect directors of your choosing or cause us to take other corporate actions you desire. Any delay or prevention of a change of control transaction or changes in our board of directors could cause the market price of our common stock to decline.

Our amended and restated bylaws will designate the Court of Chancery of the State of Delaware or the U.S. District Court for the Southern District of New York as the exclusive forum for certain litigation that may be initiated by our stockholders, which could limit our stockholders' ability to obtain a favorable judicial forum for disputes with us.

Our amended and restated bylaws, to be in effect upon the completion of this offering, provide that, unless we consent in writing to an alternative forum, 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 our behalf, (ii) any action asserting a claim of breach of a fiduciary duty owed by any of our current or former directors, officers and employees to us or our stockholders, (iii) any action asserting a claim against us or any of our current or former directors, officers, or other employees or stockholders arising pursuant to any provision of the Delaware General Corporation Law, our certificate of incorporation or our bylaws, (iv) any action to interpret, apply, enforce or determine the validity of our certificate of incorporation or our bylaws, or (v) any action asserting a claim against us or any of our current or former directors or officers or other employees that is governed by the internal affairs doctrine, in each case subject to the Court of Chancery having personal jurisdiction over the indispensable parties named as defendants therein. Our amended and restated bylaws will further provide that the U.S. District Court for the Southern District Court of New York will be the exclusive forum for resolving any complaint asserting a cause of action arising under the Securities Act. In addition, any person purchasing or otherwise acquiring any interest in any shares of our common stock shall be deemed to have notice of and to have consented to this provision of our bylaws; provided, however, that stockholders will not be deemed to have waived our compliance with the federal securities laws and the rules and regulations thereunder. These choice of forum provisions may limit a stockholder's ability to bring a claim in a judicial forum that it finds favorable for disputes with us or our directors, officers or employees, which may discourage such lawsuits against us and our directors, officers and employees even though an action, if successful, might benefit our stockholders. Stockholders who do bring a claim in the Court of Chancery or the U.S. District Court for the Southern District Court of New York could face additional litigation costs in pursuing any such claim, particularly if they do not reside in or near the jurisdiction. The Court of Chancery or the U.S. District Court for the Southern District Court of New York may also reach different judgments or results than would other courts, including courts where a stockholder considering an action may be located or would otherwise choose to bring the action, and such judgments or results may be more favorable to us than to our stockholders. Alternatively, if a court were to find this provision of our amended and restated certificate of incorporation or amended and restated bylaws inapplicable to, or unenforceable in respect of, one or more of the specified types of actions or proceedings, we may incur additional costs, which could have a material adverse effect on our business, financial condition or results of operation.

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

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

These inherent limitations include the realities that judgments in decision-making can be faulty, and that breakdowns can occur because of simple error or mistake. Additionally, controls can be circumvented by the individual acts of some persons, by collusion of two or more people or by an unauthorized override of the controls. Accordingly, because of the inherent limitations in our control system, misstatements due to error or fraud may occur and not be detected.

We have identified material weaknesses in our internal control over financial reporting. If our remediation of these material weaknesses is not effective, or if we experience additional material weaknesses in the future or otherwise fail to maintain an effective system of internal controls in the future, we may not be able to accurately report our financial condition or results of operations, which may adversely affect investor confidence in us and, as a result, the value of our common stock.

Prior to this offering, we have been a private company with limited accounting personnel and other resources with which to address our internal control over financial reporting. In connection with our preparation and the audit of our financial statements as of and for the year ended December 31, 2017, we and our independent registered public accounting firm identified two material weaknesses as defined under the Exchange Act and by the Public Company Accounting Oversight Board (United States) in our internal control over financial reporting. A material weakness is a deficiency, or a combination of deficiencies, in internal control over financial reporting, such that there is a reasonable possibility that a material misstatement of the company's annual financial statements will not be prevented or detected on a timely basis. We did not maintain a sufficient complement of resources with an appropriate level of accounting knowledge, experience, and training, which would allow for appropriate monitoring, presentation and disclosure, and internal control over financial reporting. Specifically, we have not designed and implemented a sufficient level of formal accounting policies and procedures. Additionally, the limited personnel resulted in our inability to consistently establish appropriate authorities and responsibilities in pursuit of our financial reporting objectives, as demonstrated by, amongst other things, our insufficient segregation of duties in their finance and accounting functions.

Neither our management nor an independent registered public accounting firm has performed an evaluation of our internal control over financial reporting in accordance with the provision of the Sarbanes-Oxley Act because no such evaluation has been required. Had we or our independent registered public accounting firm performed an evaluation of our internal control over financial reporting in accordance with the provisions of the Sarbanes-Oxley Act, additional material weaknesses may have been identified.

Once public, we will be subject to reporting obligations under U.S. securities laws and the Sarbanes-Oxley Act. Section 404 of the Sarbanes-Oxley Act will require that we include a report from management on the effectiveness of our internal control over financial reporting in our annual report on Form 10-K beginning with our annual report for the fiscal year ending December 31, 2020. If we fail to remediate the material weaknesses identified above, our management may conclude that our internal control over financial reporting is not effective. This conclusion could adversely impact the market price of our shares due to a loss of investor confidence in the reliability of our reporting processes.

We have begun taking measures and plan to continue to take measures to remediate these material weaknesses. However, the implementation of these measures may not fully address these material weaknesses in our internal control over financial reporting, and therefore we would not be able to conclude that it has been fully remedied. Our failure to correct these material weaknesses or our failure to discover and address any other control deficiencies could result in inaccuracies in our financial statements and could also impair our ability to comply with applicable financial reporting requirements and make related regulatory filings on a timely basis. As a result, our business, financial condition, results of operations and prospects, as well as the trading price and listing of our shares, may be materially and adversely affected. We cannot assure you that all of our existing material weaknesses have been identified, or that we will not in the future identify additional material weaknesses.

If we fail to establish and maintain proper and effective internal control over financial reporting, our operating results and our ability to operate our business could be harmed.

Ensuring that we have adequate internal financial and accounting controls and procedures in place so that we can produce accurate financial statements on a timely basis is a costly and time-consuming effort that needs to be re-evaluated frequently. Our internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements in accordance with generally accepted accounting principles. In connection with this offering, we intend to begin the process of documenting, reviewing and improving our internal controls and procedures for compliance with Section 404 of the Sarbanes-Oxley Act, which will require annual management assessment of the effectiveness of our internal control over financial reporting. We have begun recruiting additional finance and accounting personnel with certain skill sets that we will need as a public company. Our independent registered public accounting firm will not be required to formally attest to the effectiveness of our internal control over financial reporting until the later of our second annual report or the first annual report required to be filed with the SEC following the date we are no longer an emerging growth company, depending on whether we choose to rely on certain exemptions set forth in the JOBS Act.

Implementing any appropriate changes to our internal controls, including compliance with the requirements of Section 404 of the Sarbanes-Oxley Act, may distract our officers and employees, entail substantial costs to modify our existing processes and take significant time to complete. These changes may not, however, be effective in maintaining the adequacy of our internal controls, and any failure to maintain that adequacy, or consequent inability to produce accurate financial statements on a timely basis, could increase our operating costs and harm our business. In addition, investors' perceptions that our internal controls are inadequate or that we are unable to produce accurate financial statements on a timely basis may harm our stock price, make it more difficult for us to effectively market and sell our service to new and existing customers and subject us to sanctions or investigations by The Nasdaq Stock Market LLC, the SEC or other regulatory authorities. In addition, our common stock may not be able to remain listed on The Nasdaq Global Market or any other securities exchange.

SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS

This prospectus, including the sections entitled "Prospectus Summary," "Risk Factors," "Management's Discussion and Analysis of Financial Condition and Results of Operations," and "Business," contains express or implied forward-looking statements that are based on our management's belief and assumptions and on information currently available to our management. Although we believe that the expectations reflected in these forward-looking statements are reasonable, these statements relate to future events or our future operational or financial performance, and involve known and unknown risks, uncertainties and other factors that may cause our actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by these forward-looking statements. Forward-looking statements in this prospectus include, but are not limited to, statements about:

- the success, cost and timing of our product development activities and clinical trials;
- the timing, scope or likelihood of regulatory filings and approvals, including timing of Investigational New Drug Application and Biological Licensing Application filings for our current and future product candidates, and final U.S. Food and Drug Administration, European Medicines Agency or other foreign regulatory authority approval of our current and future product candidates;
- our ability to develop and advance our current product candidates and programs into, and successfully complete, clinical studies;
- our manufacturing, commercialization and marketing capabilities and strategy;
- the potential benefits of and our ability to maintain our collaboration with Gilead Sciences, Inc., and establish or maintain future collaborations or strategic relationships or obtain additional funding;
- the rate and degree of market acceptance and clinical utility of our current and future product candidates;
- our intellectual property position, including the scope of protection we are able to establish and maintain for intellectual property rights covering our VaxWave and TheraT technologies and the product candidates based on these technologies, the validity of intellectual property rights held by third parties, and our ability not to infringe, misappropriate or otherwise violate any third-party intellectual property rights;
- future agreements with third parties in connection with the commercialization of our product candidates and any other approved product;
- regulatory developments in the United States and foreign countries;
- competitive companies, technologies and our industry and the success of competing therapies that are or may become available;
- our ability to attract and retain key scientific or management personnel;
- our ability to obtain funding for our operations, including funding necessary to complete further development and commercialization of our product candidates;
- the accuracy of our estimates of our annual total addressable market, future revenue, expenses, capital requirements and needs for additional financing;
- our expectations about market trends;
- our expectations regarding the period during which we qualify as an emerging growth company under the Jumpstart Our Business Startups Act of 2012, as amended; and

- our expectations regarding use of the proceeds from this offering.

In some cases, forward-looking statements can be identified by terminology, such as "may," "will," "should," "expects," "intends," "project," "target," "plans," "anticipates," "believes," "estimates," "predicts," "potential," "continue," or the negative of these terms or other comparable terminology. These statements are only predictions and are based largely on our current expectations and projections about future events and financial trends that we believe may affect our business, financial condition and results of operations. You should not place undue reliance on forward-looking statements because they involve known and unknown risks, uncertainties, and other factors, which are, in some cases, beyond our control and which could materially affect results. Factors that may cause actual results to differ materially from current expectations include, among other things, those listed under "Risk Factors" and elsewhere in this prospectus. If one or more of these risks or uncertainties occur, or if our underlying assumptions prove to be incorrect, actual events or results may vary significantly from those implied or projected by the forward-looking statements. No forward-looking statement is a guarantee of future performance. You should read this prospectus and the documents that we reference in this prospectus and have filed with the Securities and Exchange Commission as exhibits to the registration statement, of which this prospectus is a part, completely and with the understanding that our actual future results may be materially different from any future results expressed or implied by these forward-looking statements.

The forward-looking statements in this prospectus represent our views as of the date of this prospectus. We anticipate that subsequent events and developments will cause our views to change. However, while we may elect to update these forward-looking statements at some point in the future, we have no current intention of doing so except to the extent required by applicable law. You should therefore not rely on these forward-looking statements as representing our views as of any date subsequent to the date of this prospectus.

INDUSTRY AND MARKET DATA

We obtained the industry, statistical and market data in this prospectus from our own internal estimates and research as well as from industry and general publications and research, surveys and studies conducted by third parties. Industry publications, studies and surveys generally state that they have been obtained from sources believed to be reliable, although they do not guarantee the accuracy or completeness of such information. All of the market data used in this prospectus involves a number of assumptions and limitations, and you are cautioned not to give undue weight to such data. While we believe our internal company research as to such matters is reliable and the market definitions are appropriate, neither such research nor these definitions have been verified by any independent source. The industry in which we operate is subject to a high degree of uncertainty and risk due to a variety of important factors, including those described in the section titled "Risk Factors." These and other factors could cause results to differ materially from those expressed in the estimates made by third parties and by us.

USE OF PROCEEDS

We estimate that our net proceeds from the sale of shares of our common stock in this offering will be approximately $, or $ if the underwriters exercise in full their option to purchase additional shares, assuming an initial public offering price of $ per share, which is the midpoint of the price range set forth on the cover page of this prospectus, and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us.

A $1.00 increase (decrease) in the assumed initial public offering price of $ per share would increase (decrease) the net proceeds to us from this offering by $, 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. We may also increase or decrease the number of shares we are offering. Each increase (decrease) of 1,000,000 shares in the number of shares offered by us, as set forth on the cover page of this prospectus, would increase (decrease) the net proceeds to us from this offering by $, assuming no change in the assumed initial public offering price per share and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us.

We currently estimate that we will use the net proceeds from this offering, together with our existing cash and cash equivalents, as follows:

- approximately $ million to advance HB-101 through completion of our ongoing Phase 2 clinical trial;
- approximately $ million to advance HB-201 and HB-202 into and through completion of Phase 1 clinical trials;
- approximately $ million to advance HB-301 into and through completion of a Phase 1 clinical trial;
- approximately $ million for ongoing research and development activities related to next generation programs; and
- the remainder for working capital and other general corporate purposes.

Based on our current plans, we believe that the net proceeds from this offering, together with our existing cash and cash equivalents, will be sufficient to fund our operations for at least the next months. We have based this estimate on assumptions that may prove to be incorrect, and we could use our available capital resources sooner than we currently expect.

This expected use of the net proceeds from this offering represents our intentions based upon our current plans and business conditions. As of the date of this prospectus, we cannot predict with certainty all of the particular uses for the net proceeds to be received upon the closing of this offering or the amounts that we will actually spend on the uses set forth above. The amounts and timing of our actual expenditures and the extent of clinical development may vary significantly depending on numerous factors, including the progress of our development, the status of and results from preclinical studies or clinical trials we may commence in the future, as well as any collaborations that we may enter into with third parties for our product candidates, and any unforeseen cash needs. We may also use a portion of the net proceeds to in-license, acquire, or invest in additional businesses, technologies, products or assets, although currently we have no specific agreements, commitments or understandings in this regard. As a result, our management will retain broad discretion over the allocation of the net proceeds from this offering.

Pending our use of proceeds from this offering, we intend to invest the net proceeds in a variety of capital preservation instruments, including short-term, investment-grade, interest-bearing instruments and U.S. government securities.

DIVIDEND POLICY

We have never declared or paid cash dividends on our capital stock. We intend to retain all available funds and any future earnings to fund the growth and development of our business. We do not intend to pay cash dividends to our stockholders in the foreseeable future. In addition, any future financing instruments could preclude us from paying dividends. Any future determination to pay dividends will be made at the discretion of our board of directors subject to applicable laws, and will depend upon, among other factors, our results of operations, financial condition, contractual restrictions and capital requirements. Investors should not purchase our common stock with the expectation of receiving cash dividends.

CAPITALIZATION

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

- on an actual basis;
- on a pro forma basis to give effect to the automatic conversion of all outstanding shares of our preferred stock into an aggregate of shares of common stock upon the closing of this offering and the filing and effectiveness of our amended and restated certificate of incorporation, which will occur upon the closing of this offering; and
- on a pro forma as adjusted basis to give further effect to our issuance and sale of shares of our common stock in this offering at an assumed initial public offering price of $ per share, which is the midpoint of the price range set forth on the cover page of this prospectus, after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us.

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

	As of December 31, 2018		
	Actual	Pro Forma	Pro Forma As Adjusted(1)
	(in thousands, except share and per share data)		
Cash and cash equivalents	$	$	$
Loans payable, net of discount, including current portion	$	$	$
Redeemable convertible preferred stock (Series A, B and C), par value $0.0001 per share; 1,323,506 shares authorized, issued and outstanding, actual; no shares authorized, issued or outstanding, pro forma and pro forma as adjusted			
Stockholders' equity (deficit):			
Preferred stock, $0.0001 par value per share; no shares authorized, issued or outstanding, actual; shares authorized, no shares issued or outstanding, pro forma and pro forma as adjusted	—	—	—
Common stock, par value $0.0001 per share; shares authorized, shares issued and outstanding, actual; shares authorized, shares issued and outstanding, pro forma; shares authorized, shares issued and outstanding, pro forma as adjusted			
Additional paid-in capital			
Accumulated other comprehensive (loss) income			
Accumulated deficit			
Total stockholders' equity (deficit)			
Total capitalization	$	$	$

(1) A $1.00 increase (decrease) in the assumed initial public offering price of $ per share, which is the midpoint of the price range set forth on the cover page of this prospectus, would increase (decrease) the pro forma as adjusted amount of each of cash and cash equivalents, additional paid-in capital, total stockholders' equity (deficit), and total capitalization by $, 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. We may also increase or decrease the number of shares we are offering. An increase (decrease) of 1,000,000 shares in the number of shares offered by us, as set forth on the cover page of this prospectus, would increase (decrease) the pro forma as adjusted amount of each of cash and cash equivalents, additional paid-in capital, total stockholders' equity (deficit), and total capitalization by $, assuming no change in the assumed initial public offering price per share and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us.

The table above does not include:

- shares of our common stock issuable upon the exercise of stock options under our 2018 Stock Option and Grant Plan, or the 2018 Plan, outstanding as of December 31, 2018, at a weighted average exercise price of $ per share;
- shares of our common stock available for future issuance under our 2018 Plan as of December 31, 2018;

- shares of our common stock that will become available for future issuance under our 2019 Stock Option and Incentive Plan, which will become effective in connection with the closing of this offering; and
- shares of our common stock that will become available for future issuance under our 2019 Employee Stock Purchase Plan, which will become effective in connection with the closing of this offering.

DILUTION

If you invest in our common stock in this offering, your ownership interest will be diluted immediately to the extent of the difference between the initial 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 immediately after this offering.

Our historical net tangible book value (deficit) as of December 31, 2018 was $, or $ per share of common stock. Our historical net tangible book value (deficit) is the amount of our total tangible assets less our total liabilities and the carrying value of our preferred stock, which is not included within stockholders' equity (deficit). Historical net tangible book value (deficit) per share represents historical net tangible book value (deficit) divided by shares of common stock outstanding as of December 31, 2018.

Our pro forma net tangible book value as of December 31, 2018 was $, or $ per share of common stock. Pro forma net tangible book value represents the amount of our total tangible assets less our total liabilities, after giving effect to the automatic conversion of all outstanding shares of our preferred stock into an aggregate of shares of common stock upon the closing of this offering. Pro forma net tangible book value per share represents pro forma net tangible book value divided by the total number of shares outstanding as of December 31, 2018, after giving effect to the pro forma adjustment described above.

After giving further effect to our issuance and sale of shares of our common stock in this offering at an assumed initial public offering price of $ per share, which is the midpoint of the price range set forth on the cover page of this prospectus, and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us, our pro forma as adjusted net tangible book value as of December 31, 2018 would have been $, or $ per share of common stock. This represents an immediate increase in pro forma as adjusted net tangible book value per share of $ to existing stockholders and immediate dilution of $ in pro forma as adjusted net tangible book value per share to new investors purchasing common stock in this offering. Dilution per share to new investors is determined by subtracting pro forma as adjusted net tangible book value per share after this offering from the assumed initial public offering price per share paid by new investors. The following table illustrates this dilution on a per share basis:

Assumed initial public offering price per share		$
Historical net tangible book value (deficit) per share as of December 31, 2018	$	
Increase (decrease) per share attributable to the pro forma adjustment described above		
Pro forma net tangible book value (deficit) per share as of December 31, 2018		
Increase in pro forma as adjusted net tangible book value per share attributable to new investors purchasing common stock in this offering		
Pro forma as adjusted net tangible book value per share after this offering		
Dilution per share to new investors purchasing common stock in this offering		$

The dilution information discussed above is illustrative only and will change based on the actual initial public offering price and other terms of this offering determined at pricing. A $1.00 increase (decrease) in the assumed initial public offering price of $ per share, which is the midpoint of the price range set forth on the cover page of this prospectus, would increase (decrease) our pro forma as adjusted net tangible book value per share after this offering by $ and dilution per share to new investors purchasing common stock in this offering by $, 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. We may also increase or decrease the number of shares we are offering. An increase of 1,000,000 shares in the number of shares offered by us, as set forth on the cover page of this prospectus, would increase our pro forma as adjusted net tangible book value per share after this offering by $ and decrease the dilution per share to new investors purchasing common stock in this offering by $, assuming no change in the assumed initial public offering price per share and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us. A decrease of 1,000,000 shares in the number of shares offered by us, as set forth on the cover page of this prospectus, would decrease our pro forma as adjusted net tangible book value per share after this offering by $ and increase the dilution per share to new investors purchasing common stock in this offering by $, assuming no change in the assumed initial public offering price and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us.

If the underwriters exercise their option to purchase additional shares in full, our pro forma as adjusted net tangible book value per share after this offering would be $, representing an immediate increase in pro forma as adjusted net tangible book value per share of $ to existing stockholders and immediate dilution in pro forma as adjusted net tangible book value per share of $ to new investors purchasing common stock in this offering, assuming an initial public offering price of $ per share, which is the midpoint of the price range set forth on the cover page of this prospectus, and after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us.

The following table summarizes, as of December 31, 2018, on the pro forma as adjusted basis described above, the total number of shares of common stock purchased from us on an as converted to common stock basis, the total consideration paid or to be paid, and the average price per share paid or to be paid by existing stockholders and by new investors in this offering, based on an assumed initial public offering price of $ per share, which is the midpoint of the price range set forth on the cover page of this prospectus, before deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us. As the table shows, new investors purchasing common stock in this offering will pay an average price per share substantially higher than our existing stockholders paid.

	Shares Purchased		Total Consideration		Average Price Per Share
	Number	Percent	Amount	Percentage	
Existing stockholders		%	$	%	$
New investors					$
Total		100.0%	$	100.0%	

The table above assumes no exercise of the underwriters' option to purchase additional shares in this offering. If the underwriters' option to purchase additional shares is exercised in full, the number of shares of our common stock held by existing stockholders would be reduced to % of the total number of shares of our common stock outstanding after this offering, and the number of shares of common stock held by new investors purchasing common stock in this offering would be increased to % of the total number of shares of our common stock outstanding after this offering.

The number of shares purchased from us by existing stockholders is based on shares of our common stock outstanding as of December 31, 2018, after giving effect to the automatic conversion of all outstanding shares of our preferred stock into an aggregate of shares of common stock upon the closing of this offering, and excludes:

- shares of our common stock issuable upon the exercise of stock options outstanding under our 2018 Stock Option and Grant Plan, or the 2018 Plan, as of December 31, 2018, at a weighted average exercise price of $ per share;
- shares of our common stock available for future issuance under our 2018 Plan as of December 31, 2018;
- shares of our common stock that will become available for future issuance under our 2019 Stock Option and Incentive Plan, which will become effective in connection with the closing of this offering; and
- shares of our common stock that will become available for future issuance under our 2019 Employee Stock Purchase Plan, which will become effective in connection with the closing of this offering.

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

SELECTED CONSOLIDATED FINANCIAL DATA

We have derived the consolidated statement of operations data for the year ended December 31, 2017 and the consolidated balance sheet data as of December 31, 2017 from our audited consolidated financial statements appearing at the end of this prospectus. The consolidated statement of operations data for the nine months ended September 30, 2018 and the consolidated balance sheet data as of September 30, 2018 have been derived from our unaudited consolidated financial statements appearing at the end of this prospectus and have been prepared on the same basis as the audited consolidated financial statements. In the opinion of management, the unaudited data reflects all adjustments, consisting only of normal recurring adjustments, necessary for a fair statement of the financial information in this statements. Our historical results are not necessarily indicative of the results that may be expected in the future, and our results for any interim period are not necessarily indicative of results that may be expected for any full year. You should read the following selected consolidated financial data together with our consolidated financial statements and the related notes appearing elsewhere in this prospectus and the "Management's Discussion and Analysis of Financial Condition and Results of Operations" section of this prospectus.

(in thousands, except share and per share data)	Year ended December 31, 2017	Nine months ended September 30, 2018 (unaudited)
Consolidated Statements of Operations Data:		
Revenue from collaboration and licensing	$ —	$ 2,549
Operating expenses:		
Research and development	(9,772)	(17,350)
General and administrative	(4,385)	(4,175)
Total operating expenses	(14,157)	(21,525)
Loss from operations	(14,157)	(18,976)
Other income (expense):		
Grant income	2,069	5,217
Interest income and expense, net	(606)	(578)
Other income and expenses, net	(25)	19
Total other income (expense), net	1,438	4,658
Net loss before tax	(12,719)	(14,318)
Income tax expense	(4)	(27)
Net loss	(12,723)	(14,345)
Net loss attributable to common shareholders	$ (12,723)	$ (14,345)
Net loss per share attributable to common stockholders—basic and diluted(1)	$ (162.47)	$ (183.18)
Weighted average common shares outstanding—basic and diluted(1)	78,311	78,311
Pro forma net loss per share attributable to common shareholders—basic and diluted (unaudited)(1)		$ (10.23)
Pro forma weighted average common shares outstanding—basic and diluted (unaudited)(1)		1,401,817

(1) See Note 13 to our consolidated financial statements appearing at the end of this prospectus for further details on the calculation of basic and diluted net loss per share attributable to common shareholders and on the calculation of basic and diluted net loss per share attributable to common shareholders.

	As of December 31, 2017	As of September 30, 2018
	(in thousands)	
Consolidated Balance Sheet Data:		
Cash and cash equivalents	$ 61,362	$ 55,792
Working capital(1)	65,923	50,258
Total assets	73,732	66,543
Redeemable convertible preferred stock	104,774	104,774
Accumulated deficit	43,745	58,090
Total stockholders' equity (deficit)	(42,656)	(58,106)

(1) We define working capital as current assets less current liabilities.

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 the section titled "Selected Consolidated Financial Data" and our audited consolidated financial statements and unaudited interim consolidated financial statements and related notes included elsewhere in this prospectus. This discussion and other parts of this prospectus contain forward-looking statements that involve risks and uncertainties, such as our plans, objectives, expectations, intentions and beliefs. Our actual results could differ materially from those discussed in these forward-looking statements. Factors that could cause or contribute to such differences include, but are not limited to, those identified below and those discussed in the section titled "Risk Factors" included elsewhere in this prospectus. For convenience of presentation, some of the numbers have been rounded in the text below.

Overview

We are a clinical-stage biopharmaceutical company developing a new class of immunotherapeutics targeting infectious diseases and cancers based on our proprietary arenavirus platform that is designed to reprogram the body's immune system. We are using our "off-the-shelf" technologies, VaxWave and TheraT, to elicit directly within patients a powerful and durable response of antigen-specific killer T cells and antibodies, thereby activating essential immune defenses against infectious diseases and cancers. We believe that our technologies can meaningfully leverage this immune defense mechanism for prophylactic and therapeutic purposes by eliciting killer T cell response levels previously not achieved by other published immunotherapy approaches.

Our lead infectious disease product candidate, HB-101, is in a Phase 2 clinical trial in cytomegalovirus-negative patients awaiting kidney transplantation from living cytomegalovirus-positive donors. Our lead oncology product candidates, HB-201 and HB-202, are in development for the treatment of human papillomavirus-positive cancers. We plan to file an investigational new drug application, or IND, with the U.S. Food and Drug Administration, or the FDA, for HB-201 and HB-202 in the first half and second half of 2019, respectively. We have also entered into a strategic partnership with Gilead Sciences, Inc., or Gilead, to accelerate building a pipeline of additional infectious disease product candidates in a cost efficient manner.

We have funded our operations to date primarily from private placements of our redeemable convertible preferred stock, with aggregate gross proceeds of approximately $105.0 million, grant funding and loans from an Austrian government agency, and a $10.0 million upfront payment from Gilead in June 2018 in connection with a research collaboration and license agreement. We do not expect to generate revenue from any product candidates that we develop until we obtain regulatory approval for one or more of such product candidates, if at all, and commercialize our products or enter into collaboration agreements with third parties. Substantially all of our net losses have resulted from costs incurred in connection with our research and development programs and from general and administrative costs associated with our operations.

All of our product candidates, including our most advanced product candidate, HB-101, will require substantial additional development time and resources before we would be able to apply for or receive regulatory approvals and begin generating revenue from product sales. Before launching our first products, if approved, we plan to establish our own manufacturing facility to minimize or eliminate our reliance on contract manufacturing organizations, or CMOs, which will require substantial capital expenditures and cause additional operating expenses. We currently have no marketing and sales organization and have no experience in marketing products; accordingly, we will incur significant expenses to develop a marketing organization and sales force in advance of generating any commercial product sales. As a result, we will need substantial additional capital to support our operating activities. In addition, upon the completion of this offering we expect to incur additional legal, accounting and other expenses in operating our business, including the additional costs associated with operating as a public company.

We currently anticipate that we will seek to fund our operations through equity or debt financings or other sources, such as government grants and additional collaboration agreements with third parties. Adequate funding may not be available to us on acceptable terms, or at all. If sufficient funds on acceptable terms are not available when needed, we will be required to significantly reduce our operating expenses and delay, reduce the scope of, or eliminate one or more of our development programs.

We have incurred net losses each year since inception, including net losses of $12.7 million for the year ended December 31, 2017 and $14.3 million for the nine months ended September 30, 2018. As of December 31, 2017 and September 30, 2018, we had an accumulated deficit of $43.7 million and $58.1 million, respectively, and we do not expect positive cash flows from operations in the foreseeable future. We expect to continue to incur net operating losses for at least the next several years as we advance our product candidates through clinical development, seek regulatory approval, prepare for and, if approved, proceed to commercialization, continue our research and development efforts and invest to establish a commercial manufacturing facility.

Components of Our Operating Results

Revenue from collaboration and licensing

To date, we have not generated any revenue from product sales and do not expect to do so in the near future, if at all. All of our revenue to date has been derived from a research collaboration and license agreement with Gilead.

On June 4, 2018, we entered into a Research Collaboration and License Agreement, or the Collaboration Agreement, with Gilead to evaluate potential vaccine products using or incorporating our TheraT technology and VaxWave technology for the treatment, cure, diagnosis or prevention of hepatitis B virus, or HBV, and the human immunodeficiency virus, or HIV.

Under the Collaboration Agreement, we granted Gilead an exclusive, royalty-bearing license to our technology platform for researching, developing, manufacturing or commercializing products for HIV or HBV. We received a non-refundable $10.0 million upfront payment upon entering the Collaboration Agreement. Gilead is also obligated to reimburse us for our cost, including all benefits, travel, overhead, and any other expenses, of performing research and development under the agreement and to make additional payments to us upon the achievement of preclinical, development and commercial milestones. We are also eligible for up to $140.0 million in developmental milestone payments for each of the HBV and HIV programs and up to $50.0 million in commercialization milestone payments for each of the HBV and HIV programs. Additionally, Gilead is obligated to pay royalties of a high single-digit to low-teens percentage on the worldwide net sales of each HBV product, and royalties of a mid-single-digit to low-teens percentage of worldwide net sales of each HIV product.

We determined that our performance obligations under the terms of the Collaboration Agreement included one combined performance obligation for each of the HBV and HIV research programs, comprised of the transfer of intellectual property rights and providing research and development services. Accordingly, we recognize these amounts as revenue over the performance period of the respective services on a percent of completion basis using total estimated research and development labor hours for each of the performance obligations.

Through September 30, 2018, we have received the upfront payment of $10.0 million and $0.9 million of cost reimbursements for research and development services performed during that period from Gilead, of which we have recognized revenue of $2.5 million during the nine months ended September 30, 2018.

Operating Expenses

Our operating expenses since inception have only consisted of research and development costs and general administrative costs.

Research and Development Expenses

Since our inception, we have focused significant resources on our research and development activities, including establishing our arenavirus platform, conducting preclinical studies, developing a manufacturing process and conducting a Phase 1 clinical trial for HB-101. Research and development activities account for a significant portion of our operating expenses. Research and development costs are expensed as incurred. These costs include:

- salaries, benefits and other related costs, including stock-based compensation, for personnel engaged in research and development functions;
- expenses incurred in connection with the preclinical development of our programs and clinical trials of our product candidates, including under agreements with third parties, such as consultants, contractors, academic institutions and contract research organizations, or CROs;
- the cost of manufacturing drug products for use in clinical trials, including under agreements with third parties, such as CMOs, consultants and contractors;
- laboratory costs;
- leased facility costs, equipment depreciation and other expenses, which include direct and allocated expenses; and
- intellectual property costs incurred in connection with filing and prosecuting patent applications as well as third-party license fees.

The majority of our research and development costs are external costs, which we track on a program-by-program basis. We do not track our internal research and development expenses on a program-by-program basis as they primarily relate to shared costs deployed across multiple projects under development.

We expect our research and development expenses to increase substantially in the future as we advance our existing and future product candidates into and through clinical studies and pursue regulatory approval. The process of conducting the necessary clinical studies to obtain regulatory approval is costly and time-consuming. Clinical studies generally become larger and more costly to conduct as they advance into later stages and, in the future, we will be required to make estimates for expense accruals related to clinical study expenses.

At this time, we cannot reasonably estimate or know the nature, timing and estimated costs of the efforts that will be necessary to complete the development of any product candidates that we develop from our programs. We are also unable to predict when, if ever, material net cash inflows will commence from sales of product candidates we develop, if at all. This is due to the numerous risks and uncertainties associated with developing product candidates, including the uncertainty of:

- successful completion of preclinical studies and clinical trials;
- sufficiency of our financial and other resources to complete the necessary preclinical studies and clinical trials;

- acceptance of INDs for our planned clinical trials or future clinical trials;
- successful enrollment and completion of clinical trials;
- successful data from our clinical program that support an acceptable risk-benefit profile of our product candidates in the intended populations;
- receipt and maintenance of regulatory and marketing approvals from applicable regulatory authorities;
- scale-up of our manufacturing processes and formulation of our product candidates for later stages of development and commercialization;
- establishing our own manufacturing capabilities or agreements with third-party manufacturers for clinical supply for our clinical trials and commercial manufacturing, if our product candidate is approved;
- entry into collaborations to further the development of our product candidates;
- obtaining and maintaining patent and trade secret protection or regulatory exclusivity for our product candidates;
- successfully launching commercial sales of our product candidates, if and when approved;
- acceptance of the product candidate's benefits and uses, if and when approved, by patients, the medical community and third-party payors;
- the prevalence and severity of adverse events experienced with our product candidates;
- maintaining a continued acceptable safety profile of the product candidates following approval;
- effectively competing with other therapies;
- obtaining and maintaining healthcare coverage and adequate reimbursement from third-party payors; and
- qualifying for, maintaining, enforcing and defending intellectual property rights and claims.

A change in the outcome of any of these variables with respect to the development of a product candidate could mean a significant change in the costs and timing associated with the development of that product candidate. For example, if the FDA or another regulatory authority were to require us to conduct clinical trials beyond those that we anticipate will be required for the completion of clinical development of a product candidate, or if we experience significant delays in our clinical trials due to patient enrollment or other reasons, we would be required to expend significant additional financial resources and time on the completion of clinical development.

General and Administrative Expenses

Our general and administrative expenses consist primarily of personnel costs in our executive, finance, business development and administrative functions. Other general and administrative expenses include consulting fees and professional service fees for auditing, tax and legal services, rent expenses related to our offices, depreciation and other costs. We expect our general and administrative expenses to continue to increase in the future as we expand our operating activities and prepare for potential commercialization of our current and future product candidates, increase our headcount and support our operations as a public company, including increased expenses related to legal, accounting, regulatory and tax-related services associated with maintaining compliance with requirements of the Nasdaq Global Market and the Securities and Exchange Commission, directors and officers liability insurance premiums and investor relations activities.

Grant Income

Since inception, we have received grants from an Austrian government agency, either under funding agreements or under research incentive programs. In addition, we have received loans under funding agreements that bear interest at below market interest rate. We account for the grants received as other income and for the imputed benefits arising from the difference between a market rate of interest and the rate of interest as additional grant income, and record interest expense for the loans at a market rate of interest.

Interest Expense

Interest expense results primarily from loans under funding agreements with the Austrian Research Promotion Agency, recorded at a market rate of interest. The difference between interest payments payable pursuant to the loans, which rates are at below market interest rates, and the market interest rate, is accounted for as grant income.

Income Taxes

Income tax expense results from foreign minimum income tax and profit on a legal entity basis. The losses that we have incurred since inception result primary from the losses of our Austrian subsidiary. As of September 30, 2018, we had foreign net operating loss carryforwards of $73.6 million with no expiry date, resulting in a deferred tax asset of $18.4 million. We have considered that it is more likely than not that we will not realize the benefits of the deferred tax asset, and accordingly, established a full valuation allowance as of September 30, 2018.

Results of Operations

The following table sets forth the significant components of our results of operations (in thousands):

	Year ended December 31, 2017	Nine months ended September 30, 2018
Revenue from collaboration and licensing	$ —	$ 2,549
Operating expenses:		
Research and development	(9,772)	(17,350)
General and administrative	(4,385)	(4,175)
Total operating expenses	(14,157)	(21,525)
Loss from operations	(14,157)	(18,976)
Other income (expense):		
Grant income	2,069	5,217
Interest expense	(606)	(578)
Other income and expenses, net	(25)	19
Total other income (expense), net	1,438	4,658
Net loss before tax	(12,719)	(14,318)
Income tax expense	(4)	(27)
Net loss	$ (12,723)	$ (14,345)

Revenue from collaboration and licensing

We had no revenue in the year ended December 31, 2017.

Revenue for the nine months ended September 30, 2018 was $2.5 million, which resulted from collaboration and licensing under our Collaboration Agreement, This included $0.9 million from reimbursement of research and development expenses and $1.6 million from partial recognition of revenue related to the upfront payment of $10.0 million that we received in June 2018.

Research and Development Expenses

For the year ended December 31, 2017, our research and development expenses were $9.8 million, of which $3.8 million were personnel related expenses and $0.8 million were facility related expenses with the remainder resulting from other internal costs. Direct expenses for outside services and consultants and laboratory materials were $4.5 million and were mainly driven by manufacturing costs, costs for clinical trials and costs for external preclinical services and testing.

Our research and development expenses for the nine months ended September 30, 2018 were $17.4 million. Personnel related expenses increased to $4.2 million as result of our increased research and development headcount. Facility related expenses were $0.9 million, reflecting the expansion of laboratory space as a result of our increased research and development headcount. Direct expenses for outside services and consultants and laboratory materials were $11.5 million and mainly comprised costs for manufacturing of clinical trial material, costs for clinical trials and costs for external preclinical models and sample testing. These costs have increased substantially in the nine months ended September 30, 2018, mainly due to the preparations for the Phase 2 clinical trials for our HB-101 program and due to the manufacturing of clinical trial material for our HB-201 and HB-202 programs.

The following table summarizes our research and development expenses by product candidate or program (in thousands):

	Year ended December 31, 2017	Nine months ended September 30, 2018 (unaudited)
Direct research and development expenses by program:		
HB-101	$ 1,185	$ 3,685
HB-201/202	1,695	5,910
Gilead partnered programs(1)	—	416
Other and earlier-stage programs	1,637	1,513
Internal research and development expenses:		
Personnel related (including stock-based compensation)	3,789	4,201
Facility related	779	853
Other internal costs	687	772
Total research and development expenses	$ 9,772	$ 17,350

(1) Expenses incurred by us in connection with Gilead partnered programs are reimbursed to us by Gilead and accounted for as revenue.

General and Administrative Expenses

General and administrative expenses for the year ended December 31, 2017 were $4.4 million, of which personnel expenses were $2.1 million and professional and consulting fees were $1.3 million.

General and administrative expenses for the nine months ended September 30, 2018 were $4.2 million, which were mainly attributable to personnel expenses of $1.9 million and professional fees and consulting fees of $1.1 million.

Grant Income

In the year ended December 31, 2017 and nine months ended September 30, 2018, we recorded grant income of $2.1 million and $5.2 million, respectively, from grants, research incentives and imputed benefits from below market interest rates on loans from governmental agencies. A significant part of our grant income is linked to the amount of qualifying research and development expenses, which have increased substantially in the nine months ended September 30, 2018 and thus our grant income has also increased.

Interest Expense

Interest expenses for loans from government agencies in both, the year ended December 31, 2017 and nine months ended September 30, 2018 were $0.6 million and in both periods included $0.1 million in contractual interest at below market rates and an additional $0.5 million in interest representing the difference between contractual interest and the market rate of interest.

Liquidity and Capital Resources

Sources of Liquidity

Since our inception, we have funded our operations primarily through private placements of our convertible preferred stock as well as from grants, research incentives and borrowings under various agreements with public funding agencies, and most recently, from an upfront payment and service reimbursement of fees received pursuant to the Collaboration Agreement. Through September 30, 2018, we had received gross proceeds of approximately $105.0 million from the issuance of our convertible preferred stock and $10.2 million pursuant to the Collaboration Agreement. As of September 30, 2018, the principal amount outstanding under loans from government agencies was $8.4 million and we had cash and cash equivalents of $55.8 million. Key financing and corporate milestones include:

- In November 2011, we raised gross proceeds of approximately $9.5 million from the issuance of our Series A convertible preferred stock.
- Between November 2013 and June 2015, we raised gross proceeds of $25.6 million from the issuance of our Series B convertible preferred stock.
- In December 2016, we raised gross proceeds of $5.2 million from the issuance of a second tranche of our Series B convertible preferred stock.
- In March 2017, we raised gross proceeds of $5.3 million from an extension of the issuance of a second tranche of our Series B convertible preferred stock.
- In December 2017, we raised gross proceeds of $59.4 million from the issuance of our Series C convertible preferred stock.

We entered into various funding agreements with the Austrian Research Promotion Agency, or FFG. The loans by FFG, or the FFG Loans, were made on a project-by-project basis and bear interest at rates ranging from 0.75% to 1.0% per annum. In the event that the underlying program research results in a scientific or technical failure, the principal then outstanding under any loan may be forgiven by FFG and converted to non-repayable grant funding on a project-by-project basis. The FFG Loans contain no financial covenants and are not secured by any of our assets.

Because the FFG Loans bear interest at below market rates we account for the imputed benefit arising from the difference between an estimated market rate of interest and the contractual interest rate as grant funding from FFG, which is included in grant income. On the date that FFG Loan proceeds are received, we recognize the portion of the loan proceeds allocated to grant funding as a discount to the carrying value of the loan and as unearned income. As of September 30, 2018, the unamortized debt discount related to FFG Loans was $4.2 million.

We do not expect positive cash flows from operations in the foreseeable future, if at all. Historically, we have incurred operating losses as a result of ongoing efforts to develop our arenavirus technology platform and our product candidates, including conducting ongoing research and development, preclinical studies, clinical trials, providing general and administrative support for these operations and developing our intellectual property portfolio. We expect to continue to incur net operating losses for at least the next several years as we progress clinical development, seek regulatory approval, prepare for and, if approved, proceed to commercialization of our most advanced product candidates HB-101, HB-201 and HB-202, continue our research and development efforts relating to our other and future product candidates, and invest in our manufacturing capabilities and our own manufacturing facility.

Future Funding Requirements

We have no products approved for commercial sale. To date, we have devoted substantially all of our resources to organizing and staffing our company, business planning, raising capital, undertaking preclinical studies and clinical trials of our product candidates. As a result, we are not profitable and have incurred losses in each period since our inception in 2011. As of December 31, 2017 and September 30, 2018, we had an accumulated deficit of $43.7 million and $58.1 million, respectively. We expect to continue to incur significant losses for the foreseeable future. We anticipate that our expenses will increase substantially as we:

- pursue the clinical and preclinical development of our current and future product candidates;
- leverage our technologies to advance product candidates into preclinical and clinical development;
- seek regulatory approvals for product candidates that successfully complete clinical trials, if any;
- attract, hire and retain additional clinical, quality control and scientific personnel;
- establish our manufacturing capabilities through third parties or by ourselves and scale-up manufacturing to provide adequate supply for clinical trials and commercialization;
- expand our operational, financial and management systems and increase personnel, including personnel to support our clinical development, manufacturing and commercialization efforts and our operations as a public company;
- expand and protect our intellectual property portfolio;
- establish a sales, marketing, medical affairs and distribution infrastructure to commercialize any products for which we may obtain marketing approval and intend to commercialize on our own or jointly;
- acquire or in-license other product candidates and technologies; and
- incur additional legal, accounting and other expenses in operating our business, including the additional costs associated with operating as a public company.

Even if we succeed in commercializing one or more of our product candidates, we will continue to incur substantial research and development and other expenditures to develop and market additional product candidates. We may encounter unforeseen expenses, difficulties, complications, delays and other unknown factors that may adversely affect our business. The size of our future net losses will depend, in part, on the rate of future growth of our expenses and our ability to generate revenue. Our prior losses and expected future losses have had and will continue to have an adverse effect on our stockholders' equity and working capital.

Even if we consummate this offering, we will require substantial additional financing and a failure to obtain this necessary capital could force us to delay, limit, reduce or terminate our product development programs, commercialization efforts or other operations.

Since our inception, we have invested a significant portion of our efforts and financial resources in research and development activities for our VaxWave and TheraT technologies and our product candidates derived from these technologies. Preclinical studies and clinical trials and additional research and development activities will require substantial funds to complete. We believe that we will continue to expend substantial resources for the foreseeable future in connection with the development of our current product candidates and programs as well as any future product candidates we may choose to pursue, as well as the gradual gaining of control over our required manufacturing capabilities and other corporate uses. These expenditures will include costs associated with conducting preclinical studies and clinical trials, obtaining regulatory approvals, and manufacturing and supply, as well as marketing and selling any products approved for sale. In addition, other unanticipated costs may arise. Because the outcome of any preclinical study or clinical trial is highly uncertain, we cannot reasonably estimate the actual amounts necessary to successfully complete the development and commercialization of our current or future product candidates.

Our future capital requirements depend on many factors, including:

- the scope, progress, results and costs of researching and developing our current and future product candidates and programs, and of conducting preclinical studies and clinical trials;
- the number and development requirements of other product candidates that we may pursue, and other indications for our current product candidates that we may pursue;
- the stability, scale and yields of our future manufacturing process as we scale-up production and formulation of our product candidates for later stages of development and commercialization;
- the timing of, and the costs involved in, obtaining regulatory and marketing approvals and developing our ability to establish sales and marketing capabilities, if any, for our current and future product candidates we develop if clinical trials are successful;
- the success of our collaboration with Gilead;
- our ability to establish and maintain collaborations, strategic licensing or other arrangements and the financial terms of such agreements;
- the cost of commercialization activities for our current and future product candidates that we may develop, whether alone or with a collaborator;
- the costs involved in preparing, filing, prosecuting, maintaining, expanding, defending and enforcing patent claims, including litigation costs and the outcome of such litigation;
- the timing, receipt and amount of sales of, or royalties on, our future products, if any; and
- the emergence of competing oncology and infectious disease therapies and other adverse market developments.

A change in the outcome of any of these or other variables with respect to the development of any of our current and future product candidates could significantly change the costs and timing associated with the development of that product candidate. Furthermore, our operating plans may change in the future, and we will need additional funds to meet operational needs and capital requirements associated with such operating plans.

We do not have any committed external source of funds or other support for our development efforts. Until we can generate sufficient product and royalty revenue to finance our cash requirements, which we may never do, we expect to finance our future cash needs through a combination of public or private equity offerings, debt financings, collaborations, strategic alliances, licensing arrangements and other marketing or distribution arrangements as well as grant funding. Based on our research and development plans, we expect that the net proceeds from this offering, together with our existing cash and cash equivalents, will enable us to fund our operating expenses and capital expenditure requirements for at least the next months. These estimates are based on assumptions that may prove to be wrong, and we could utilize our available capital resources sooner than we expect.

If we raise additional capital through marketing and distribution arrangements or other collaborations, strategic alliances or licensing arrangements with third parties, we may have to relinquish certain valuable rights to our product candidates, technologies, future revenue streams or research programs or grant licenses on terms that may not be favorable to us. If we raise additional capital through public or private equity offerings, the terms of these securities may include liquidation or other preferences that adversely affect our stockholders' rights. Further, to the extent that we raise additional capital through the sale of common stock or securities convertible or exchangeable into common stock, your ownership interest will be diluted. If we raise additional capital through debt financing, we would be subject to fixed payment obligations and 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. If we are unable to obtain additional funding on favorable terms when needed, we may have to delay, reduce the scope of or terminate one or more of our research and development programs or clinical trials.

Cash Flows

The following table sets forth a summary of the primary sources and uses of cash (in thousands):

	Year ended December 31, 2017	Nine months ended September 30, 2018
		(unaudited)
Net cash used in operating activities	$ (11,913)	$ (8,622)
Net cash used in investing activities	(1,297)	(1,900)
Net cash provided by financing activities	58,892	6,867
Net increase (decrease) in cash and cash equivalents	$ 45,682	$ (3,655)

Cash Used in Operating Activities

During the year ended December 31, 2017, cash used in operating activities was $11.9 million, which consisted of a net loss of $12.7 million, adjusted by non-cash charges of $1.1 million and cash used due to changes in our operating assets and liabilities of $0.3 million. The non-cash charges consisted primarily of depreciation and amortization expense of $0.4 million and stock-based compensation of $0.8 million. The change in our operating assets and liabilities was primarily due to a decrease of $1.2 million in accounts payable, partially offset by an increase of accrued expenses and other liabilities of $1.0 million.

During the nine months ended September 30, 2018, cash used in operating activities was $8.6 million, which consisted of a net loss of $14.3 million, adjusted by non-cash charges of $1.1 million and cash provided by changes in our operating assets and liabilities of $4.6 million. The change in our operating assets and liabilities was primarily due to an increase in deferred revenues of $8.6 million mainly driven by the unrecognized portion of the $10.0 million upfront payment received pursuant to the Collaboration Agreement. The cash effect of this increase was partially offset by an increase in prepaid expenses and other current assets of $3.6 million which was mainly a result of an increase in assets related to future research incentive payments.

Cash Used in Investing Activities

During the year ended December 31, 2017, cash used in investing activities was $1.3 million, which resulted from capital expenditures in connection with leasehold improvements to expand our laboratory space and for purchase of property and equipment.

During the nine months ended September 30, 2018, cash used in investing activities was $1.9 million, which resulted from capital expenditures in connection with leasehold improvements to expand our laboratory space and for purchase of property and equipment.

Cash Provided by Financing Activities

During the year ended December 31, 2017, cash provided by financing activities was $58.9 million, which primarily consisted of net proceeds from the issuances of shares of our Series C convertible preferred stock of $58.1 million and $0.7 million in loan proceeds from FFG.

During the nine months ended September 30, 2018, cash provided by financing activities was $6.9 million, which primarily consisted of $6.4 million in net proceeds from the issuances of shares of our Series C convertible preferred stock in December 2017, and of proceeds from borrowings of $0.4 million, received under a loan from FFG.

Options Granted

The following table sets forth by grant date the number of shares underlying options granted between January 1, 2017 and September 30, 2018, the per share exercise price of the options, the fair value of common stock per share on each grant date, and the per share estimated fair value of the options on each grant date:

Grant Date	Number of Shares Subject to Options Granted	Per Share Exercise Price of Options	Fair Value per Share of Common Stock on Option Grant Date	Per Share Estimated Fair Value of Option on Grant Date
February 20, 2017	16,174	$ 1.16	$ 18.86	$ 19.05
June 13, 2017	6,375	$ 1.16	$ 18.86	$ 19.05
December 30, 2017	24,383	$ 1.16	$ 34.12	$ 30.75

In determining the compensation expense in our consolidated statements of operations and comprehensive loss, we retrospectively estimated the fair value of our common stock as of the date of each option grant. See "—Critical Accounting Policies and Use of Estimates—Stock-based compensation."

Off-Balance Sheet Arrangements

We did not have during the periods presented and we do not currently have any off-balance sheet arrangements, as defined in the rules and regulations of the Securities and Exchange Commission.

Contractual Obligations and Commitments

Operating leases

As of September 30, 2018, our future annual minimum lease payments under non-cancellable operating leases and debt obligations were as follows (in thousands):

	Payments Due by Period				
	Total	Less Than 1 Year	1 - 3 Years	4 - 5 Years	More than 5 Years
Operating lease commitments(1)	$ 1,120	$ 221	$ 845	$ 54	$ —
CMO commitments(2)	3,363	3,363	—	—	—
Debt obligations(3)	8,437	—	2,199	3,774	2,464
Total	$ 12,920	$ 3,584	$ 3,044	$ 3,828	$ 2,464

(1) Our lease obligations relate primarily to the rent of our office and laboratory facilities in Vienna, Austria, which expire in 2020 and 2023.

(2) Reflects our non-cancellable obligations under arrangements with CMOs. Does not reflect the entering into an agreement with a CMO for the production of manufacturing material in December 2018 pursuant to which the Company is obliged to pay non-cancellable minimum service fees totaling $15.7 million through 2021.

(3) Reflects the contractually required principal and interest payments payable under the FFG Loans.

The contractual obligations table does not include any potential contingent payments upon the achievement by us of specified clinical, regulatory and commercial events, as applicable, or patent prosecution or royalty payments we may be required to make under license agreements we have entered into with various universities or partners pursuant to which we have in-licensed certain intellectual property, including our license agreements with the University of Zurich, the University of Basel and the University of Geneva. We have excluded these potential payments in the contractual obligations table because the timing and likelihood of these contingent payments are not known. See "Business—License Agreements" for additional information about these license agreements, including with respect to potential payments thereunder.

We enter into contracts in the normal course of business with CROs for clinical trials, preclinical research studies and testing, manufacturing and other services and products for operating purposes. These contracts generally provide for termination upon notice, and therefore we believe that our non-cancellable obligations under these agreements are not material.

Intellectual property licenses

In October 2011, we entered into a license agreement with University of Zurich for an exclusive, worldwide, royalty-bearing license for a propagation-deficient arenavirus vector. Pursuant to the license agreement, we are obligated to pay the University of Zurich low single-digit royalties on aggregate net sales of products licensed under the agreement, and to pay mid-single digit to low-double digit percentage of the sublicense fees that we may receive from sublicensing.

In January 2017, we entered into a license agreement with University of Basel for an exclusive, worldwide, royalty-bearing license for a tri-segmented Pichinde virus vector. We are required to use reasonable efforts to make commercially available licensed products. Pursuant to the license agreement, we are obligated to pay nominal milestone payments for each licensed product upon the achievement of certain development and regulatory milestones and to pay royalties of low single digits of net sales of licensed products. We are also obligated to pay a percentage of the sublicense fees that we may receive from sublicensing.

In February 2017, we entered into a license agreement with the University of Geneva for an exclusive, worldwide, royalty-bearing license for a tri-segmented arenavirus vector. Pursuant to the license agreement, we are obligated to pay the University of Geneva an annual fee which is fully deductible from any milestone, royalty or sublicense payments. We are also obligated to pay milestone nominal payments for each licensed product upon the achievement of certain development and regulatory milestones and to pay low single-digit royalties on aggregate net sales of products licensed under the agreement, and to pay low-single digit to low-double digit percentage of the sublicense fees that we may receive from sublicensing.

In the nine months ended September 30, 2018, we recorded $0.1 million in licensing fees from intellectual property licenses as research and development expenses. At September 30, 2018, $0.5 million payable from sublicensing fees were included in accrued expenses and other current liabilities.

For additional information on these license agreements, please see "Business—Intellectual Property—License Agreements."

Critical Accounting Policies and Use of Estimates

This discussion and analysis of financial condition and results of operation is based on our financial statements, which have been prepared in accordance with accounting principles generally accepted in the United States, or GAAP. The preparation of financial statements requires management to make estimates and judgments that affect the reported amounts of assets and liabilities and disclosures of contingent assets and liabilities as of the date of the financial statements and the reported amounts of expenses during the reporting period. On an ongoing basis, management evaluates its estimates, including those related to accruals for external manufacturing of clinical trial material as well as clinical study conduct, fair value of assets and liabilities, and the fair value of common stock and stock-based compensation. Management bases its estimates on historical experience and on various other market-specific and relevant assumptions that management believes to be reasonable under the circumstances. Actual results could differ from those estimates.

While our significant accounting policies are more fully described in the notes to our audited financial statements included elsewhere in this prospectus, we believe that the following accounting policies are critical to the process of making significant judgments and estimates in the preparation of our financial statements and understanding and evaluating our reported financial results.

Recognition of revenue from contracts with customers

We have entered into the Collaboration Agreement with Gilead for the development and commercialization of certain of its product candidates. Our performance obligations under the terms of this agreement include one combined performance obligation for each research program comprised of the transfer of intellectual property rights (licenses) and providing research and development services. Payments by Gilead to us under this agreement included a non-refundable up-front payment, payments for research and development activities, and may include payments based upon the achievement of defined milestones, payments for manufacturing services, commercial milestones and royalties on product sales if certain future conditions are met.

We evaluate our collaboration and licensing arrangements pursuant to Accounting Standards Codification 606, or ASC 606. To determine the recognition of revenue from arrangements that fall within the scope of ASC 606, we perform 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 Company satisfies a performance obligation. We present revenues from collaboration and licensing arrangements separately from other sources of revenue.

Amounts received by us as non-refundable upfront payment under the collaboration and licensing agreement prior to satisfying the above revenue recognition criteria are recorded as deferred revenue in our consolidated balance sheets. Such amounts are recognized as revenue over the performance period of the respective services on a percent of completion basis for each of the obligations. Reimbursement of costs for or services under the collaboration and licensing agreement are presented as revenue and not deducted from expenses. Amounts of consideration allocated to the performance of research or manufacturing services are recognized over the period in which services are performed. Contingent milestone payments related to specified preclinical and clinical development milestones are not initially recognized within the transaction price as they are fully constrained under the guidance in ASC 606. The collaboration and licensing arrangement also includes certain sales-based milestone and royalty payments upon successful commercialization of a licensed product which we anticipate recognizing if and when sales from a licensed product are generated.

Research and development costs

Research and development costs are expensed as incurred. Research and development expenses consist of costs incurred in performing research and development activities, including salaries and bonuses, stock-based compensation, employee benefits, facilities costs, laboratory supplies, depreciation, manufacturing expenses and external costs of vendors engaged to conduct preclinical development activities and clinical trials as well as the cost of licensing technology. Advance payments for goods or services to be received in the future for use in research and development activities are recorded as prepaid expenses. The prepaid amounts are expensed as the related goods are delivered or the services are performed.

All patent-related costs incurred in connection with filing and prosecuting patent applications are classified as research and development expenses and expensed as incurred due to the uncertainty about the recovery of the expenditure. Upfront payments, milestone payments and annual payments made for the licensing of technology are generally expensed as research and development in the period in which they are incurred. Incremental sublicense fees triggered by contracts with customers are capitalized and expensed as research and development expenses over the period in which the relating revenue is recognized.

Stock-based compensation

We measure stock options and other stock-based awards granted to employees, directors, consultants or advisors of the company or its affiliates based on their fair value on the date of the grant and recognize compensation expense of those awards, net of estimated forfeitures, over the requisite service period, which is generally the vesting period of the respective award. We classify stock-based compensation expense in our Consolidated Statements of Operations and Comprehensive Loss in the same manner in which the award recipient's payroll costs are classified. Compensation expense for those awards is recognized, net of forfeitures, over the requisite service period, which is generally the vesting period of the respective award. We use the straight-line method to record the expense of awards with service-based vesting conditions.

We measure stock-based awards granted to employees and directors based on the fair value on the date of grant using the Black-Scholes option-pricing model for options. The fair value of options granted before the year ended December 31, 2018 were determined retrospectively as no independent third party valuation was performed at the time of such grants. Black-Scholes utilizes assumptions related to expected term, forfeitures, volatility, the risk-free interest rate, the dividend yield (which is assumed to be zero, as we have not paid any cash dividends) and employee exercise behavior. The assumptions used in the Black-Scholes model to determine fair value for the 2017 stock option grants were:

	Year ended December 31, 2017
Risk-free interest rate	(0.67)%
Expected term (in years)	2.8
Expected volatility	66%
Expected dividends	—

In the nine months ended September 30, 2018, no stock options were granted.

As there is no public market for our common stock to date, we retrospectively estimated fair value of our common stock as of the date of each option grant, considering third-party valuations. These valuations considered both objective and subjective factors, including:

- the prices at which we sold preferred stock and the superior rights and preferences of the preferred stock relative to our common stock at the time of each grant;
- the progress of our research and development programs, including the status of preclinical studies and planned clinical trials for our product candidates;
- our stage of development and our business strategy;
- external market conditions affecting the biotechnology industry, and trends within the biotechnology industry;
- our financial position, including cash on hand, and our historical and forecasted performance and operating results;
- the lack of an active public market for our common stock and our preferred stock; and
- the likelihood of achieving a liquidity event, such as an initial public offering or a sale of our company in light of prevailing market conditions.

The valuations were performed in December 2018 in accordance with the guidance outlined in the American Institute of Certified Public Accountants' Accounting and Valuation Guide, *Valuation of Privately-Held-Company Equity Securities Issued as Compensation*. The methods used to derive total equity value varied, depending on the availability of objective valuation-related information. Inputs used in our retrospective valuations include the issue prices of our periodic investment rounds, Return-on-R&D-Spend, and market factors based on recent mergers and acquisitions within the biotechnology and pharmaceutical industries. An option pricing allocation method, or OPM, was selected to allocate the total equity value. The OPM treats common stock and preferred stock as call options on the total equity value of a company, with exercise prices based on the value thresholds at which the allocation among the various holders of a company's securities changes. Under this method, the common stock has value only if the funds available for distribution to stockholders exceeded the value of the preferred stock liquidation preference at the time of the liquidity event, such as a strategic sale or a merger.

The assumptions underlying these valuations represented management's best estimate, which involved inherent uncertainties and the application of management's judgment. As a result, if we had used significantly different assumptions or estimates, the fair value of our common stock and our stock-based compensation expense could have been materially different.

Once a public trading market for our common stock has been established in connection with the completion of this offering, it will no longer be necessary for our board of directors to estimate the fair value of our common stock in connection with our accounting for granted stock options and other such awards we may grant, as the fair value of our common stock will be determined based on the quoted market price of our common stock.

Recognition of other income under government grant agreements and research incentives

We recognize income from grants, research incentives and the imputed benefit arising from the difference between an estimated market rate of interest and the contractual interest rate on loans received from Austrian government agencies. Income from grants and incentives is recognized in the period during which the related qualifying expenses are incurred, provided that the conditions under which the grants or incentives were provided have been met. For grants under funding agreements and for proceeds under research incentive programs, we recognize grant and incentive income in an amount equal to the qualifying expenses incurred in each period multiplied by the applicable reimbursement percentage.

Grant income that we have received in advance of incurring qualifying expenses is recorded in the consolidated balance sheets as deferred income. Grant and incentive income recognized upon incurring qualifying expenses in advance of receipt of grant funding or proceeds from research and development incentives is recorded in the consolidated balance sheets as prepaid expenses and other current assets.

We have received loans under funding agreements that bear interest below market rates. We account for the imputed benefit arising from the difference between an estimated market interest rate and the actual interest rate charged on such loans as additional grant income, and record interest expense for the loans at a market interest. On the date that loan proceeds are received, we recognize the portion of the loan proceeds allocated to grant funding as a discount to the carrying value of the loan and as unearned income, which is subsequently recognized as additional grant income over the term of the funding agreement.

JOBS Act

We are an emerging growth company under the Jumpstart Our Business Startups Act of 2012, as amended, or the JOBS Act. As an emerging growth company, we may delay the adoption of certain accounting standards until those standards would otherwise apply to private companies. However, we have irrevocably elected not to avail ourselves of this extended transition period for complying with new or revised accounting standards and, therefore, we will be subject to the same new or revised accounting standards as other public companies that are not emerging growth companies.

We will remain an emerging growth company until the earliest of (1) the last day of the fiscal year (a) following the fifth anniversary of the consummation 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" as defined in Rule 12b-2 under the Exchange Act, which would occur if the market value of our common stock held by non-affiliates exceeded $700.0 million as of the prior June 30th, and (2) the date on which we have issued more than $1.0 billion in non-convertible debt securities during the prior three-year period.

Quantitative and Qualitative Disclosures About Market Risk

Foreign currency and currency translation

We are subject to the risk of fluctuations in foreign currency exchange rates, specifically with respect to the euro. Our functional currency is the U.S. dollar and the functional currency of our wholly owned foreign subsidiary, Hookipa Biotech GmbH, is the euro. Our cash and cash equivalents as of September 30, 2018 consisted primarily of cash balances held by Hookipa Biotech GmbH in euros.

Assets and liabilities of Hookipa Biotech GmbH are translated into U.S. dollars at the exchange rate in effect on the balance sheet date. Income items and expenses are translated at the average exchange rate in effect during the period. Unrealized translation gains and losses are recorded as a cumulative translation adjustment, which is included in the consolidated Statements of Stockholders' Equity as a component of accumulated other comprehensive loss. Adjustments that arise from exchange rate changes on transactions denominated in a currency other than the local currency are included in other income and expenses, net in the consolidated Statements of Operations and Comprehensive Loss as incurred.

Interest Rate Sensitivity

We are exposed to market risk related to changes in interest rates. We had cash and cash equivalents of $55.8 million as of September 30, 2018, which were primarily held as account balances with foreign banks. A hypothetical 10% relative change in interest rates during any of the periods presented would not have had a material impact on our financial statements.

Internal Control over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting. Internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements in accordance with GAAP. As a result of becoming a public company, we will be required, pursuant to Section 404 of the Sarbanes-Oxley Act of 2002, as amended, to furnish a report by our management on, among other things, the effectiveness of our internal control over financial reporting for the first fiscal year beginning after the effective date of the registration statement of which this prospectus is a part or the date we are no longer an "emerging growth company" as defined in the JOBS Act, if we take advantage (as we expect to do) of the exemptions contained in the JOBS Act. This assessment will need to include disclosures of any material weaknesses identified by our management in our internal control over financial reporting. The SEC defines a material weakness as a deficiency, or combination of deficiencies, in internal control over financial reporting such that there is a reasonable possibility that a material misstatement of a company's annual or interim financial statements will not be detected or prevented on a timely basis.

In connection with our preparation and the audit of our financial statements as of and for the year ended December 31, 2017, we and our independent registered public accounting firm identified two material weaknesses, as defined under the Exchange Act and by the Public Company Accounting Oversight Board (United States), in our internal control over financial reporting. We did not maintain a sufficient complement of resources with an appropriate level of accounting knowledge, experience, and training, which would allow for appropriate monitoring, presentation and disclosure, and internal control over financial reporting. Specifically, we have not designed and implemented a sufficient level of formal accounting policies and procedures. Additionally, the limited personnel resulted in our inability to consistently establish appropriate authorities and responsibilities in pursuit of our financial reporting objectives, as demonstrated by, amongst other things, our insufficient segregation of duties in their finance and accounting functions. These kinds of control deficiencies could result in a misstatement of these accounts or disclosures that would result in a material misstatement of our annual or interim consolidated financial statements that would not be prevented or detected, and accordingly, it was determined that these control deficiencies constituted material weaknesses.

Plan for Remediation of the Material Weaknesses

We are implementing measures designed to improve our internal control over financial reporting to remediate these material weaknesses, including the following:

- we are in the process of hiring additional qualified accounting personnel and segregating duties among accounting personnel; and

- we are formalizing our internal controls documentation and strengthening supervisory reviews by our management.

These additional resources and procedures are designed to enable us to broaden the scope and quality of our internal review of underlying information related to financial reporting and to formalize and enhance our internal control procedures. With the oversight of senior management and our audit committee, we have begun taking steps and plan to take additional measures to remediate the underlying causes of the material weaknesses.

We intend to complete the implementation of our remediation plan during fiscal year 2019. Although we believe that our remediation plan will improve our internal control over financial reporting, additional time may be required to fully implement it and to make conclusions regarding the effectiveness of our internal controls over financial reporting. Our management will closely monitor and modify, as appropriate, the remediation plan to eliminate the identified material weakness.

If our remediation of the material weaknesses is not effective, or if we experience additional material weaknesses or otherwise fail to maintain an effective system of internal controls in the future, we may not be able to accurately or timely report our financial condition or results of operations. Accordingly, there could continue to be a reasonable possibility that a material misstatement of our financial statements would not be prevented or detected on a timely basis. We cannot assure you that the measures we have taken to date, or any measures we may take in the future, will be sufficient to remediate the material weaknesses we have identified or avoid potential future material weaknesses.

Recent Accounting Pronouncements

See Note 2 to our audited consolidated financial statements and unaudited interim consolidated financial statements and related notes included elsewhere in this prospectus.

BUSINESS

Overview

We are a clinical-stage biopharmaceutical company developing a new class of immunotherapeutics targeting infectious diseases and cancers based on our proprietary arenavirus platform that is designed to reprogram the body's immune system. We are using our "off-the-shelf" technologies, VaxWave and TheraT, to elicit directly within patients a powerful and durable response of antigen-specific killer T cells and antibodies, thereby activating essential immune defenses against infectious diseases and cancers. We believe that our technologies can meaningfully leverage the human immune system for prophylactic and therapeutic purposes by eliciting killer T cell response levels previously not achieved by other published immunotherapy approaches. Our lead infectious disease product candidate, HB-101, is in a randomized, double-blinded Phase 2 clinical trial in cytomegalovirus-negative patients awaiting kidney transplantation from cytomegalovirus-positive donors. Our lead oncology product candidates, HB-201 and HB-202, are in development for the treatment of human papillomavirus-positive cancers. We plan to file an investigational new drug application with the U.S. Food and Drug Administration for HB-201 and HB-202 in the first half and second half of 2019, respectively. We have also entered into a strategic partnership with Gilead Sciences, Inc. to accelerate building a pipeline of additional infectious disease product candidates in a cost efficient manner.

Our platform is based on engineering arenaviruses to carry and deliver virus-specific or tumor-specific genes directly in patients to dendritic cells, which are natural activators of killer T cells, also known as cytotoxic T cells, or CD8+ T cells. Arenaviruses have been used for decades as a preclinical tool to study CD8+ T cell responses. Our co-founder, Rolf Zinkernagel, was awarded a Nobel Prize in Physiology or Medicine for his arenavirus-based work on how CD8+ T cells recognize virus-infected cells. We believe that arenaviruses have several key advantages which give them the characteristics of an optimal antigen-specific immunotherapy, including:

- ability to induce a robust CD8+ T cell response by directly targeting and activating dendritic cells, which are the most efficient antigen-presenting cells of the body;
- ability to induce a robust antibody response to disease-specific target antigens;
- are not neutralized by vector-specific antibodies, thereby allowing for repeat administration that can boost immune response;
- do not require an adjuvant to stimulate the immune system; and
- have been observed to be well tolerated in preclinical studies and clinical trials.

We believe we are the first to reengineer arenaviruses for therapeutic purposes. We have created two technologies capable of delivering disease-specific antigens for the prevention and treatment of disease. Our first technology, VaxWave, is a replication-defective arenavirus which induces a strong immune response for prophylactic use against infectious disease. Our second technology, TheraT, is a replication-attenuated arenavirus which produces an even more powerful immune response that we believe is more appropriate for use in oncology. In preclinical studies, our TheraT technology was able to reprogram the immune system such that more than half of the body's CD8+ T cells focused on a specific cancer antigen target of our choice without observed serious adverse events. We have designed our platform to be modular in nature in order to allow substitution of antigens to target a broad range of infectious diseases and cancers. We have a robust intellectual property portfolio for our suite of arenaviruses with exclusive rights in issued patents and patent applications related to our VaxWave technology and exclusive and joint rights in patent applications related to our TheraT technology. These platform technologies can be used with a broad spectrum of antigens in therapeutic applications in immunotherapy ranging from infectious diseases to oncology. We believe the breadth and depth of our intellectual property is a strategic asset that has the potential to provide us with a significant competitive advantage.

We believe that our arenavirus platform approach gives us a unique and powerful way to tap into the biology of the immune system and reprogram it by instructing dendritic cells to express antigen-encoding genes that direct the immune system to the desired targets. Our product candidates are designed to deliver full-length proteins to activate T cells and B cells to produce a robust immune response through natural means, avoiding the use of artificial *ex vivo* constructs such as CAR-T cells and related approaches that bypass the immune system's normal control mechanisms. Although these latter approaches have shown clinical efficacy, they have the potential to cause life-threatening side effects, including cytokine release syndrome. In addition, we believe that our "off-the-shelf" immunotherapy is simpler, more straightforward and cost effective to manufacture and administer than CAR-T cells or other patient-derived cellular approaches.

Our lead product candidate in infectious diseases, utilizing VaxWave technology, is HB-101 for the prevention of cytomegalovirus infections. A majority of the worldwide human population is latently infected with cytomegalovirus and can transmit the infection through bodily fluids. While infection in immunocompetent persons typically presents as mild or asymptomatic, cytomegalovirus remains a major cause of morbidity and mortality in persons with a compromised immune system and in patients undergoing solid organ or hematopoietic stem cell transplants. In a cytomegalovirus-negative patient receiving an organ or stem cells from a cytomegalovirus-positive donor, the spread of the virus through the bloodstream, known as viremia, can cause end-organ disease, such as hepatitis, pneumonitis, gastroenteritis and retinitis, and can result in transplant rejection and death. In this high risk patient group, approximately 80% of kidney transplant recipients develop active cytomegalovirus infections. Cytomegalovirus disease in the transplant setting varies according to the type of transplant, the immunosuppressive drugs used and the presence of any other comorbidity risk factors. Symptomatic cytomegalovirus infections develop in patients in between 8% and 32% of kidney transplants, 22% and 29% of liver transplants, 9% and 23% of heart transplants and 50% and 75% of lung transplants. Based on a recent market research study we commissioned from an independent third party and reviewed by management, we believe that approximately 110,000 patients are added to the solid organ transplant waiting list annually in developed countries, with kidney transplantation representing approximately 60% of cases. Furthermore, more than 20,000 allogeneic cell transplants, in which cell and tissue donors are matched with transplant recipients, are carried out annually worldwide. In this group, the incidence of cytomegalovirus infection is approximately 30% as a result of the donor being cytomegalovirus positive. Current therapies to prevent the transmission of cytomegalovirus during organ transplants utilize antiviral prophylactic and therapeutic strategies. However, these therapies are only partially protective in preventing viral disease while also being hampered by toxicity and resistance.

HB-101 delivers two clinically validated antigens, phosphoprotein 65, or pp65, to induce cytomegalovirus-specific CD8+ T cells and glycoprotein B, or gB, to elicit cytomegalovirus-neutralizing antibodies. In our Phase 1 clinical trial, HB-101 was well tolerated and elicited a strong cytomegalovirus-specific immune responses in all 42 of the treatment arm volunteers. Importantly, we observed robust CD8+ and CD4+ T cell responses as well as cytomegalovirus-neutralizing antibody responses, without meaningful vector-neutralizing antibody responses. These responses increased in a statistically significant manner upon repeat administration. The CD8+ T cell levels achieved in our trial were in the range of, or higher than, the therapeutic levels published by third parties, in separately designed and conducted clinical trials, using adoptive T cell transfer approaches for the same antigen. We believe these results demonstrate the differentiating features of our arenavirus platform. In the fourth quarter of 2018, we commenced a Phase 2 clinical trial for HB-101 in cytomegalovirus-negative patients awaiting kidney transplantation from living cytomegalovirus-positive donors. We expect safety and immunogenicity data from the first cohorts enrolled in this trial in the first half of 2020, and preliminary efficacy data to follow in the second half of 2020.

We are developing our lead oncology product candidates, HB-201 and HB-202, both utilizing TheraT technology, for cancers caused by human papilloma virus, or HPV. These cancers account for approximately 5% of the total worldwide cancer prevalence and recent studies have shown that approximately 70% of cancers of the tonsil and tongue base and the majority of cervical and anal cancers may be linked to HPV. Tumors caused by HPV are referred to as HPV-positive tumors, or HPV+, and can be characterized by their expression of proteins from the HPV genome, particularly the viral E6 and E7 proteins. These two proteins are expressed in tumors but absent in normal cells, which makes them ideal target candidates for immunotherapy, however, to date, there are no therapeutically approved agents directed against these targets.

HB-201 utilizes our TheraT replication-attenuated viral vector technology to target E6 and E7 proteins on HPV16+ cancer cells. In preclinical studies, HB-201 as a monotherapy was effective at suppressing tumor growth and eliminated up to 40% of HPV+ tumors. HB-201 generated a strong and durable T cell and antibody response with successfully treated animals demonstrating resistance to a tumor re-challenge. Based on these preliminary results, we believe that treating patients with HB-201 has the potential to both control metastatic disease and prevent relapse. HPV16+ cancers include cancers of the head, neck, anus, vagina, cervix and penis. Based on a recent market research study we commissioned from an independent third party, we believe that in developed countries, approximately 70,000 patients annually are newly diagnosed with HPV16+ head and neck cancer. Each year, approximately 30,000 of these patients present with metastatic disease and an additional 10,000 patients progress to the recurrent and metastatic stages of the disease. We intend to file an investigational new drug application, or IND, for HB-201 in patients with treatment-refractory HPV16+ cancers in the first half of 2019. Our first planned Phase 1/2 clinical trial will assess the safety and efficacy of HB-201 both as a monotherapy and in combination with a checkpoint inhibitor. Our second planned Phase 1/2 clinical trial will assess the safety and efficacy of the combination of HB-201 and HB-202 in HPV16+ cancers, with or without a checkpoint inhibitor. HB-202 is also based on our TheraT technology and similarly targets E6 and E7 of HPV16+ tumors, but uses a different arenavirus than HB-201. We believe that our preclinical studies demonstrate that the combination of HB-201 and HB-202 results in a synergistic increase in E7 immunogenicity as compared to either HB-201 or HB-202 alone. Our goal is to establish the safety of this combination approach and its superiority over monotherapy.

In June 2018, we partnered with Gilead Sciences, Inc., or Gilead, a world leader in innovative therapies against infectious diseases, to develop arenavirus based therapeutics to treat hepatitis B virus, or HBV, and human immunodeficiency virus, or HIV, infections. We received a one-time upfront payment of $10.0 million upon entering into the agreement. We are also eligible to receive milestone payments based upon the achievement of specified development, regulatory, and commercial milestones potentially amounting to approximately $400 million, as well as tiered royalties ranging from high single-digit to mid-teens percentage on net sales.

We are led by a team of highly experienced executives, clinicians, and scientists with focused and translational expertise in oncology, immunology, vaccinology, clinical development and commercialization. Our Chief Executive Officer, Jörn Aldag, was previously the Chief Executive Officer of uniQure, a company that under his leadership pioneered the approval of the first gene therapy product. Igor Matushansky, M.D., Ph.D., our Chief Medical Officer and Global Head of Research and Development was previously Global Head of Translational Development for Oncology at Daiichi Sankyo. The fundamental discoveries underlying our arenavirus platform originated with our co-founders, Nobel laureate Rolf Zinkernagel, M.D., and Daniel Pinschewer, M.D., an internationally recognized arenavirus expert who serves as our Chief Scientific Officer.

We are supported by prominent biotechnology investors, including BioMedPartners, Boehringer Ingelheim Venture Fund, Forbion Capital Partners, HBM Partners, Hillhouse Capital, Sofinnova Partners and Takeda Ventures, as well as Gilead, a leading biopharmaceutical company.

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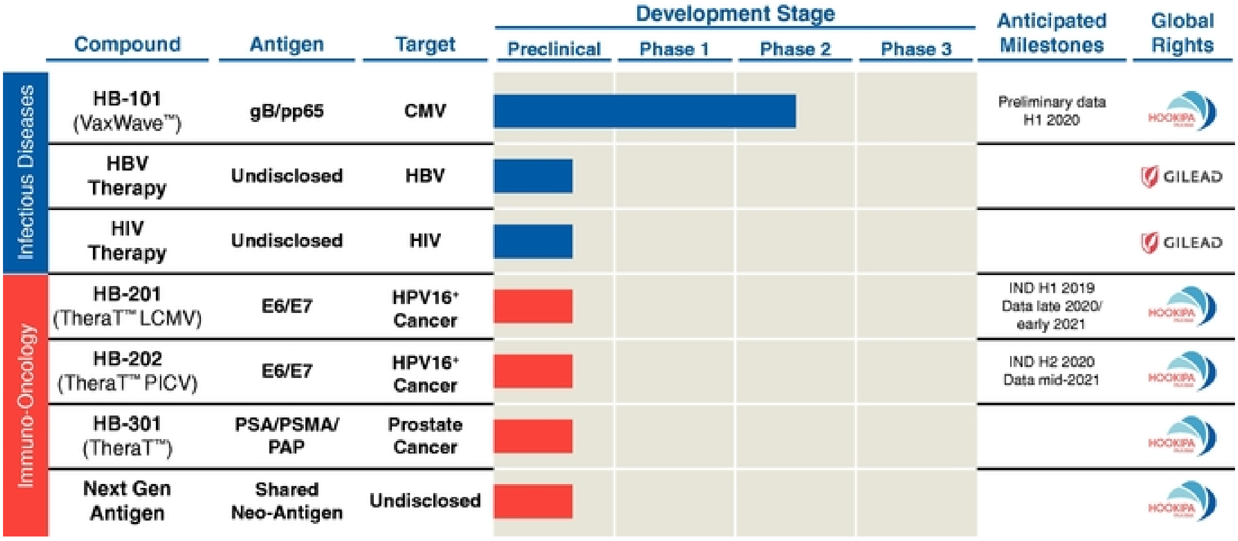
Our Pipeline

We are leveraging our modular arenavirus platform to develop the following product candidates for multiple infectious diseases and cancers:



Our Strategy

Our goal is to transform the prevention and treatment of infectious diseases and cancers to significantly improve the lives of patients by developing and commercializing a new class of "off-the-shelf" immunotherapeutics.

The key elements of our strategy are:

- ***Advance our lead infectious disease product candidate through clinical development and regulatory approval.*** Our lead product candidate, HB-101, is being developed for the prevention of cytomegalovirus infection in patients receiving a solid organ transplant. Our Phase 1 clinical trial of HB-101 demonstrated the ability of our VaxWave technology to elicit both robust CD8+ T cell and antibody responses, while being well tolerated, which we believe supports the broad therapeutic potential of our technologies. In the fourth quarter of 2018, we commenced a randomized, double-blinded Phase 2 clinical trial of HB-101 in cytomegalovirus negative patients receiving a kidney transplant from cytomegalovirus positive donors, and we expect immunogenicity data from the first cohorts enrolled in this trial in the first half of 2020, and preliminary efficacy data to follow in the second half of 2020.

- ***Simultaneously progress our lead immuno-oncology product candidates through clinical development and regulatory approval.*** Our lead immuno-oncology product candidates are HB-201 and HB-202, which are based on our TheraT technology. Both of these product candidates are in development for the treatment of HPV16+ cancers, including cancers of the head, neck, anus, vagina, cervix and penis. In preclinical models, HB-201 as a monotherapy was active in suppressing the tumor growth, and eliminated up to 40% HPV antigen positive tumors. We intend to file an IND with the U.S. Food and Drug Administration, or the FDA, for HB-201 and HB-202 in the first half and second half of 2019, respectively. We plan to initiate a Phase 1/2 clinical trial for HB-201 in patients with treatment-refractory HPV16+ cancers in the second half of 2019 and expect preliminary results in late 2020 or early 2021. We also plan to combine HB-201 with a checkpoint inhibitor and to commence a Phase 1/2 trial combining HB-201 and HB-202, both with and without a checkpoint inhibitor, in patients with treatment-refractory HPV16+ cancers in late 2020.

- ***Apply our arenavirus platform to develop additional novel immuno-oncology product candidates.*** We believe that our technologies have broad potential within the field of immuno-oncology. We plan to utilize the potential of our platform to develop additional product candidates for the treatment of a broad range of cancers, starting with our HB-301 program in prostate cancer. Beyond our current pipeline of preclinical assets, which includes viral and self-antigen targets, we intend to invest in our research and development activities in order to expand the potential of our platform to target a new class of antigens, which are shared across a subpopulation of patients. We believe that our technologies have the potential to be applied in any cancer associated with specific antigens.

- ***Selectively collaborate to realize the full potential of our arenavirus platform.*** We are building a broad pipeline of product candidates using our arenavirus platform. Beyond our current collaboration with Gilead, we plan to pursue strategic collaborations with additional leading biopharmaceutical companies with specialized capabilities or know-how, including development and commercial expertise. We may pursue partnerships that may allow us to expedite the discovery and development of product candidates for the prevention and treatment of infectious diseases and tumors, and provide us opportunities to combine our technologies with other modalities. We believe this approach may further broaden the therapeutic reach of our technologies, provide non-dilutive financing, and complement and expand our internal development expertise while allowing us to strategically retain rights to our product candidates.

- ***Strengthen and scale our manufacturing capabilities and ultimately operate our own manufacturing facility.*** We believe the quality, reliability, scalability and timing of our manufacturing activities will be an important factor in successfully developing and commercializing our product candidates and therefore, we intend to invest in manufacturing capabilities. We recently secured access to a dedicated good manufacturing practice, or GMP, suite to control the manufacturing capacity required to conduct a broad range of upcoming clinical trials for our product candidates. In the future, we intend to establish and operate our own current good manufacturing practice, or cGMP, facility for multi-product manufacturing of our commercial products.

Background

Immune System Function: Antigen Presentation by Dendritic Cells

The immune system is designed to protect the human body from infections and cancers. Infections can be generally defined as the proliferation of foreign microorganisms such as bacteria, viruses, and parasites in a patient's body resulting in clinical manifestations of disease. Cancer can be generally defined as the uncontrolled proliferation of native cells resulting in disease. In both cases, the immune system recognizes and destroys microorganisms, infected cells and cancers by targeting specific proteins, or antigens, as well as their immunogenic sub-parts, which are referred to as epitopes.

The innate immune system is the body's first line of defense and enables a rapid, short-lived and non-specific response. In contrast, the adaptive immune system utilizes highly specialized immune cells called lymphocytes that have been selected to recognize specific foreign antigens. Although it takes longer to mobilize, the adaptive immune system is capable of providing long-term, more effective immunity against specific pathogens by being able to recall prior antigen exposure and mounting a very powerful and specific response.

In order for the adaptive immune system to function effectively, the innate immune system must first present disease specific antigens to a subset of lymphocytes called T cells in order to "instruct" the T cells as to which antigen they must recognize. The T cell population consists of CD8+ T cells, those that kill virus-infected and cancer cells by releasing cytotoxic proteins, and CD4+ T cells that help or stimulate additional parts of the immune system such as B cells that produce antibodies. Antigen presentation to T cells is mediated by antigen presenting cells, or APCs, the most important being the dendritic cells.

Immunotherapy and Current Limitations

The clinical application of immunotherapy in the context of managing infectious diseases and cancers is distinctly different. The approach taken for infectious diseases is commonly that of "vaccination," whereby the aim is to prevent onset of disease by administering a derivative of the disease causing agent to a healthy individual. In contrast, for cancer, the approach is typically one of therapeutic intervention in patients with active disease.

Infectious disease and cancer immunotherapies represent areas of medicine with high potential for prophylactic and therapeutic benefit and have generated significant interest and investment from leading biopharmaceutical companies. Data from ongoing industry and academic research have demonstrated the potential clinical benefit for patients in a range of infectious disease and cancer settings and several immunotherapy products have been approved by the FDA, the European Medicines Agency, or the EMA, and other foreign regulatory agencies. However, despite ongoing development efforts and successes, we believe that the current immunotherapies are limited by several factors, including:

Lack of Robust CD8+ T Cell Response. Dendritic cells are the most efficient antigen-presenting cells of the body and the natural mechanism by which to induce a robust CD8+ T cell response to fight the disease. However, we do not believe there are any existing immunotherapies that have the ability to independently and directly deliver full length proteins to target and activate dendritic cells to present antigens directly to CD8+ T cells. This limitation prevents them from inducing a robust and durable CD8+ T cell response.

Presence of Virus Neutralizing Antibodies and Pre-Existing Immunity. Nearly all viral vectors used to deliver antigens elicit neutralizing antibodies against both the desired target and the vectors themselves. In some cases, these circulating antibodies can be present before treatment is commenced owing to prior virus exposure. The presence of pre-existing vector-neutralizing antibodies can reduce or eliminate the viral vector's ability to elicit CD8+ T cell and antibody responses to the desired antigen. For example, a significant proportion of the global population carries adenovirus 5 neutralizing antibodies from natural infection which can affect vector immunogenicity. Even in the absence of pre-existing immunity, if virus neutralizing antibodies are induced in response to immunization, such as is the case with recombinant adenovirus or poxvirus-based vaccines, repeat doses administered to the patient may also be rendered ineffective or impractical.

Safety and Toxicity Concerns. Some immunotherapies, such as engineered T cells (CAR-T and TCR-T), use artificial constructs that bypass normal control mechanisms of the immune system. As a result these approaches have the risk of causing life-threatening immune reactions, including cytokine release syndrome, and can have various other toxicity concerns.

Clinical Application. Two common limiting factors of many immunotherapies are the inability to deliver full length proteins directly to dendritic cells and the inability to be administered systemically. The former limitation restricts these therapies to being patient-specific as they can only deliver smaller proteins such as neoantigens and it furthermore prevents an "off-the-shelf" approach. The latter restricts their application only to tumors that are amenable to intratumoral administration, as is the case for oncolytic viruses.

Handling and Manufacturing. *Ex vivo* approaches, such as CAR-T, require CD8+ T lymphocytes to be isolated from cancer patients, manipulated, substantially expanded and delivered back into the patient. This represents a costly, time-consuming and substantially more complex approach.

Unlike with cancer treatment, immunotherapies in the context of infectious diseases, commonly stimulate an antibody response that is dependent on the presence of CD4+ T cells. We believe that a vaccine approach that can generate the combination of CD8+ T cells with an antibody response offers a solution to optimally mobilize the immune response and potentially overcome many of the limitations that exist with current approaches.

Our Technology Platform

Our proprietary platform is based on engineering arenaviruses to carry and deliver virus-specific or tumor-specific genes to dendritic cells, which are natural activators of CD8+ T cells. Arenaviruses have been used for decades to stimulate potent CD8+ T cells responses in preclinical research. Our co-founder, Rolf Zinkernagel, was awarded a Nobel Prize in Physiology or Medicine for his arenavirus-based work on how CD8+ T cells recognize virus-infected cells.

Arenaviruses have several important advantages, which we believe represent the optimal characteristics for an antigen-specific immunotherapy. Specifically, they:

- have the ability to induce a robust CD8+ T cell response by directly targeting and activating dendritic cells, which are the most efficient antigen-presenting cells of the body;
- have the ability to induce a robust antibody response to disease-specific target antigens;
- are not neutralized by vector-specific antibodies, thereby allowing for repeat administration that can further boost immune response;
- do not require an adjuvant to stimulate the immune system; and
- have been observed to be well tolerated in preclinical studies and clinical trials.

The arenavirus family is comprised of 24 currently known species, many of which we believe have potential prophylactic and therapeutic applications. We believe we are the first to reengineer arenaviruses for the prevention and treatment of disease. We have created two types of viral technologies capable of delivering disease-specific antigens: VaxWave, a replication-defective vector, and TheraT, a replication-competent but attenuated vector.

Our VaxWave and TheraT technologies utilize both lymphocytic choriomeningitis, or LCMV, and Pichinde virus, or PICV, two of the 24 species of arenaviruses, as a backbone of the product candidates we are developing. LCMV is principally carried and secreted by wild mice, with human infection being secondary to such exposure and uncommon. Approximately 2% to 5% of individuals in industrialized countries have circulating antibodies against LCMV, which indicates prior exposure in these individuals. Individuals infected with LCMV typically remain asymptomatic or may present with a non-specific and self-resolving flu-like illness. PICV is principally carried and secreted by Colombian rice rats (*oryzomys albigularis*) and is a nonpathogenic virus that does not cause disease in humans.

VaxWave Overview

Our proprietary VaxWave technology disables arenavirus replication by substituting one of its four structural genes with the gene for a desired antigen. The modified, replication-defective arenavirus is able to directly infect individual dendritic cells and deliver proteins that serve as antigens to activate the immune system, but is not able to replicate and infect additional dendritic cells in the body.

Advantages of VaxWave

Based on the preclinical and clinical data that we have generated to date, we believe our VaxWave technology supports the benefits of our arenavirus platform approach. Specifically, in preclinical studies and clinical trials VaxWave has demonstrated that it is well tolerated and has the following additional benefits:

Robust CD8+ T Cell Response as Well as Pathogen Neutralization Response. Our VaxWave technology is designed to induce a robust CD8+ T cell and pathogen neutralizing response to fight disease. We believe our technology results in an immunotherapeutic approach with potential for greater potency than existing prophylactic treatments.

Immunological Memory and Protection Against Challenge. Our VaxWave technology has shown the ability to trigger a long term CD8+ T cell response of at least 12 months. Furthermore, in various animal models VaxWave immunization resulted in protection against infectious challenge.

Lack of Vector-specific Neutralizing Antibodies. Our VaxWave technology does not generate clinically meaningful vector-specific neutralizing antibodies, allowing for repeat administration which can further boost the immune response.

TheraT Overview

Our proprietary TheraT technology is replication-competent but attenuated. The intent of designing a replicating vector was to allow it to retain all of the beneficial properties of VaxWave but to induce an even more robust immune response. Unlike naturally occurring arenaviruses which have two genomic segments, our TheraT constructs were engineered to have three segments in order to allow for the introduction of genomic space in which to insert additional target antigens of choice. As a result of the larger genome the virus' ability to replicate is naturally attenuated.

Advantages of TheraT

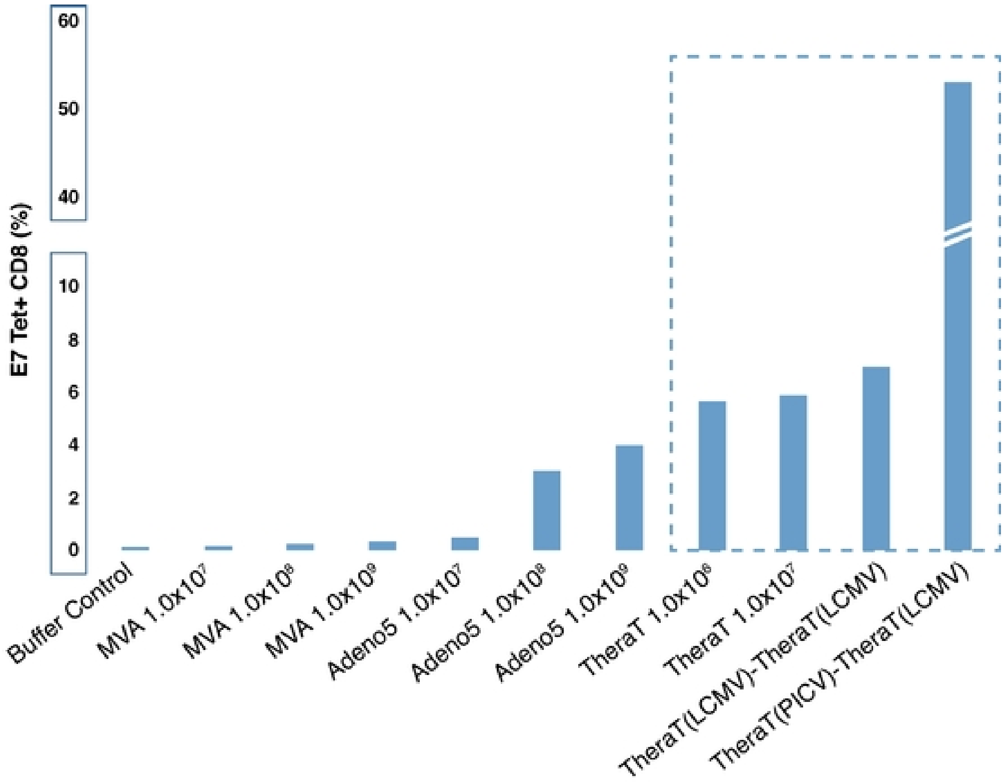
Based on the preclinical data that we have generated to date, we believe our TheraT technology supports the benefits of our arenavirus platform approach. In addition to having the advantages of VaxWave technology, in preclinical studies TheraT has shown the following additional benefits:

Quantitatively; Even More Robust CD8+ T Cell Response. Our TheraT technology is designed to induce a CD8+ T cell response that directs more than 50% of a body's T cells, which is approximately ten times greater than the response induced by VaxWave, to focus on a single target of choice. We believe our technology results in an immunotherapeutic approach with potential for greater potency than existing therapeutic treatments.

Qualitatively; Immunological Memory and Protection Against Challenge. Our TheraT technology has shown the ability to trigger a long term CD8+ T cell response. Furthermore, in various animal models TheraT immunization resulted in protection against a cancer re-challenge months after primary treatment and response to TheraT.

The additional benefits of TheraT are attributable to its ability to replicate. This allows it to infect not only dendritic cells but also lymphoid stromal cells, which are immune support cells found in lymph nodes and the spleen. Infection of lymphoid stromal cells results in the release of a signaling protein which further drives the proliferation and differentiation of CD8+ T cells. This mechanism has the potential to generate ten-fold more antigen-specific CD8+ T cells as compared to viral delivery systems that are unable to trigger this pathway. Furthermore, we believe TheraT-induced CD8+ T cells do not need the addition of commonly used checkpoint inhibitors to function at optimal potency, as they are able to establish long-lasting interactions with their target cells inside solid tissues and kill them.

To demonstrate the superior properties of our approach, we performed a head-to-head comparison in mice of our TheraT LCMV and PICV E7 constructs versus modified vaccinia virus Ankara, or MVA, and adenovirus 5, or Adeno5, each expressing E7 antigens for their ability to induce E7-specific CD8+ T cells. As shown below, our TheraT constructs were superior to MVA and Adeno5, despite being dosed at concentrations 1,000 times lower than the latter two vectors. Furthermore, sequential dosing of TheraT(PICV) followed by administration of TheraT(LCMV) resulted in over 50% of CD8+ T cells being targeted against E7.



In additional preclinical models, including a mouse melanoma model and a cancer-testis self-antigen cancer model, we again demonstrated the ability of sequential administration of TheraT PICV and LCMV constructs to direct up to 50% of a body's T cells to focus on a single target of choice.

VaxWave Preclinical Data

We believe our preclinical data support the development of VaxWave for prophylactic and therapeutic uses for infectious disease.

HIV Model

We conducted a preclinical study in a monkey model of HIV infection using simian immunodeficiency virus, or SIV. We treated ten monkeys using an adenoviral vector carrying the SIV

Env protein. The expression of the SIV Env protein is meant to prime the animal's immune system to detect and attack SIV. From earlier work, this initial adenoviral-Env prophylactic immunization on its own was shown not to prevent SIV infection. We then boosted the monkeys eight weeks later with an LCMV vector encoding SIV Env. We also treated ten monkeys with vectors encoding no relevant genes, identified as the null group below. Starting at week six, both groups were challenged with weekly SIV injections for 12 weeks. The dosing regimen of the study is shown in Figure 1 below. As depicted in the Figure 2 below, the VaxWave(LCMV)-Env vaccination resulted in over 70% of monkeys being SIV free at the end of the trial, as compared to less than 20% in the null group.

Figure 1

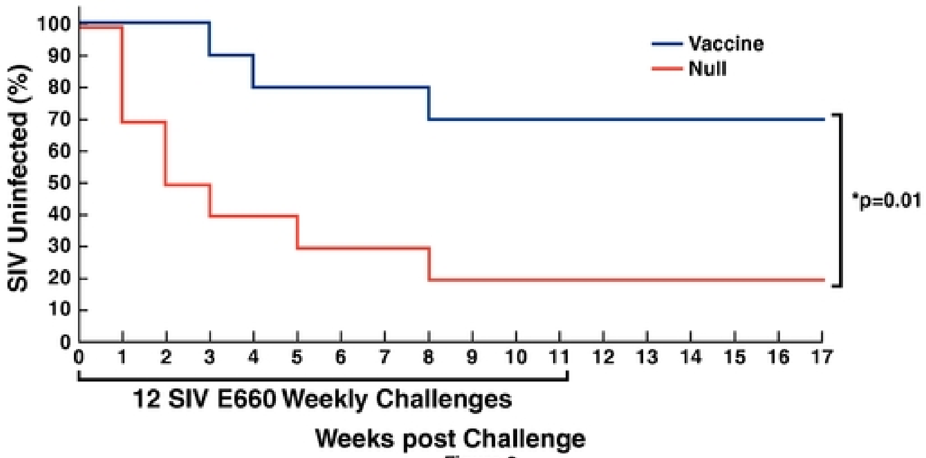


Figure 2

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* A p-value of 0.05 or less represents statistical significance, meaning that there is a less than 1-in-20 likelihood that the observed results occurred by chance. A p-value of 0.01 or less means that there is a less than 1-in-100 likelihood that the observed results occurred by chance.

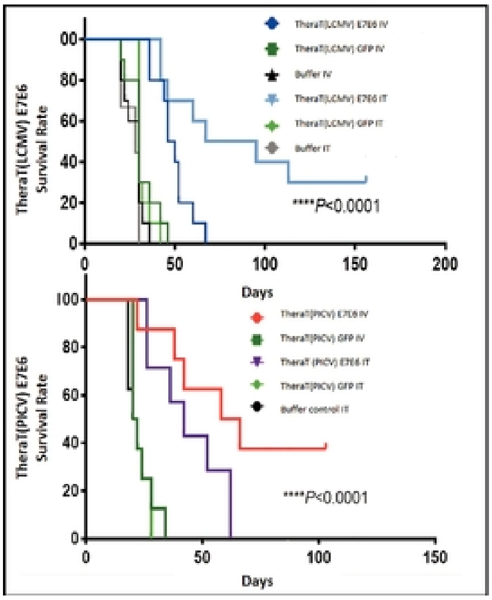
HBV Model

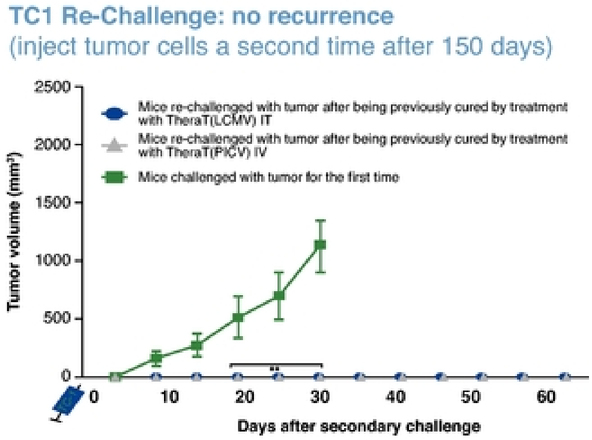
In addition to the HIV model, we explored the ability of our VaxWave vectors to induce immune responses against hepatitis B core, HBc, and hepatitis B surface, HBs, antigens. In our study, we observed that VaxWave(LCMV) expressing both HBc and HBs was able to generate significant CD8+ T cell responses against both proteins. These data indicate that a single dose of VaxWave expressing HBV antigens elicits robust cellular immunity against both encoded proteins delivered in a single vector. We believe that VaxWave-based immunotherapy may form an important cornerstone of a potential cure for the estimated 350 million people worldwide, who are persistently infected with HBV.

We believe that the combination of our HIV and HBV preclinical and subsequent VaxWave clinical data facilitated our Gilead collaboration.

TheraT Preclinical Data

We have conducted several preclinical studies assessing the efficacy of our TheraT technology, for both LCMV and PICV constructs, carrying the HPV specific E7/E6 fusion protein through intravenous, or IV, and intratumoral, or IT, administration. Mice treated with the replication-attenuated TheraT vectors showed no evidence of toxicity. In a mouse model of HPV-induced cancer (TC1), we observed that a single intravenous administration of TheraT(LCMV) significantly suppressed and delayed tumor growth while a single intratumoral administration of TheraT(LCMV) eliminated the tumor in approximately half of the mice (top left panel). Intravenous administration of TheraT(PICV) eliminated the tumor in approximately half of the mice, by the same definition, while intratumoral administration of TheraT(PICV) significantly suppressed and delayed tumor growth (bottom left panel). These mice had complete remission without recurrence for at least six months, which represents over 25% of a mouse's lifetime (right panel). In contrast, TheraT vectors carrying non-tumor specific antigens, such as GFP, demonstrated no anti-tumor activity. In these studies, we also observed resistance to a tumor re-challenge after six months (right panel).





We have also performed "tracking" experiments wherein we observed that while our intravenous TheraT vectors travel to dendritic cells, the reprogrammed antigen CD8+ T cells travel to tumors. We illustrated this in an EG7-OVA model, which analyzed subcutaneous tumors for the presence of antigen specific CD8+T cells. In mice injected with a TheraT vector, histopathology showed clear evidence of strong CD8+ T cell infiltration, as shown by the brown staining in the pictures below.

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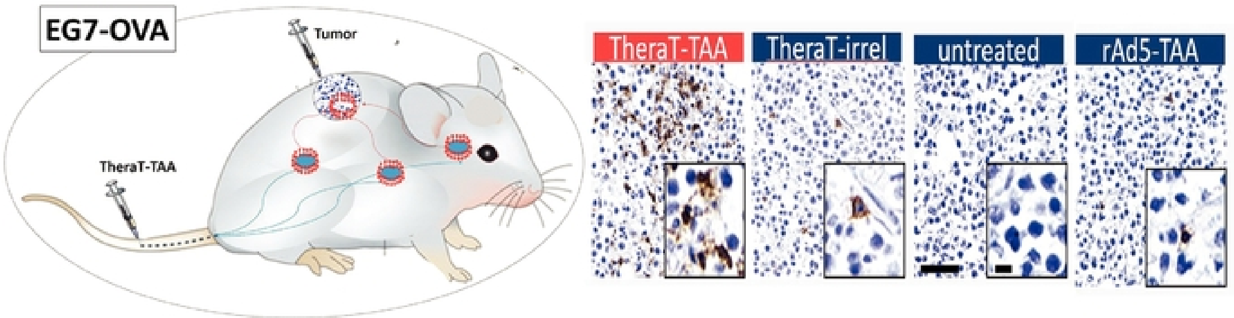
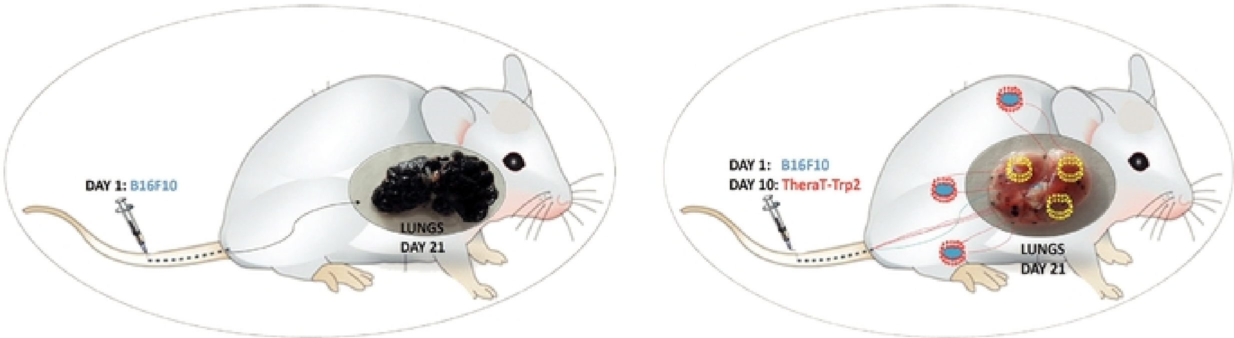
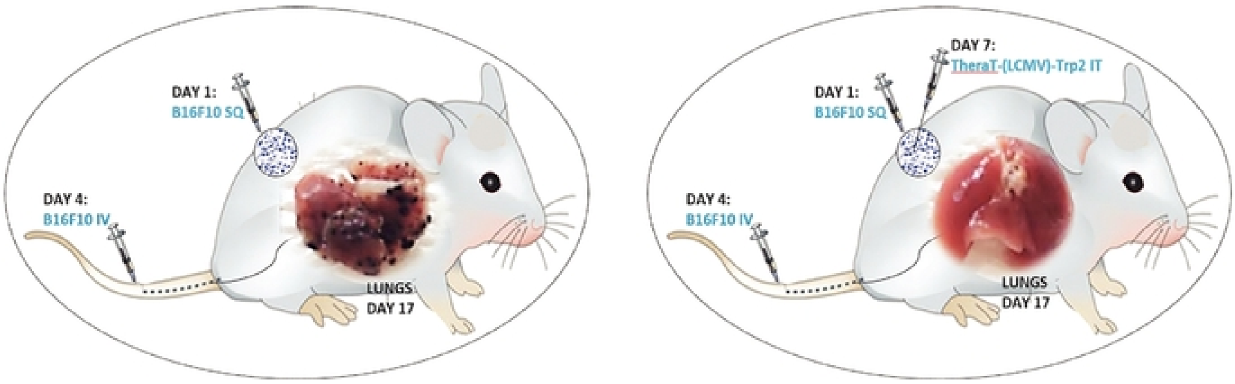


We observed similar results in a more aggressive B16F10 melanoma mouse model. In this experiment B16F10 malignant cells were introduced into the tail vein of mice, resulting in lung metastases within three weeks. Ten days after the introduction of B16F10, a TheraT vector expressing Trp2, a melanoma antigen, was introduced intravenously leading to a significant delay in disease progression. Similarly, in subcutaneously growing B16F10 tumors treated intravenously, histopathology showed clear evidence of strong CD8+ T cell infiltration.

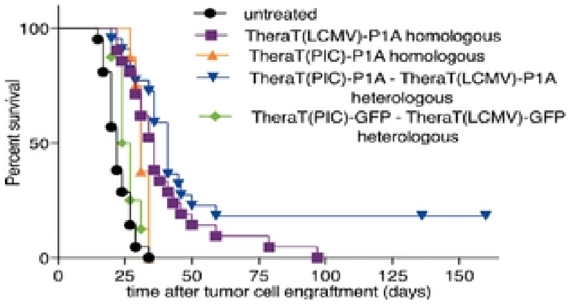


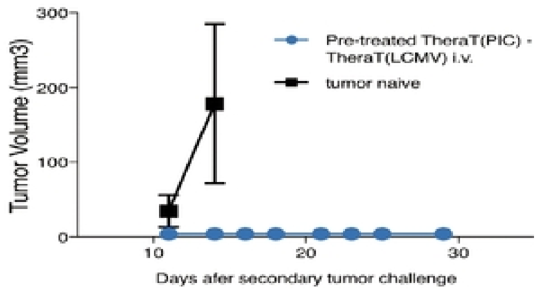
When we combined the above two experiments, by initially introducing B16F10 malignant cells subcutaneously, and then intravenously, we achieved both a localized subcutaneous tumor and metastatic lung lesions. Subsequent administration of our intratumoral TheraT vector demonstrated both a localized response, through subcutaneous tumor shrinkage, and systemic response, through clearance of lung metastases. The long term survivor mice were then re-challenged with B16F10 several months after remission with no observed subsequent tumor regrowth.



Advantages of sequential administration of TheraT(PICV) and TheraT(LCMV)

We have observed increased anti-tumor activity and survival of animals that received sequential administration of TheraT(PICV) and TheraT(LCMV) in a preclinical mastocytoma model. In this model, tumor cells expressed a cancer-testis self-antigen known as P1A. In the absence of treatment, tumors grew rapidly and most of the mice died by day 25. When given a first dose with a TheraT(LCMV) P1A vector, followed by a second dose with the same vector, there was a delay in tumor growth of approximately ten days and an increase in survival rates, with some mice surviving to almost 100 days (left panel below). In contrast, mice that were treated first with TheraT(PICV) P1A followed by a second dose with a different arenavirus, TheraT(LCMV) P1A, had an average tumor growth delay of approximately 25 days and in 18% of the mice the tumors were eliminated and they survived beyond the 160 days of the study. Furthermore, and as seen in our other studies, mice with eliminated tumors demonstrated resistance to a tumor re-challenge (right panel below).





Our Product Candidates

HB-101, a Prophylactic Vaccine for Cytomegalovirus

HB-101 is a VaxWave product candidate that delivers two clinically validated antigens: pp65, to induce cytomegalovirus-specific CD8+ T cells, and gB, to elicit cytomegalovirus-neutralizing antibodies. Cytomegalovirus infections present a serious risk for patients with suppressed immune systems, such as solid organ and stem cell transplant recipients. In our Phase 1 clinical trial, HB-101 was well tolerated and elicited strong and durable cytomegalovirus-specific immune responses in all 42 volunteers in the treatment arm. Importantly, we observed robust CD8+ and CD4+ T cell responses as well as cytomegalovirus-neutralizing antibody responses. As anticipated, the LCMV vector did not elicit clinically meaningful vector-neutralizing antibodies, as only one volunteer developed a transient neutralizing antibody response against the vector after three administrations. The pp65 CD8+ T cell levels achieved by VaxWave in healthy volunteers were in the range of, or higher than, the therapeutic levels published by third parties in separately designed and conducted adoptive T cell transfer clinical trials, in which CD8+ T cells directed against pp65 were isolated from exposed individuals and transferred to patients with active cytomegalovirus viremia. Furthermore, upon repeat administration, the pp65 CD8+ T cell levels achieved by VaxWave increased in a statistically significant manner. In the fourth quarter of 2018, we commenced a randomized, double-blinded Phase 2 clinical trial for HB-101 in cytomegalovirus-negative patients awaiting kidney transplantation from living cytomegalovirus-positive donors. We expect immunogenicity data from the first cohorts enrolled in this trial in the first half of 2020, and efficacy data to follow in the second half of 2020. We intend to pursue regulatory approval for HB-101 for the prevention of cytomegalovirus in all solid organ transplants regardless of cytomegalovirus status of the recipient. In the future, and in the event of successful proof of concept of HB-101 in the Phase 2 clinical trial, we may pursue additional indications such as stem cell transplantation and congenital cytomegalovirus infection.

Cytomegalovirus

Cytomegalovirus is a virus that is commonly transmitted in childhood and early adulthood. Approximately 60% of the U.S. population has been exposed, and as such, is latently infected. Worldwide data indicate that while half the people in industrialized countries have been exposed, up to

99% of people in developing countries, including China and India, have been exposed. Infections result in lifelong latent persistence of the virus with few symptoms, if any. However, in immunosuppressed patients, such as transplant recipients, primary cytomegalovirus infection or reactivation generally causes significant morbidity, mortality and graft rejection. There are two scenarios in which cytomegalovirus infections are relevant in the transplant setting. In one case, the recipient could be cytomegalovirus negative, or previously uninfected, and the donor cytomegalovirus positive. In this case, introduction of cytomegalovirus into the immunocompromised recipient can lead to rapid virus spread and development of serious complications. In the other case, the recipient is already cytomegalovirus positive, but the immunosuppressive treatments required as part of the transplant procedure lead to reactivation of latent virus. Based on a recent market research study we commissioned from an independent third party, we believe that approximately 110,000 patients are added to the solid organ transplant waiting list annually in developed countries, with kidney transplantation representing approximately 60% of cases. Furthermore, more than 20,000 allogeneic cell transplants, in which cell and tissue donors are matched with transplant recipients, are carried out annually worldwide. In this group, the incidence of cytomegalovirus infection is approximately 30% as a result of the donor being cytomegalovirus positive. Current therapies to prevent the transmission of cytomegalovirus during organ transplants utilize antiviral prophylactic and therapeutic strategies. However, these therapies are only partially protective in preventing viral disease while also being hampered by toxicity and resistance.

There are currently two standards of care to deal with cytomegalovirus during solid organ transplant; prophylactic and preemptive. In prophylactic therapy, patients are given antiviral drugs for several months after transplant. Antivirals can reduce the rate of cytomegalovirus viremia from approximately 70% to 36% in kidney transplant patients over a 12 month period. Of the 36% that present with viremia, most of these cases emerge once antiviral treatment has been stopped. In preemptive therapy, patients are intensively monitored post-transplant for cytomegalovirus reactivation using laboratory diagnostics, and short-term antiviral treatment is given only to those with significant viral loads, or cytomegalovirus viremia, before symptoms and overt cytomegalovirus disease occur. In preemptive therapy, most infections occur within three months following a transplant. However, the antiviral drugs used to treat cytomegalovirus have the potential to induce significant toxicities, including bone marrow toxicity for ganciclovir, valganciclovir and cidofovir, and renal toxicity for foscarnet and cidofovir. In addition, cytomegalovirus drug resistance mutations arise during this antiviral therapy. Despite the use of prophylactic and preemptive therapy using small molecule antivirals, many transplant patients develop serious symptomatic complications from cytomegalovirus, highlighting the need for new treatments.

Cytomegalovirus in Kidney Transplant Patients

In 2015, approximately 85,000 of the approximately 126,000 solid organ transplants performed worldwide were kidney transplants, an increase of 5.5% over the previous year. Approximately 80% of high risk kidney transplant recipients develop active cytomegalovirus infections. High risk recipients are defined as cytomegalovirus-negative patients receiving kidney transplants from cytomegalovirus-positive donors. In most solid organ transplant patients, complications from cytomegalovirus develop between 30 and 90 days after transplantation and rarely after 180 days.

Our Solution, HB-101

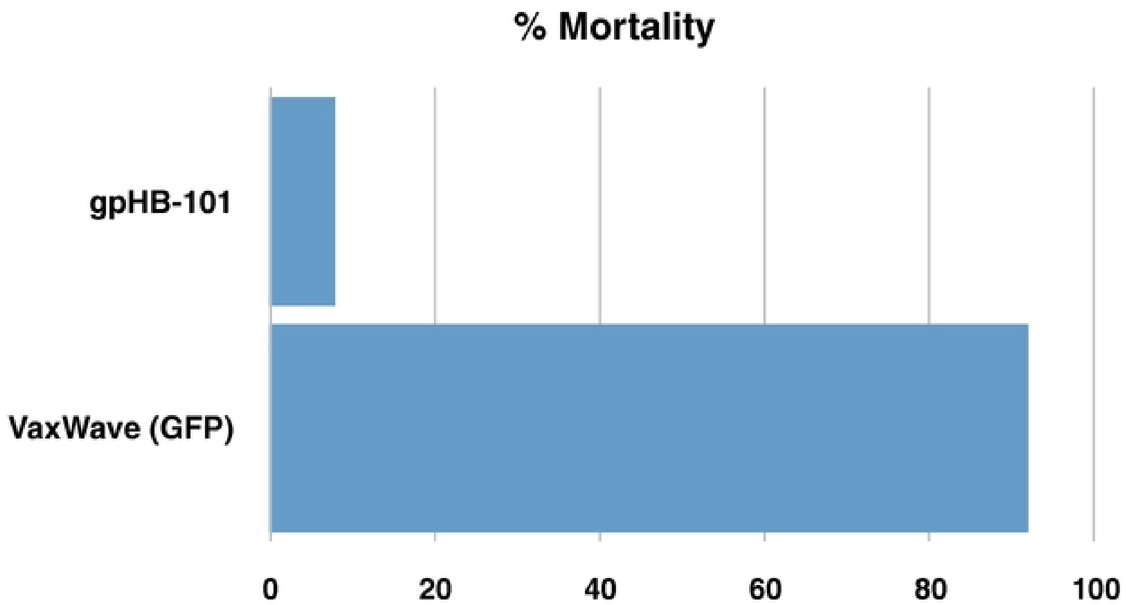
HB-101 is a VaxWave-based product candidate designed to stimulate the immune system against cytomegalovirus and to protect against future cytomegalovirus infection or reactivation from latency. HB-101 is comprised of two VaxWave(LCMV)-based vectors:

- one vector expresses the gene encoding the cytomegalovirus 65 kD pp65 protein; and
- another vector expresses the gene encoding the cytomegalovirus gB protein.

We, and third parties, have shown that pp65 is immunogenic. Adoptive T cell transfer approaches performed by third parties, in which CD8+ T cells directed against pp65 are isolated from exposed individuals and transferred to patients with active cytomegalovirus viremia, have also demonstrated the therapeutic efficacy of pp65. However, no vaccine approach to date has been successful in achieving CD8+ T cell levels sufficiently high enough to be protective. gB has been shown in previous third-party clinical trials to be immunogenic and protective by inducing antibody responses but not CD8+ T cells. However, response rates were limited, immunity was transient and protection was incomplete. In our preclinical data, using pp65 and gB as targets, we have observed robust immunogenicity, activity and durability thereby potentially overcoming the limitations of current approaches.

HB-101 Preclinical Results

In preclinical studies, we have observed that HB-101 has the ability to improve the survival rates in animal models in a statistically significant manner. In our study, non-pregnant female guinea pigs were administered three doses of HB-101 at 30-day intervals. Thirty days after the last vaccination, females were allowed to mate. Following conception, the pregnant females were infected with cytomegalovirus during the gestation period, putting the guinea pig pups at risk of severe viral infection, low birth weight and potential mortality. As depicted below, guinea pig pups born to cytomegalovirus-infected females that had received a guinea pig equivalent of HB-101 (gpHB-101) had a statistically significant ($p<0.0001$) lower mortality rate at birth compared to those born to females who had only received a VaxWave carrying an irrelevant antigen, labeled as GFP in the figure below. Cytomegalovirus-positive pups born to mothers that received gpHB-101 vaccination also gained weight more rapidly and had improved survival rates as compared to those born to mothers vaccinated with placebo.

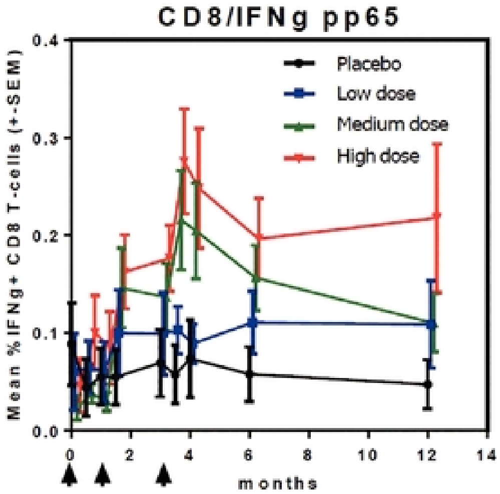


HB-101 Phase 1 (H-100-001) Clinical Results

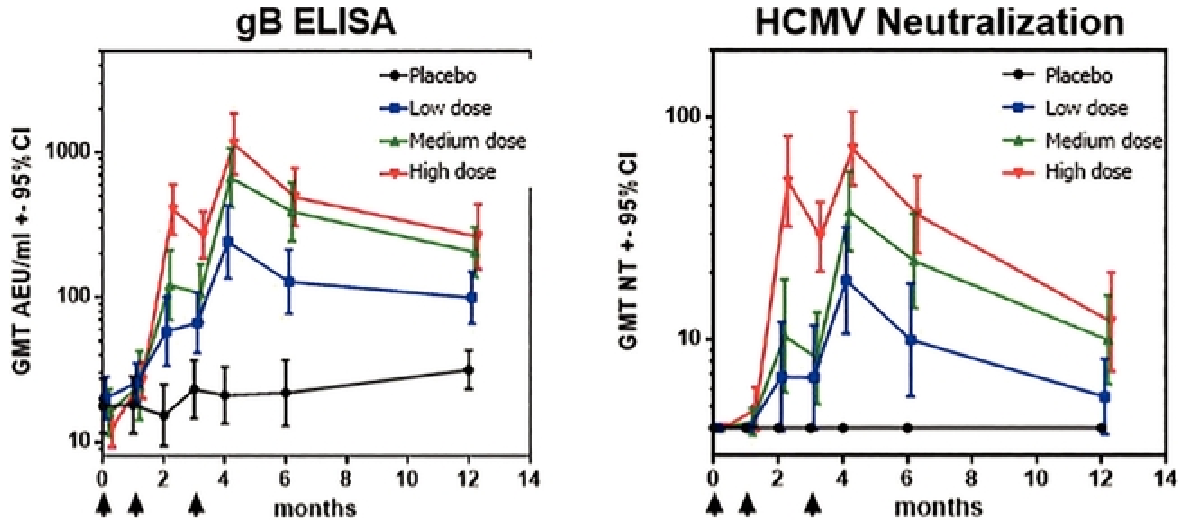
We conducted a placebo-controlled, randomized double-blinded dose escalating Phase 1 clinical trial of HB-101 to assess the vaccine's safety and immunogenicity. In this trial, 54 healthy volunteers aged 18 to 45 were administered three consecutive doses of either HB-101 or placebo by intramuscular injection at month zero, one and three, then monitored for one year after the initial dose. The volunteers were randomized into three cohorts of 18 volunteers, with 14 volunteers receiving the study drug and four receiving placebo in each cohort.

We observed that HB-101 was well tolerated with no dose limiting toxicities. There were no treatment-related adverse events that resulted in early withdrawal from the trial, and no serious adverse events were reported. There was not a statistically significant difference in the percentage of subjects reporting severe causally-related adverse events as compared to placebo. The most commonly reported adverse events in subjects receiving HB-101 were local pain, fatigue, malaise and generalized muscle pain, all of which resolved within eight days.

In addition, HB-101 elicited a strong, dose-dependent, and durable response as measured by the frequency of pp65-specific interferon-gamma, or IFNg, producing CD8+ T cells. Each administration of HB-101, as depicted by the black arrows in the figure below, resulted in an increase in IFNg producing CD8+ T cells, demonstrating the potential and rationale for repeat administrations of HB-101. Importantly, the frequencies of IFNg producing CD8+ T cells induced by the highest dose of HB-101 after the third administration in healthy volunteers were in the range of, or higher than, the therapeutic levels reported in human adoptive T cell therapy clinical trials which were separately designed and conducted by third-parties for patients with active cytomegalovirus viremia. These frequencies were observed to be therapeutic in patients experiencing active cytomegalovirus infection following stem cell as well as organ transplantation.

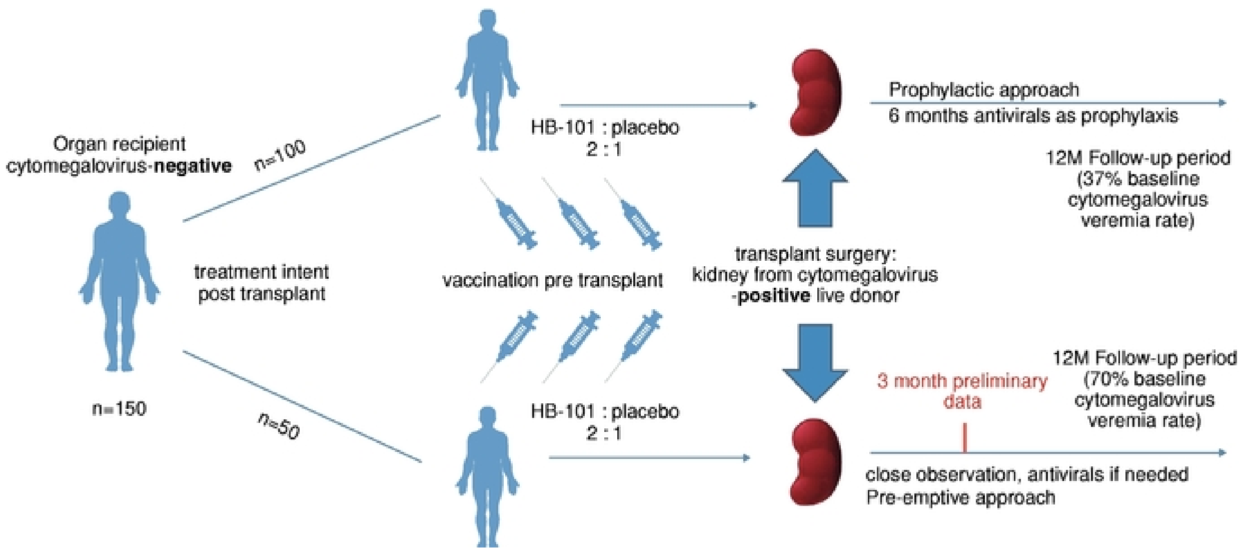


Similarly, HB-101 administration also resulted in a strong neutralizing antibody response to the cytomegalovirus antigen gB that increased with each additional dose, as depicted by the black arrows in the figures below, which was sustained over the twelve-month follow up period. All volunteers receiving the highest or middle doses of HB-101, and 92% of the volunteers receiving the lowest dose, developed cytomegalovirus-neutralizing antibodies. The levels of antibodies generated in the highest dose after three doses were comparable to therapeutic levels reported with other cytomegalovirus vaccine product candidates in development that have demonstrated clinical efficacy in separately designed and conducted, published third-party clinical trials. As anticipated, the LCMV vector did not elicit clinically meaningful vector-neutralizing antibodies, as only one volunteer developed a transient neutralizing antibody response against the vector after three administrations. We believe that a fourth administration of the vaccine in all 42 of these volunteers could have resulted in an additional antibody response, if desired.



HB-101 Clinical Development Plan

In the fourth quarter of 2018, pursuant to an IND filed by us with the FDA in July 2018, we initiated a randomized, double-blinded Phase 2 trial of HB-101 to assess the safety, reactogenicity, immunogenicity and efficacy of HB-101 in cytomegalovirus-negative patients receiving a kidney transplant from living cytomegalovirus-positive donors. The primary endpoint of this trial will evaluate safety and immunogenicity of HB-101. The secondary endpoint will evaluate efficacy, which is defined as the reduction of viremia, as well as the decreased need to use antivirals. We plan to enroll a total of 150 patients, randomized 2:1 between the study drug and placebo, in two treatment groups. The first group will be randomized to receive two to three administrations of either HB-101 or placebo prior to transplant and then treated with standard preemptive anti-viral therapy post-transplant. The second group will be randomized to receive two to three administrations of either HB-101 or placebo before transplant, and will then receive three to six months of anti-viral prophylaxis therapy post-transplant. Patients will be monitored for twelve months post-transplant to assess safety and T cell and antibody responses to pp65, gB and the LCMV vector, as well as cytomegalovirus viremia and the need for use of antivirals. The trial design is depicted in the figure below.



H-200 Program for the Treatment of HPV16+ Positive Cancers

We are currently developing two immunotherapeutics targeting HPV16+ cancers.

HB-201 is a TheraT(LCMV)-based product candidate expressing the E6/E7 fusion protein specific to HPV16+ cells and being developed for the treatment of HPV16+ cancers, including head and neck squamous cell carcinoma, or HNSCC, cervical and anal cancer. HB-201 will be studied as both monotherapy and in combination with a checkpoint inhibitor.

HB-202 is a TheraT(PICV)-based product candidate expressing the E6/E7 fusion protein and also being developed for the treatment of HPV16+ cancers, including HNSCC, cervical and anal cancer. HB-202 will be studied in combination with HB-201, both with and without a checkpoint inhibitor. Our preclinical data support the concept that the combination of two different TheraT constructs based on different arenaviruses, but carrying the same tumor antigen results in an exponentially more robust immune response with potential improvements in anti-tumor activity.

We plan to initiate a Phase 1/2 clinical trial for HB-201 in patients with treatment-refractory HPV16+ cancers in the second half of 2019 and expect preliminary results in the second half of 2020. We also plan to combine HB-201 with a checkpoint inhibitor and to commence a Phase 1/2 trial combining HB-201 and HB-202, both with and without a checkpoint inhibitor, in patients with treatment-refractory HPV16+ cancers in the second half of 2020.

HPV-Positive Cancers

HPV is estimated to cause about 5% of cancers worldwide, including approximately 99% of cervical cancers, 25% to 60% of HNSCC, 70% of vaginal cancers and 88% of anal cancers, the majority of which are caused by the HPV serotype 16. While most infections with HPV are cleared from the body with no lasting consequences, in some cases, HPV DNA becomes integrated into chromosomal DNA. When host cells take up this DNA, they express the HPV E6 and E7 proteins. The expression of these proteins can potentially cause cancer because they can lead to alterations in cell cycle control, which in turn predisposes these cells to become cancerous.

While the rates of HNSCC from causes such as smoking and alcohol are decreasing, the rates of HPV16+ HNSCC are increasing. HNSCC is the fifth most common form of cancer. Each year, HNSCC is diagnosed in more than 600,000 people worldwide, with 65,000 new cases and more than 13,700 deaths occurring in the United States alone. HNSCC includes tumors of the oral cavity, oropharynx, larynx and hypopharynx. The current standard of care for HNSCC is the same regardless of HPV status. Treatment typically involves a combination of chemotherapy, radiation and surgery. These treatments are associated with acute and long-term effects including mucositis, swallowing dysfunction, dry mouth, and dental problems. The overall survival rate for patients with advanced metastatic HNSCC progressing on platinum and checkpoint based therapies is less than six months. While there is no T cell therapy approved for HNSCC, retrospective analyses have shown that patients with high levels of CD8+ T cells in tumors have a much better prognosis. In many cases, the survival rate of these patients is more than double that of patients with lower levels of CD8+ T cells.

We believe that evaluating the potential of our product candidates for the treatment of HPV16+ HNSCC is a rational clinical development strategy as there is precedent data supporting the efficacy of immunotherapy in this patient population. In developed countries, HPV16+ HNSCC accounts for only 13% of the approximately 120,000 annual cases of HPV+ cancers. In contrast, in less developed countries, HPV+ HNSCC accounts for just 1% of 490,000 annual HPV-related cancer cases. Proof of concept in either HPV16+ HNSCC or HPV16+ non-HNSCC could support the potential of our product candidates to be effective for all HPV16+ cancers, regardless of the cancer's tissue of origin.

Our Solution HB-200 Programs: HB-201 and HB-202

Both HB-201(LCMV) and HB-202(PICV) are TheraT-based product candidates expressing a non-oncogenic but highly antigenic E6/E7 fusion protein from HPV16. In animal models, HB-201 was observed to be highly immunogenic, resulting in a robust CD8+ T cell response. Based on the levels of antigen-specific CD8+ T cells induced by HB-201 in preclinical models, notably when compared to therapeutic levels induced by other published approaches including adoptive cell therapies, as observed in separately designed and conducted third-party clinical trials, we believe that HB-201 monotherapy has the potential to provide therapeutic benefit to patients across the broader HPV16+ cancer setting. We have observed strong immunogenicity and robust anti-tumor activity in mouse models for HB-201 alone as well as for the sequential administration of HB-201 and HB-202.

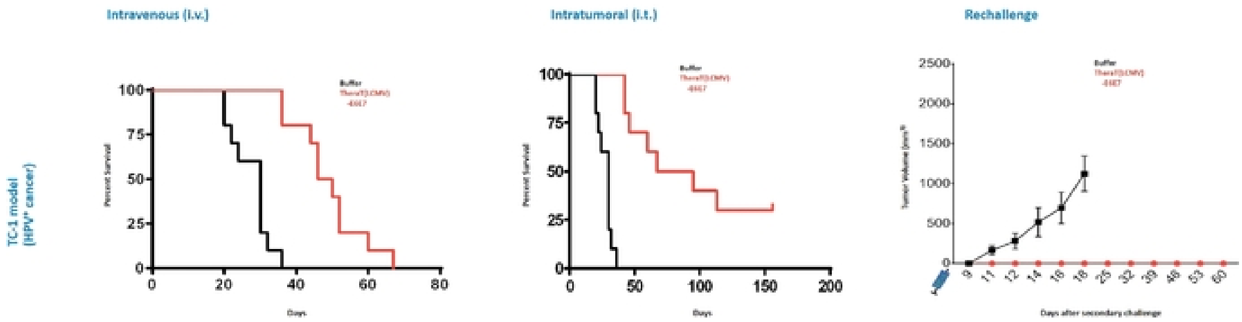
Relevance of E6 and E7 as Tumor Antigens

Integration of HPV viral sequences into the genome of a cell can result in the introduction of E6 and E7 oncoproteins. They are present in cells that become cancerous and play a critical role in interfering with cellular processes and interrupting normal tumor suppressor functions.

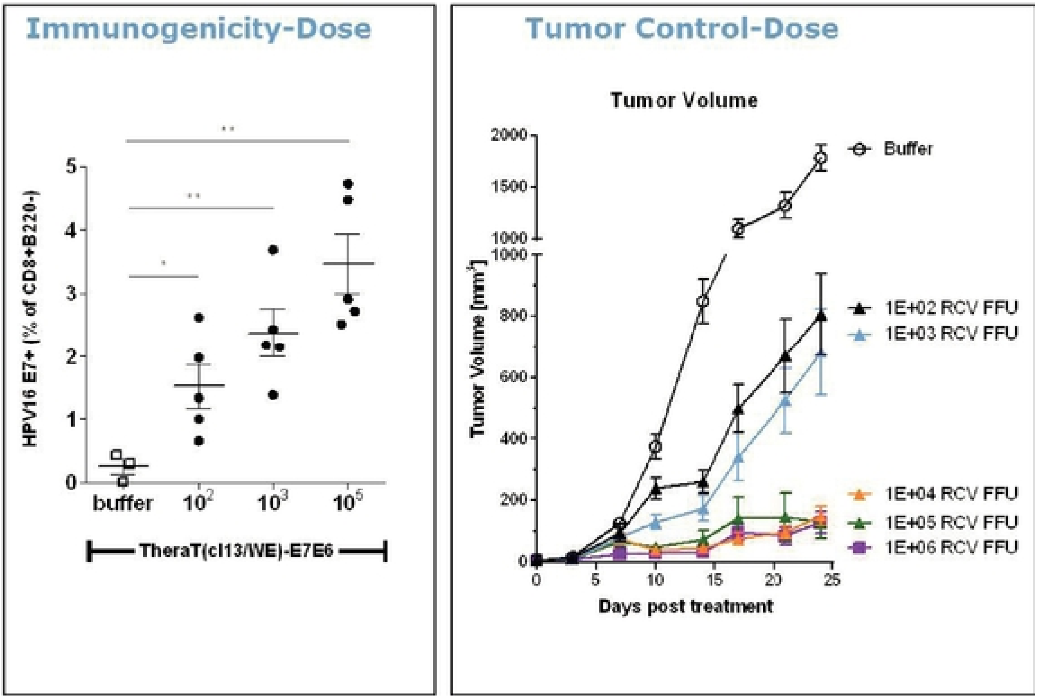
Profiling of immune cells isolated from patients with HPV16+ tumors have identified E6- and E7-specific T-cells, indicating that the E6 and E7 proteins are immunogenic, meaning that they trigger antigen-specific CD8+ T cell responses. Because both E6 and E7 are highly expressed in tumor cells and are absent in normal cells, they are ideal candidates for use as targets of tumor-directed active immunization.

HB-201 Preclinical Results

The ability of HB-201 to suppress tumor growth was tested in a TC1 mouse model of a transplantable HPV16+ E6/E7 expressing tumor. HB-201 was administered either intravenously or intratumorally to animals when tumor volume was approximately 100mm^3. In both cases, as depicted in the figures below, single doses of HB-201 led to suppression of tumor growth in a statistically significant manner ($p < 0.05$) in all treated mice, and intratumoral administrations resulted in an approximately 40% long term survival rate. When these long term survivor mice were re-challenged with the same tumor six months later, no new tumor growth was detected. We believe that these results demonstrate the potential for HB-201 to be active both in treating primary tumors and also controlling metastatic and recurring disease.



Furthermore, we have observed that the dose of HB-201 strongly correlated with both immunogenicity, as depicted in the left side of the figure below, and anti-tumor activity, as depicted in the right side of the figure below. We believe that this indicates that anti-tumor activity is directly linked to immunogenicity. Specifically, low doses of HB-201 containing as few as 100 replication-competent virus, or RCV, particles per dose suppressed tumor growth by more than 50% as compared to untreated tumors. Dosing with the highest three doses of HB-201, ranging from 10,000 to 1,000,000 RCV particles per dose, led to greater suppression of tumor growth. These data suggest that the maximal effective dose was already achieved at the lower of those three doses, or 10,000 RCV particles per dose. All doses of HB-201 were well-tolerated in this model.



HB-201 Clinical Plans

We intend to initiate an open label, dose escalating Phase 1/2 clinical trial to evaluate HB-201 in HPV16+ cancers, alone and in combination with nivolumab, an approved checkpoint inhibitor that is marketed as Opdivo by Bristol-Myers Squibb Company as a current second line standard of care therapy in patients with HPV16+ HNSCC with disease progression on or after platinum-based therapy.

We expect to enroll 100 patients in total for this trial with 20 patients in each dose escalation and expansion group, respectively. The trial will consist of two dose escalation groups in Phase 1 and three dose expansion groups in Phase 2.

For Phase 1 dose escalation, the patient population will be divided into two groups:

- Group 1 (intravenous, or IV, administration HB-201): patients with HPV16+ cancers with tumor progression or recurrence on standard of care therapy, or for whom standard of care therapy is contraindicated.

- Group 2 (intratumoral, or IT, administration of HB-201 followed by IV administration of HB-201): patients with HPV16+ cancers with a safe and accessible tumor site amenable for IT administration who had tumor progression or recurrence on standard of care therapy or for whom standard of care therapy is contraindicated.

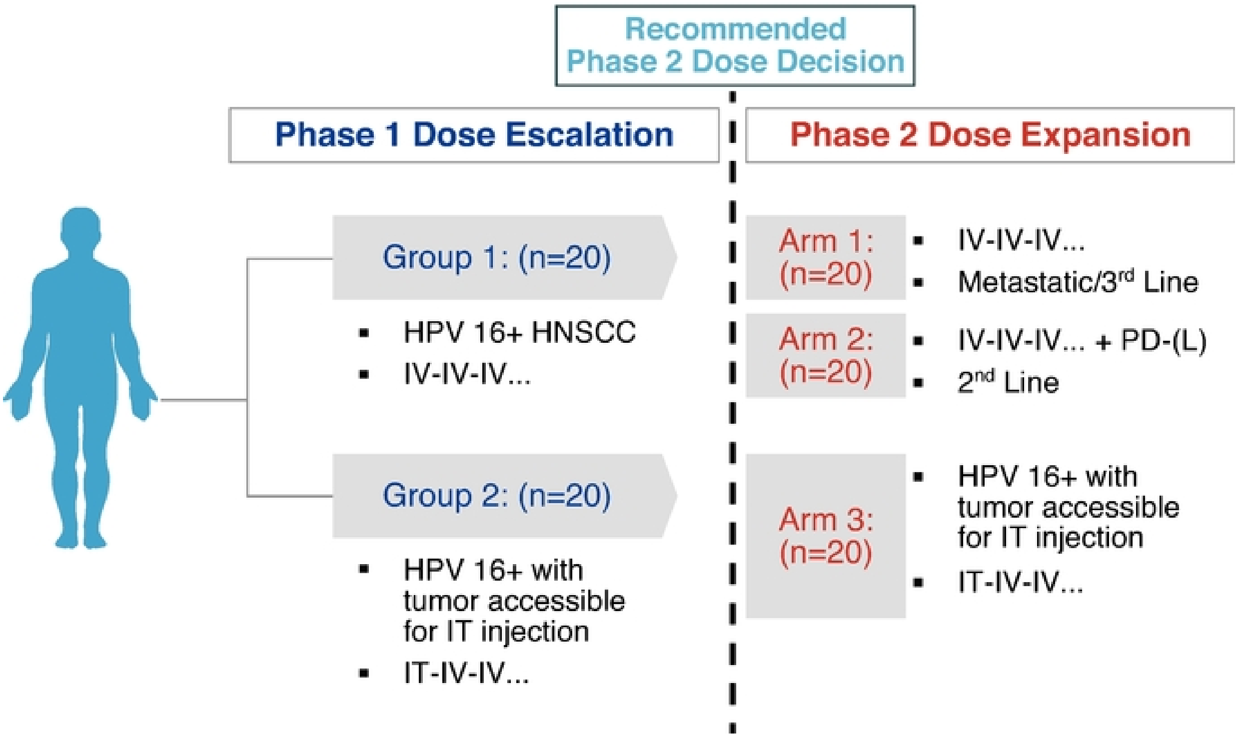
For Phase 2 dose expansion, the patient population will be divided into three arms:

- Arm 1 (IV administration of HB-201): patients with HPV16+ cancers with tumor progression or recurrence on standard of care therapy, or for whom standard of care therapy is contraindicated.

- Arm 2 (IV administration of HB-201 with nivolumab): patients with HPV16+ cancers with tumor progression or recurrence on standard of care therapy, or for whom standard of care therapy is contraindicated.

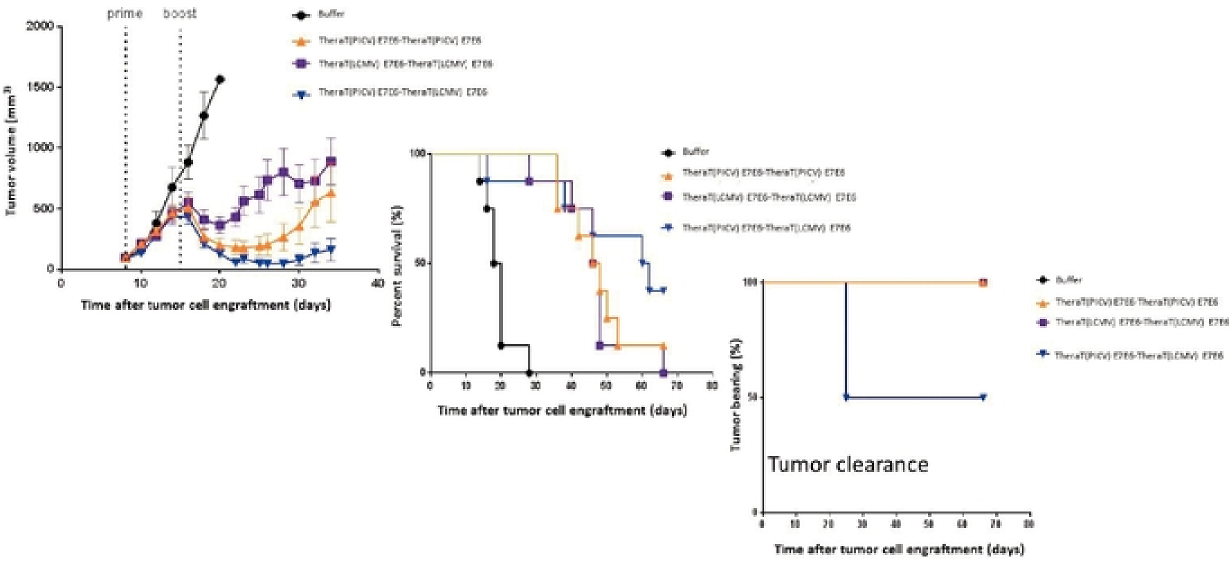
- Arm 3 (IT administration of HB-201 followed by IV administration of HB-201): patients with HPV16+ cancers with a safe and accessible tumor site amenable for IT administration who had tumor progression or recurrence on standard of care therapy or for whom standard of care therapy is contraindicated.

The primary endpoint of the Phase 1 portion of this trial will be to evaluate safety and tolerability to determine the recommended dose for the Phase 2 portion. Secondary endpoints will evaluate anti-tumor activity and immunogenicity. The Phase 2 groups of the trial will also investigate the efficacy of HB-201 alone and in combination with nivolumab. We anticipate commencing the initial Phase 1/2 clinical trial in the second half of 2019 with preliminary data expected to be available in late 2020 or early 2021.



HB-202 Preclinical Studies

HB-202, like HB-201, is directed against HPV16+ E6/E7 tumors. In a mouse model of HPV16+ E6/E7 tumors, single doses of HB-202 were shown to be similarly effective as single doses of HB-201 when administered both intravenously and intratumorally. Also, as in HB-201, long term survivor mice were uniformly resistant to re-challenge at six months. The results of our preclinical studies of HB-202 are depicted below.



Additionally we have observed that if HB-202 and HB-201 are administered sequentially, activity levels, which tend to indicate effectiveness, are significantly superior to the repeat administration of either one alone.

HB-201 and HB-202 Clinical Plans

Based on preclinical data observed with HB-201, we intend to commence an open label dose escalating Phase 1/2 trial to evaluate HB-201 alone and in combination with nivolumab. Based on our preclinical experience, we anticipate that this combination approach may deliver significantly more robust anti-tumor activity in patients than nivolumab alone. The design of the trial will be the same as that of the single agent trial for HB-201. The primary endpoint of the Phase 1 portion of this trial will be to evaluate safety and tolerability to determine the recommended dose for the Phase 2 portion of the trial. Secondary endpoints will evaluate anti-tumor activity and immunogenicity. We anticipate commencing the initial Phase 1/2 trial in the second half of 2019 with preliminary data expected to be available in late 2020 or early 2021. Subsequent trials will also investigate the potential of HB-201 and HB-202 together and in combination with nivolumab.

Targeting Self-Antigens

We believe that our viral vectors may be appropriate for any antigen where a T cell response may be therapeutically meaningful. We have shown in multiple preclinical models that TheraT product candidates are active in generating robust immune responses to tumor self-antigens and that this response results in decreased tumor growth and an increase in survival rates.

Additional Product Opportunities: Tumor Self-Antigens

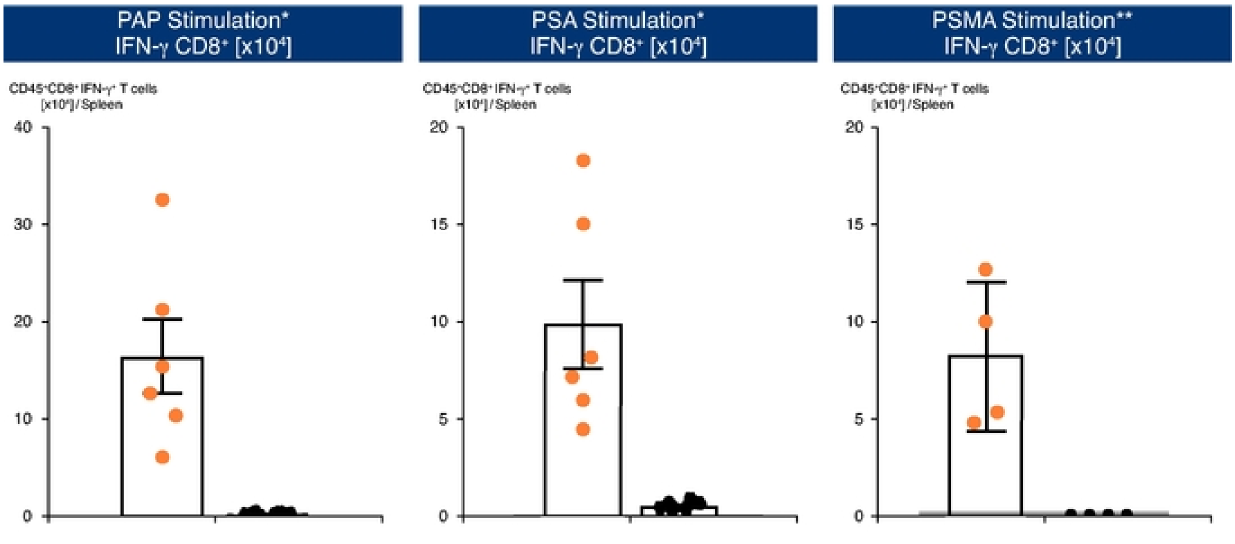
Our HB-101, HB-201 and HB-202 programs target viral antigens associated with virally-induced tumors. In these programs, the viral, or non-self nature of the antigens, makes them a natural target for an immunotherapy approach. In addition, we are pursuing the development of product candidates based on our arenavirus platform to target self-antigens, non-viral antigenic proteins that are highly overexpressed in solid tumors or only minimally expressed in normal cells. Because these self-antigens are found in certain normal cells as well as tumor cells, the immune system does not typically recognize them as foreign proteins and does not respond to them. This protection of self-antigens from immune system attack is known as immune tolerance. The results obtained by earlier-generation marketed products such as sipuleucel-T, developed as Provenge by Dendreon Pharmaceuticals, Inc. and currently marketed by Sanpower Group Co., Ltd. have proven that it is possible to overcome immune tolerance and activate the immune system to produce an anti-tumor response.

HB-301 in Prostate Cancer

We are developing our most advanced self-antigen project in this area, HB-301, as a TheraT product candidate in metastatic, hormone-resistant prostate cancer. Prostate cancer provides a unique treatment opportunity for immunotherapy because prostate cancer cells express a number of tumor-specific antigens that serve as potential targets. HB-301 targets three of these antigens: prostatic acid phosphatase, or PAP, prostate specific antigen, or PSA, and prostate-specific membrane antigen, or PSMA.

Direct evidence for the ability to induce a therapeutically relevant immune response to one of these antigens, PAP, comes from Provenge. To create Provenge, a personalized treatment, clinicians remove dendritic cells from the body, load them with PAP and then reintroduce them to the patient. The use of Provenge has been shown to increase survival in patients with metastatic, hormone-resistant prostate cancer. Other companies are developing dendritic cell therapies similar to Provenge by using other tumor antigens. All of these dendritic cell therapies require a complex, patient-specific therapeutic manufacturing process involving isolating cells from patients, loading them *ex vivo* with tumor antigens and then re-administering the cells to patients.

Our TheraT technology has been engineered to hold two additional genes compared to the natural form of the arenavirus. This allows us to express multiple antigens in one construct. In HB-301, we are including the coding sequences for PAP, PSA and PSMA antigens. Since it is a TheraT-based product candidate, we can deliver HB-301 by simple infusion and it can target dendritic cells in the body without the need for cellular isolation or *ex vivo* processing. We have shown in preclinical experiments that TheraT vectors can lead to robust CD8+ T cell responses to the encoded antigens. We intend to maximize these CD8+ T cell responses using a combination of TheraT vectors based on both LCMV and PICV in a sequential dosing regimen.



* PSA and PAP specific CD8+ responses in C57BL6 mice after single dose of TheraT
** PSMA specific CD8+ responses in Balb/cmice after single dose of TheraT

In the future, we intend to develop product candidates against other self-antigens with the aim of eventually establishing a franchise of "off-the-shelf," dendritic-cell-targeting agents that take advantage of the ability of arenaviruses to stimulate CD8+ T-cell responses.

Next Generation Product Candidates

A critical advantage of our technology is that it is designed to deliver full length proteins directly to dendritic cells for endogenous expression and direct presentation to CD8+ T cells. Having the dendritic cell express and present full length proteins rather than fragments overcomes the major difficulty of attempting to predict which part of the protein, or epitope, will be presented by the patient's individual major histocompatibility complex, or MHC, class I alleles. This presentation is important in immunotherapy because T cells will only recognize and respond to the antigen when it is bound to the individual's MHC class I molecules, of which several hundred different versions exist in the population. While this approach overcomes the major issue faced by neo-epitope-based personalized antigen approaches, it also has limitations in that the repertoire of known tumor-associated proteins that could be used for targets is limited. The best example of full length proteins that are, to a degree, cancer specific and immunogenic include the cancer-testis antigens, examples of which include NY-ESO-1, MAGE and CAGE. These cancer-testis antigens have been known for decades, and many of them are currently being pursued by other companies. For many tumor types the cancer-testis type of antigens remains unknown. Furthermore, most of the known tumor-associated antigens are not commonly expressed or are not sufficiently specific to tumor tissue, making them suboptimal targets for clinical development.

In collaboration with DarwinHealth, a New York City-based bioinformatics company pioneering novel bioinformatic approaches, we intend to identify the next generation of "cancer-testis antigens." Our goal is to find novel immunogenic full length transcripts that are specific for, and highly represented in specific tumor types, allowing for an "off-the-shelf" approach for many cancer types. We have entered in an initial two year preclinical collaboration in which we will develop and validate the bioinformatics approach and resulting proprietary algorithms. We will start out by identifying "off-the-shelf" next generation cancer-testis type antigens in mouse tumors, and will assess the anti-tumor efficacy of our technology when targeting these same antigens in tumor-bearing animals. Mice will thereby serve as a testing ground to validate and optimize our new proprietary bioinformatics algorithms. In parallel we will apply the same validated algorithms to human samples, and will prepare to initiate human trials based on the identification of human "off-the-shelf" next generation of cancer-testis antigens.

Intellectual Property

Our success depends, in part, on our ability to obtain and maintain intellectual property protection for our product candidates, technology and know-how, to defend and enforce our intellectual property rights, in particular, our patent rights, to preserve the confidentiality of our know-how and trade secrets, and to operate without infringing the proprietary rights of others. We seek to protect our product candidates and technologies by, among other methods, filing U.S. and foreign patent applications related to our proprietary technology, inventions and improvements that are important to the development of our business. We also rely on trade secrets, know-how, continuing technological innovation and in-licensing of third-party intellectual property to develop and maintain our proprietary position. We, or our collaborators and licensors, file patent applications directed to our key product candidates in an effort to establish intellectual property positions to protect our product candidates as well as uses of our product candidates for the prevention and/or treatment of diseases.

As of November 24, 2018, we are the owner or exclusive licensee to five issued U.S. patents and seven pending U.S. patent applications, 22 issued foreign patents and approximately 53 foreign patent applications, and two international Patent Cooperation Treaty, or PCT, applications. These patents and patent applications are related to our technologies concerned with the arenavirus-based immunization systems, VaxWave and TheraT, our product candidates and various development programs, which are directed to the use of these immunization systems for the treatment and/or prevention of various infectious diseases or cancer, and certain clinical uses of our current or future product candidates in oncology. The issued patents and pending patent applications contain claims directed to various aspects of our work, including compositions of matter, methods of treatment and prevention, methods of producing certain compositions, and use of our product candidates in combination with certain other therapeutics.

VaxWave Technology Portfolio

Our patent portfolio related to our VaxWave technology includes a patent family exclusively licensed to us from the University of Zurich. This patent family includes three patents granted in the United States and patents granted in Europe (validated in Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Poland, Spain, Sweden, Switzerland and the United Kingdom), Canada, China, India, Hong Kong and Japan. This patent family also includes pending applications in the United States, Europe, China, Hong Kong and India. The granted patents and pending applications related to our VaxWave technology are expected to expire no earlier than 2028, not giving effect to any potential patent term extensions and patent term adjustments and assuming payment of all appropriate maintenance, renewal, annuity or other governmental fees. Our VaxWave technology is being employed or may be employed in one or more of the product candidates or programs described herein.

TheraT Technology Portfolio

We are the owner or exclusive licensee to proprietary patent positions related to our TheraT technology. Our patent portfolio related to our TheraT technology includes a patent family exclusively licensed from the University of Geneva. This patent family includes pending applications in the United States, Europe, Canada, Australia, Japan, India, China and Hong Kong. The second patent family in our TheraT platform portfolio is jointly owned by us and the University of Basel. The rights of the University of Basel under this patent family are exclusively licensed to us. This second patent family includes pending applications in various countries, including in the United States, Europe, Canada, Australia, New Zealand, Mexico, Japan, Brazil, Singapore, India, and Israel. The pending applications related to our TheraT technology are expected to expire between 2035 and 2037, not giving effect to any potential patent term extensions or patent term adjustments and assuming payment of all appropriate maintenance, renewal, annuity or other governmental fees. Our TheraT technology is being employed or may be employed in one or more of the product candidates or programs described herein.

Oncology Technology Portfolio

For the application of our VaxWave and TheraT technologies in oncology, we own three patent families. These patent families include pending applications in the United States, Europe, Australia, Canada, China, India and Japan, as well as two pending PCT applications. These patent families relate to potential clinical uses of our product candidates, such as combination treatments and modes of administration. The pending applications are expected to expire between 2036 and 2038, not giving effect to any potential patent term extensions or patent term adjustments and assuming payment of all appropriate maintenance, renewal, annuity or other governmental fees.

HB-101 (Cytomegalovirus)

Our HB-101 product candidate relies on our VaxWave technology. In addition to the VaxWave patent portfolio, we own one patent family that more specifically relates to our HB-101 product candidate. This patent family includes one patent granted in the United States with claims directed to pharmaceutical compositions. This patent family also includes pending applications in the United States, Europe, Australia, Canada, China, Hong Kong, India and Japan. Excluding the VaxWave patent portfolio, the granted patent and pending applications specifically related to our HB-101 product candidate are expected to expire in 2034, not giving effect to any potential patent term extensions or patent term adjustments and assuming payment of all appropriate maintenance, renewal, annuity or other governmental fees.

HBV

Our HBV program, co-developed with Gilead, is in the discovery phase and is being built on either our VaxWave or TheraT technologies. In addition to the VaxWave and TheraT patent portfolios, we own one patent family that relates to the use of our platform technologies for prevention and treatment of HBV. This patent family includes pending applications in the United States, Europe, Australia, Brazil, Canada, China, India, Israel, Japan, Korea, Mexico, New Zealand and Singapore. Excluding the VaxWave and TheraT patent portfolios, the pending applications related to the HBV program are expected to expire in 2036, not giving effect to any potential patent term extensions or patent term adjustments and assuming payment of all appropriate maintenance, renewal, annuity or other governmental fees.

HIV

Our HIV program, co-developed with Gilead, is in discovery phase and is being built on either our VaxWave or TheraT technologies. We currently do not own any patents or patent applications that more specifically relate to an HIV program outside of the VaxWave and TheraT patent portfolios.

HB-201 (HPV)

Our HB-201 product candidate relies on our TheraT technology and, depending on its clinical implementation, may relate to one or more applications in our oncology patent portfolio. In addition to the TheraT and oncology patent portfolios, we own one patent family that relates more specifically to our HB-201 product candidate. This patent family includes pending applications in the United States, Europe, Australia, Canada, China, India, Japan and Hong Kong. Excluding the TheraT and oncology patent portfolios, the pending applications specifically related to our HB-201 product candidate are expected to expire in 2036, not giving effect to any potential patent term extensions or patent term adjustments and assuming payment of all appropriate maintenance, renewal, annuity or other governmental fees.

HB-202 (HPV)

Our HB-202 product candidate relies on our TheraT technology and, depending on its clinical implementation, may relate to one or more applications in our oncology patent portfolio. In addition to the TheraT and oncology patent portfolios, we own one patent family that relates more specifically to our HB-202 product candidate. This patent family includes pending applications in the United States, Europe, Australia, Canada, China, India, Japan and Hong Kong. Excluding the TheraT and oncology patent portfolios, the pending applications specifically related to our HB-202 product candidate are expected to expire in 2036, not giving effect to any potential patent term extensions or patent term adjustments and assuming payment of all appropriate maintenance, renewal, annuity or other governmental fees.

HB-301

Our HB-301 product candidate relies on our TheraT technology and, depending on its clinical implementation, may relate to one or more applications in our oncology patent portfolio. We currently do not own any patents or patent applications that more specifically relate to our HB-301 product candidate outside of the TheraT and oncology patent portfolios.

The actual term of any patent that may issue from the above-described patent applications claiming one of our product candidates could be longer than described above due to patent term adjustment or patent term extension, if available, or shorter if we are required to file terminal disclaimers. 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.

Our ability to maintain and solidify our proprietary position for our product candidates and technologies will depend on our success in obtaining effective patent claims and enforcing those claims once granted. We do not know whether any of our patent applications will result in the issuance of any patents, or what the scope of the claims in any future issued patents may be. Our issued patents and those that may issue in the future, or those licensed to us, may be challenged, invalidated, narrowed, rendered unenforceable or circumvented, which could limit our ability to stop competitors from marketing identical or substantially similar products or could reduce the length of term of patent protection that we may have for our products. With respect to patents and patent applications licensed to us, our licensors may have the right to terminate our licenses if we fail to comply with our obligations under the applicable license agreement. In addition, the claims granted in any of our issued patents may not provide us with advantages against competitors with similar products or technology. Furthermore, our competitors may independently develop technologies that are similar or identical to technology developed by us but that do not infringe our patents or other intellectual property. Because of the extensive time required for development, testing and regulatory review of a potential product, it is possible that, by the time that any of our product candidates or those developed by our collaborators can be commercialized, our key patent may have expired or may only continue to remain in force for a short period following commercialization, thereby reducing the usefulness of the patent.

We seek to protect our proprietary technology and processes, in part, by confidentiality agreements with our employees, consultants, scientific advisors and other contractors. These agreements 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 or contractors use technology or know-how owned by others in their work for us, disputes may arise as to the rights in related inventions. For this and more comprehensive risks related to our intellectual property, see "Risk Factors—Risks Related to Our Intellectual Property."

Gilead Collaboration Agreement

Overview

On June 4, 2018, we entered into a Research Collaboration and License Agreement, the Collaboration Agreement, with Gilead to collaborate on preclinical research programs to evaluate potential vaccine products using or incorporating our TheraT and Vaxwave technology platforms for the treatment, cure, diagnosis, or prevention of HBV or HIV, which we refer to, collectively, as the Field.

Pursuant to the Collaboration Agreement, we granted Gilead an exclusive (even as to us and our affiliates), worldwide, royalty-bearing license to our know-how and our owned and in-licensed patent rights (including those patent rights in-licensed from the University of Geneva, the University of Basel, and the University of Zurich) that are necessary or reasonably useful for researching, developing, manufacturing or commercializing products that contain a vaccine that uses our TheraT or Vaxwave technology platforms for expressing one or more HIV or HBV antigens, which foregoing know-how and patent rights we refer to as the Licensed Technology (and each such product a Licensed Product), for the purpose of researching, developing, manufacturing and commercializing Licensed Products for uses in the Field.

Pursuant to the Collaboration Agreement, we will own all new intellectual property conceived or created out of the activities conducted under the Collaboration Agreement that specifically relate to the TheraT and Vaxwave technology platforms. Gilead will own all other intellectual property rights conceived or created out of the activities conducted under the Collaboration Agreement.

Governance

The development of the programs governed by the Collaboration Agreement will be overseen by a six-member joint steering committee, or the JSC, comprised of three representatives each from us and Gilead. The JSC will oversee the activities carried out pursuant to the Collaboration Agreement, including reviewing the research plan for potential amendments, settling disputes arising under the Collaboration Agreement, and approving a Licensed Product as being ready for development. Similarly, the Collaboration Agreement establishes a six-member joint research committee, or the JRC, comprised of three representatives each from us and Gilead. The JRC will review the research activities conducted by us and Gilead, provide guidance with respect to such research activities, review and discuss the results, status and progress of such research activities, and approve our use of third party subcontractors to perform our tasks under the Collaboration Agreement.

Research on HBV and HIV products

Under the Collaboration Agreement, we are responsible for manufacturing and supplying to Gilead Lymphocytic Choriomeningitis Virus- and Pichinde Virus-based vectors expressing one or more HIV or HBV antigens to the extent necessary for both us and Gilead to carry out our respective research activities under the research plans. HBV antigen-encoding vectors and HIV antigen-carrying vectors used in good laboratory practice, or GLP, studies will be produced at a CMO. We are also responsible during the collaboration term for preparing all non-clinical and chemistry, manufacturing and control, or CMC, reports for inclusion in any IND filing. Pursuant to the Collaboration Agreement, each party is obligated to use commercially reasonable efforts to perform it obligations under the HBV and HIV research plans.

Development and Commercialization of HBV and HIV products

Pursuant to the Collaboration Agreement, Gilead is solely responsible for conducting the development activities, including all regulatory filings, at its expense for any product arising from the Collaboration Agreement designated for development by Gilead and approved by the JSC. Gilead is also solely responsible, at its expense, for the manufacture and commercialization of any Licensed Product developed and commercialized under the Collaboration Agreement.

Non-Compete

We may not, directly or indirectly, conduct, participate in or fund any research, development, manufacture, or commercialization of, or with respect to products utilizing arenavirus-based vectors for the treatment, cure, diagnosis, or prevention of HBV or HIV, except for the activities we are expressly permitted to perform under the Collaboration Agreement.

Right of First Negotiation

Pursuant to the Collaboration Agreement, in the event we offer a license or other rights to the Licensed Technology to a third party to research, develop, manufacture or commercialize a Licensed Product outside of the Field before June 4, 2028, we are required to offer Gilead a right of first negotiation for the same rights to the Licensed Technology in such field offered to the third party.

Financial Terms

Upon execution of the Collaboration Agreement, Gilead paid us a one-time upfront fee of $10.0 million. For each of the HBV and the HIV program, Gilead is obligated to pay us a one-time, low six-digit dollar amount upon the delivery by us of each research grade vector specified in the applicable program and a one-time mid seven-digit dollar amount after initiation of the IND-enabling studies for such program. In addition we are eligible for up to $140.0 million in developmental milestone payments for each of the HBV and HIV programs and $50.0 million in commercialization milestone payments for each of the HBV and HIV programs. Upon the commercialization of a Licensed Product, we are eligible to receive tiered royalties of a high single-digit to mid-teens percentage on the worldwide net sales of each HBV Licensed Product, and royalties of a mid-single-digit to low-teens percentage of worldwide net sales of each HIV Licensed Product. The royalty payments are subject to reduction under specified conditions set forth in the Collaboration Agreement.

In addition, Gilead is obligated to pay us for all out-of-pocket costs actually incurred by us in connection with the HBV and HIV programs, including CMO-related costs, to the extent contemplated under the research plans and research budget.

Termination

Either party may terminate for the uncured breach of the other party and upon the other party filing for bankruptcy, reorganization, liquidation, or receivership proceedings. Gilead may terminate at any time in its entirety for convenience or on a product-by-product or a country-by-country basis upon prior written notice. If the Collaboration Agreement is not otherwise terminated prior to the expiration of the last-to-expire royalty term, upon such expiration the license granted to Gilead will continue in effect, but will be fully paid-up, royalty-free, perpetual, and irrevocable.

License Agreements

University of Geneva License Agreement

In February 2017, we entered into an Exclusive License Agreement with the University of Geneva, or the Geneva Agreement. Pursuant to the Geneva Agreement, the University of Geneva granted us a worldwide, exclusive license to use the University of Geneva's technology titled "method for vaccine delivery" and the patent rights in the subject matter of U.S. Provisional Patent Application No. 62/079,493 and PCT Patent Application No. PCT/EP2015/076458, each titled "Tri-Segmented Arenavirus as Vaccine Vectors," including any patents that claim priority thereto, the Geneva Licensed Patent Rights, to make, have made, to use and have used, to sell and have sold, to commercialize and have commercialized products, the manufacture, use, sale, or importation of which would infringe a claim of the Geneva Licensed Patent Rights, each a Geneva Licensed Product.

Pursuant to the terms of the Geneva Agreement, we are obligated to use reasonable efforts to develop and make commercially available Geneva Licensed Products. Beginning on March 31, 2019 and for as long as the University of Geneva has not received any milestone, royalty or sublicense payments pursuant to the Geneva Agreement, we are required to provide the University of Geneva with an annual report detailing our efforts and progress to develop Geneva Licensed Products. We are also required to provide proof to the University of Geneva that we have filed an IND or an equivalent application for a Geneva Licensed Product within seven years of the effective date of the Geneva Agreement. The University of Geneva can terminate the Geneva Agreement if we fail to provide such report, such report shows that we have stopped the development and/or exploitation of the technology licensed by the University of Geneva to us, or if we fail to provide proof of filing of such IND within such seven year period.

Starting with the third anniversary of the effective date of the Geneva Agreement, we are required to pay the University of Geneva a nominal annual fee, which is deductible from any milestone payments, royalties or sublicense payments payable by us to the University of Geneva during the same fiscal year. We are required to pay the University of Geneva, subject to the achievement by us of specified development and regulatory milestones, payments aggregating up to CHF 290,000 per Geneva

Licensed Product. While the Geneva Agreement remains in effect, we are required to pay the University of Geneva low-single digit royalties on aggregate net sales of Geneva Licensed Products sold by us. We must also pay the University of Geneva a low-single digit to low-double digit percentage, decreasing as a Geneva Licensed Product proceeds through development stages, of any consideration we receive from sublicensees, depending on the timing of such sublicense. We are also responsible for the prosecution and maintenance of the Geneva Licensed Patents Rights, including the costs related thereto.

Unless earlier terminated, the Geneva Agreement remains in effect until the expiration of the last to expire of the Geneva Licensed Patent Rights. Following the expiry of the Geneva Agreement due to the last to expire of the Geneva Licensed Patent Rights, we will have a fully paid-up, royalty-free right to use, sell and commercialize Geneva Licensed Products. We or the University of Geneva may terminate the Geneva Agreement for the other party's breach that remains uncured after 60 days' notice. We may terminate the Geneva Agreement for convenience upon prior notice. The University of Geneva may terminate the Geneva Agreement if we cease to carry on our business or become insolvent.

University of Basel License Agreement

In January 2017, we entered into an Exclusive License Agreement with the University of Basel, or the Basel Agreement. Pursuant to the Basel Agreement, the University of Basel granted us a worldwide, exclusive license under the University of Basel's share in U.S. Provisional Patent Application No. 62/338,400, titled "Tri-segmented Pichinde viruses as vaccine vectors," including any patents that claim priority thereto, the Basel Licensed Patent Rights to use the technology titled "tri-segmented Pichinde viruses as vaccine vectors" as covered by the Basel Licensed Patent Rights, to make and have made, to use and have used, to sell and have sold, to commercialize and have commercialized products, the manufacture, use, sale, or importation of which would infringe a claim of the Basel Licensed Patent Rights, each a Basel Licensed Product.

Pursuant to the terms of the Basel Agreement, we are obligated to use reasonable efforts to develop and make commercially available Basel Licensed Products. Beginning on February 28, 2018 and for as long as we have not effected a first commercial use of a Basel Licensed Product, we are required to provide the University of Basel with an annual report detailing our efforts to develop Basel Licensed Products.

We are required to pay the University of Basel, subject to the achievement of specified development and regulatory milestones, payments aggregating up to CHF 265,000 per Basel Licensed Product. While the Basel Agreement remains in effect, we are required to pay the University of Basel low-single digit royalties on net sales of Basel Licensed Products. We must also pay the University of Basel a low- to mid-single digit percentage, decreasing as a Basel Licensed Product proceeds through development stages, of any consideration we receive from sublicensees, depending on the timing of such sublicense. We are also responsible for the prosecution and maintenance of the Basel Licensed Patent Rights, and the costs related thereto.

Unless earlier terminated, the Basel Agreement remains in effect until the expiration of the last to expire of the Basel Licensed Patent Rights. Following the expiry of the Basel Agreement due to the last to expire of the Basel Licensed Patent Rights, we will have a fully paid-up, royalty-free right to use, sell and commercialize Basel Licensed Products. We or the University of Basel may terminate the agreement for the other party's breach that remains uncured after 60 days' notice. We may terminate the Basel Agreement for convenience upon prior notice. The University of Basel may terminate the Basel Agreement if we cease to pay for the costs associated with prosecution and maintenance of the Basel Licensed Patent Rights.

University of Zurich License Agreement

In October 2011, we entered into a License Agreement with the University of Zurich, or the Zurich Agreement. Pursuant to the Zurich Agreement, the University of Zurich granted us a worldwide, exclusive license to PCT Patent Application No. PCT/EP/08/010994, titled "Propagation-deficient arenavirus vectors," or the Zurich Licensed Patent Rights, to make and have made, use, sell, offer for sale, and import products that fall within the scope of the Zurich Licensed Patent Rights, each a Zurich Licensed Product and to practice the Zurich Licensed Patent Rights and methods that fall within the scope of the Zurich Licensed Patent Rights, each a Zurich Licensed Method.

Pursuant to the terms of the Zurich Agreement, we are obligated to diligently proceed with the development, manufacture, and sale of, and the obtaining of government approvals for the manufacture, use and sale of, suitable Zurich Licensed Products in the United States, Japan and certain European countries. If we fail to use commercially reasonable efforts to do the foregoing, the University of Zurich can demand a written development and marketing plan. Failure of the parties to agree on a development and marketing plan entitles the University of Zurich to terminate the Zurich Agreement. Beginning on January 1, 2012 and ending on the date of the first commercial sale of a Zurich Licensed Product, we are required to provide the University of Zurich with an annual report detailing our efforts to develop and test Zurich Licensed Products and to use the Zurich Licensed Patent Rights and Zurich Licensed Methods.

In consideration for the license granted to us under the Zurich Agreement, we issued 2,297 shares with a nominal value of EUR 2,297 of our common stock to the University of Zurich and agreed to provide them certain anti-dilution rights, which rights have subsequently expired. We are required to pay the University of Zurich low-single digit royalties on net sales of Zurich Licensed Products or Zurich Licensed Methods. We must also pay the University of Zurich a mid-single digit to low-double digit percentage of any sublicense fees and consideration we receive from sublicensees, depending on the cumulative monetary value of the consideration and fees received from all sublicensees. We are responsible for the prosecution and maintenance of the Zurich Licensed Patent Rights, and the costs related thereto.

Unless earlier terminated, the Zurich Agreement remains in effect on a country-by-country basis until the expiration of the last to expire of the Zurich Licensed Patent Rights in such country. The University of Zurich may terminate the agreement for our uncured breach or if we oppose or dispute the validity of any of the Zurich Licensed Patent Rights, or assist a third party to do the same. If we fail to use commercially reasonable efforts to market and develop the Zurich Licensed Products in certain countries, and if we fail to agree with the University of Zurich on any amendments to our development and marketing plans within the time specified in the Zurich Agreement upon such demand for amendments from the University of Zurich, the University of Zurich may terminate the Zurich Agreement. We may terminate the Zurich Agreement for convenience upon prior notice. The Zurich Agreement automatically terminates if we file a petition for bankruptcy, insolvency, or reorganization relating to bankruptcy or insolvency, or in the event of an adjudication that we have become bankrupt or insolvent.

National Institutes of Health License Agreement

In September 2013, we entered into a Biological Materials License Agreement with the National Institutes of Health, or the NIH, which was subsequently amended in April 2017 and July 2018, hereinafter referred to as the NIH Agreement. Pursuant to the NIH Agreement, the NIH granted us a worldwide, non-exclusive license to make, have made, import and use certain cells and cell clones developed at the Vaccine Research Center of the NIH, or the NIH Licensed Products, to manufacture viral vectors based on our proprietary arenavirus-based vectors.

Pursuant to the terms of the NIH Agreement, we are required to provide the NIH with an annual report which states the number and description of NIH Licensed Products made or otherwise disposed of. We are further responsible for obtaining and maintaining any required third-party license for the background rights for the commercial use of the respective cells and cell clones.

In consideration of the license granted to us pursuant to the NIH Agreement, we paid the NIH a low-six figure and a mid-five figure issue royalty, upon execution of the NIH Agreement and the first amendment, respectively. We must also pay the NIH a low-double digit percentage of any consideration we receive from sublicensees. We must also pay the NIH low-five figure to mid-six figure annual royalty payments, increasing as our most developed product candidate manufactured from NIH Licensed Products proceeds through development stages.

Unless earlier terminated, the NIH Agreement remains in effect for a term of 20 years from the effective date. We have the option to extend the term of the agreement for additional one year periods, upon prior notice to the NIH. The NIH may terminate the NIH Agreement if we are in default in performing any material obligation under the NIH Agreement and do not remedy such default within a specified period upon notice thereof. We may terminate the NIH Agreement for convenience upon prior notice.

Competition

The biotechnology and pharmaceutical industries have made substantial investments in recent years into the rapid development of novel immunotherapies for the treatment of a range of pathologies, including infectious diseases and cancers, making this a highly competitive market.

We face substantial competition from multiple sources, including large and specialty pharmaceutical, biopharmaceutical and biotechnology companies, academic research institutions and governmental agencies and public and private research institutions. Our competitors compete with us on the level of the technologies employed to target various therapeutic areas, such as adoptive cell therapies and active immunization technologies, or on the level of development of product candidates. In addition, many small biotechnology companies have formed collaborations with large, established companies to (i) obtain support for their research, development and commercialization of products or (ii) combine several treatment approaches to develop longer lasting or more efficacious treatments that may potentially directly compete with our current or future product candidates. We anticipate that we will continue to face increasing competition as new therapies and combinations thereof, technologies, and data emerge within the field of immunotherapy and, furthermore, within the treatment of infectious diseases and cancers.

In addition to the current standard of care treatments for patients with infectious diseases or cancers, numerous commercial and academic preclinical studies and clinical trials are being undertaken by a large number of parties to assess novel technologies and product candidates in the field of immunotherapy. Results from these studies and trials have fueled increasing levels of interest in the field of immunotherapy.

Companies that compete with us directly on the level of the development of product candidates in our therapeutic areas, include, among others:

- In cytomegalovirus management, companies such as Helocyte, Inc., VBI Vaccines Inc., Moderna, Inc., SL VaxiGen Inc., Merck & Co., GlaxoSmithKline plc and Pfizer Inc.

- In immuno-oncology for HPV+ cancers, companies such as Kite Pharma, a Gilead company, Advaxis, Inc., ISA Pharmaceuticals B.V., in collaboration with Regeneron Pharmaceuticals, Inc. and BioNtech AG;

On the technology level, other direct competitors which can potentially develop competing product candidates in areas in and outside of HPV16+ cancers and cytomegalovirus infection such as neoantigens, oncolytic viruses, bispecific antibodies, engineered cell therapies and tumor specific antigens, and other active immunization technologies, include, among others, Gritstone Oncology, Inc., in collaboration with bluebird bio, Inc., Neon Therapeutics, Inc., Replimune Group, Inc., in collaboration with Bristol-Myers Squibb Company, Immune Design Corp., in collaboration with MedImmune LLC, Turnstone Biologics Inc., Adaptimmune PLC, Achilles Therapeutics Ltd., CureVac AG, Roche Holdings AG, Five Prime Therapeutics, Inc., Novartis International AG and Juno Therapeutics, Inc.

Many of our competitors, either alone or in combination with their respective strategic partners, have significantly greater financial resources and expertise in research and development, manufacturing, the regulatory approval process, and marketing than we do. Mergers and acquisition activity in the pharmaceutical, biopharmaceutical and biotechnology sector is likely to result in greater resource concentration among a smaller number of our competitors. Smaller or early-stage companies may also prove to be significant competitors, particularly through sizeable collaborative arrangements with established companies. These competitors also compete with us in recruiting and retaining qualified scientific and management personnel and establishing clinical trial sites and patient registration for clinical trials, as well as in acquiring technologies complementary to, or necessary for, our programs.

Our commercial opportunity could be reduced or eliminated if one or more of our competitors develop and commercialize products that are safer, more effective, better tolerated, or of greater convenience or economic benefit than our proposed product offering. Our competitors also may be in a position to obtain FDA or other regulatory approval for their products more rapidly, resulting in a stronger or dominant market position before we are able to enter the market. The key competitive factors affecting the success of all of our programs are likely to be product safety, efficacy, convenience and treatment cost.

Manufacturing

We are establishing manufacturing processes and supply agreements for all of the components used in our product candidates to support ongoing and planned clinical trials. These include the components for our VaxWave-based and TheraT-based product candidates. We rely on CMOs to produce our product candidates for clinical use and currently do not own or operate manufacturing facilities beyond laboratory scale production. We require that our CMOs produce bulk drug substances and finished drug products in accordance with cGMP, and all other applicable laws and regulations. Although we plan to establish our own manufacturing facility before the launch of our first commercial product, we may continue to rely on CMOs for parts of the process, like filling and labelling of our products for commercial sale. We maintain agreements with potential and existing manufacturers that include confidentiality and intellectual property provisions to protect our proprietary rights related to our product candidates.

We plan to ultimately establish our own manufacturing facility. By establishing our own manufacturing facility, we aim to minimize or eliminate our reliance on CMOs, which typically have limited capacity at commercial scale and quality. We believe that having control over the whole manufacturing process will allow us to reduce cycle times, increase the robustness and consistency of the process and reduce cost of goods for commercial production. We expect that control over our own manufacturing facility will also help to shorten overall timelines for new product candidates in our development pipeline, as well as help us develop drug formulations or presentations to simplify distribution as well as administration of future immunotherapeutics. We also believe that having a dedicated manufacturing facility will allow us to optimize commercial-scale processes and to develop a suitable workforce capable of supporting market launch.

As an intermediate step between utilizing different CMOs for production of clinical trial material, depending on their availability at the required times, and establishing our own manufacturing facility, we have recently entered into an agreement with Valneva Sweden AB, or Valneva, a commercial vaccine manufacturer, by which we gain exclusive access to a dedicated GMP facility including qualified workforce for the manufacture of clinical trial material according to our specifications. We expect that through this agreement, the necessary capacity for manufacture of Phase 1 and Phase 2 clinical trial material will largely be covered from 2020 onwards. In addition, we will avoid technology transfer activities to different CMOs and will benefit from increases in experience and efficiency with each additional run performed under the Valneva agreement.

Government Regulation

Government authorities in the United States at the federal, state and local level and in other countries regulate, among other things, the research, development, testing, manufacture, quality control, approval, labeling, packaging, storage, record-keeping, promotion, advertising, distribution, post-approval monitoring and reporting, marketing and export and import of biological products, such as those developed from our VaxWave and TheraT technologies and any other product candidates we develop. Generally, before a new drug or biologic can be marketed, considerable data demonstrating its quality, safety and efficacy must be obtained, organized into a format specific for each regulatory authority, submitted for review and approved by the regulatory authority.

U.S. Biological Product Development

In the United States, the FDA regulates drugs under the Federal Food, Drug, and Cosmetic Act, or FDCA, and its implementing regulations and biologics under the FDCA, the Public Health Service Act, or the PHSA, and their implementing regulations. Both drugs and biologics also are subject to other federal, state and local statutes and regulations. The process of obtaining regulatory approvals and the subsequent compliance with appropriate federal, state and local statutes and regulations requires the expenditure of substantial time and financial resources. Failure to comply with the applicable U.S. requirements at any time during the product development process, approval process or post-market may subject an applicant to administrative or judicial sanctions. These sanctions could include, among other actions, the FDA's refusal to approve pending applications, withdrawal of an approval, license revocation, a clinical hold, untitled or warning letters, product recalls or market withdrawals, product seizures, total or partial suspension of production or distribution, injunctions, fines, refusals of government contracts, restitution, disgorgement and civil or criminal penalties. Any agency or judicial enforcement action could have a material adverse effect on us.

Our product candidates and any future biological product candidates we develop must be approved by the FDA through a biologics license application, or BLA, process before they may be legally marketed in the United States. The BLA is a request for approval to market the biologic for one or more specified indications and must contain proof of safety, purity and potency. The FDA review and approval process generally involves the following:

- Completion of extensive preclinical studies in accordance with applicable regulations, including studies conducted in accordance with GLP requirements;
- Submission to the FDA of an IND, which must become effective before human clinical trials may begin;
- Approval by an Institutional Review Board, or IRB, or independent ethics committee at each clinical trial site before each trial may be initiated;
- Performance of adequate and well-controlled human clinical trials in accordance with applicable IND regulations, good clinical practice, or GCP, requirements and other clinical

trial-related regulations to establish the safety and efficacy of the investigational product for each proposed indication;

- Submission to the FDA of a BLA;

- A determination by the FDA within 60 days of its receipt of a BLA to accept the filing for review;

- Satisfactory completion of an FDA pre-approval inspection of the manufacturing facility or facilities where the biologic will be produced to assess compliance with cGMP requirements to assure that the facilities, methods and controls are adequate to preserve the biologic's identity, strength, quality and purity;

- Potential FDA audit of the clinical trial sites that generated the data in support of the BLA; and

- FDA review and approval of the BLA, including consideration of the views of any FDA advisory committee, prior to any commercial marketing or sale of the biologic in the United States.

The preclinical and clinical testing and approval process requires substantial time, effort and financial resources, and we cannot be certain that any approvals for our product candidates will be granted on a timely basis, or at all.

Preclinical Studies and IND

Preclinical studies include laboratory evaluation of product chemistry and formulation, as well as in vitro and animal studies to assess the potential for adverse events and in some cases to establish a rationale for therapeutic use. The conduct of preclinical studies is subject to federal regulations and requirements, including GLP regulations for safety/toxicology studies.

An IND sponsor must submit the results of the preclinical studies, together with manufacturing information, analytical data, any available clinical data or literature and plans for clinical trials, among other things, to the FDA as part of an IND. An IND is a request for authorization from the FDA to administer an investigational product to humans, and must become effective before human clinical trials may begin. Some long-term preclinical testing may continue after the IND is submitted. An IND automatically becomes effective 30 days after receipt by the FDA, unless before that time, the FDA raises concerns or questions related to one or more proposed clinical trials and places the trial on clinical hold. In such a case, the IND sponsor and the FDA must resolve any outstanding concerns before the clinical trial can begin. As a result, submission of an IND may not result in the FDA allowing clinical trials to commence.

Clinical Trials

The clinical stage of development involves the administration of the investigational product to healthy volunteers or patients under the supervision of qualified investigators, generally physicians not employed by or under the trial sponsor's control, in accordance with GCP requirements, which include the requirement that all research subjects provide their informed consent for their participation in any clinical trial. Clinical trials are conducted under protocols detailing, among other things, the objectives of the clinical trial, dosing procedures, subject selection and exclusion criteria and the parameters to be used to monitor subject safety and assess efficacy. Each protocol, and any subsequent amendments to the protocol, must be submitted to the FDA as part of the IND. Further, each clinical trial must be reviewed and approved by an IRB for each institution at which the clinical trial will be conducted to ensure that the risks to individuals participating in the clinical trials are minimized and are reasonable in relation to anticipated benefits. The IRB also approves the informed consent form that must be provided to each clinical trial subject or his or her legal representative, and must monitor the clinical trial until completed. There also are requirements governing the reporting of ongoing clinical trials and completed clinical trial results to public registries.

A sponsor who wishes to conduct a clinical trial outside of the United States may, but need not, obtain FDA authorization to conduct the clinical trial under an IND. If a foreign clinical trial is not conducted under an IND, the sponsor may submit data from the clinical trial to the FDA in support of a BLA. The FDA will accept a well-designed and well-conducted foreign clinical trial not conducted under an IND if the study was conducted in accordance with GCP requirements, and the FDA is able to validate the data through an onsite inspection if deemed necessary.

Clinical trials generally are conducted in three sequential phases, known as Phase 1, Phase 2 and Phase 3, and may overlap.

- Phase 1 clinical trials generally involve a small number of healthy volunteers or disease-affected patients who are initially exposed to a single dose and then multiple doses of the product candidate. The primary purpose of these clinical trials is to assess the metabolism, pharmacologic action, side effect tolerability and safety of the product candidate.

- Phase 2 clinical trials involve studies in disease-affected patients to determine the dose required to produce the desired benefits. At the same time, safety and further pharmacokinetic and pharmacodynamic information is collected, possible adverse effects and safety risks are identified and a preliminary evaluation of efficacy is conducted.

- Phase 3 clinical trials generally involve a large number of patients at multiple sites and are designed to provide the data necessary to demonstrate the effectiveness of the product for its intended use, its safety in use and to establish the overall benefit/risk relationship of the product and provide an adequate basis for product labeling.

Post-approval trials, sometimes referred to as Phase 4 clinical trials, may be conducted after initial marketing approval. These trials are used to gain additional experience from the treatment of patients in the intended therapeutic indication. In certain instances, the FDA may mandate the performance of Phase 4 clinical trials as a condition of approval of a BLA.

Progress reports detailing the results of the clinical trials, among other information, must be submitted at least annually to the FDA and written IND safety reports must be submitted to the FDA and the investigators for serious and unexpected suspected adverse events, findings from other studies or animal or in vitro testing that suggest a significant risk for human subjects and any clinically important increase in the rate of a serious suspected adverse reaction over that listed in the protocol or investigator brochure.

Phase 1, Phase 2 and Phase 3 clinical trials may not be completed successfully within any specified period, if at all. The FDA or the sponsor may suspend or terminate a clinical trial at any time on various grounds, including a finding that the research subjects or patients are being exposed to an unacceptable health risk. Similarly, an IRB can suspend or terminate approval of a clinical trial at its institution if the clinical trial is not being conducted in accordance with the IRB's requirements or if the biologic has been associated with unexpected serious harm to patients. Additionally, some clinical trials are overseen by an independent group of qualified experts organized by the clinical trial sponsor, known as a data safety monitoring board or committee. This group provides authorization for whether a trial may move forward at designated check points based on access to certain data from the trial. Concurrent with clinical trials, companies usually complete additional animal studies and also must develop additional information about the chemistry and physical characteristics of the biologic as well as finalize a process for manufacturing the product in commercial quantities in accordance with cGMP requirements. The manufacturing process must be capable of consistently producing quality batches of the product and, among other things, companies must develop methods for testing the identity, strength, quality and purity of the final product. Additionally, appropriate packaging must be selected and tested and stability studies must be conducted to demonstrate that the product candidates do not undergo unacceptable deterioration over their shelf life.

FDA Review Process

Following completion of the clinical trials, data are analyzed to assess whether the investigational product is safe and effective for the proposed indicated use or uses. The results of preclinical studies and clinical trials are then submitted to the FDA as part of a BLA, along with proposed labeling, chemistry and manufacturing information to ensure product quality and other relevant data. The BLA may include both negative and ambiguous results of preclinical studies and clinical trials, as well as positive findings. Data may come from company-sponsored clinical trials intended to test the safety and efficacy of a product's use or from a number of alternative sources, including studies initiated by investigators. To support marketing approval, the data submitted must be sufficient in quality and quantity to establish the safety, purity and potency of the investigational product to the satisfaction of FDA. FDA approval of a BLA must be obtained before a biologic may be marketed in the United States.

Under the Prescription Drug User Fee Act, or PDUFA, as amended, each BLA must be accompanied by a user fee. The FDA adjusts the PDUFA user fees on an annual basis. According to the FDA's fee schedule, effective through September 30, 2019, the user fee for an application requiring clinical data, such as a BLA, is $2,588,478. The sponsor of an approved BLA is also subject to an annual prescription drug program fee, which for fiscal year 2019 is $309,915. Fee waivers or reductions are available in certain circumstances, including a waiver of the application fee for the first application filed by a small business. Additionally, no user fees are assessed on BLAs for products designated as orphan drugs, unless the product also includes a non-orphan indication.

The FDA reviews all submitted BLAs before it accepts them for filing, and may request additional information rather than accepting the BLA for filing. The FDA decides whether to accept a BLA for filing within 60 days of receipt, and such decision could include a refusal to file by the FDA. Once the submission is accepted for filing, the FDA begins an in-depth review of the BLA. Under the goals and policies agreed to by the FDA under PDUFA, the FDA has ten months, from the filing date, in which to complete its initial review of an original BLA and respond to the applicant, and six months from the filing date of an original BLA designated for priority review. The FDA does not always meet its PDUFA goal dates for standard and priority BLAs, and the review process is often extended by FDA requests for additional information or clarification.

Before approving a BLA, the FDA will conduct a pre-approval inspection of the manufacturing facilities for the new product to determine whether they comply with cGMP requirements. The FDA will not approve the product unless it determines that the manufacturing processes and facilities are in compliance with cGMP requirements and adequate to assure consistent production of the product within required specifications. The FDA also may audit data from clinical trials to ensure compliance with GCP requirements. Additionally, the FDA may refer applications for novel products or products which present difficult questions of safety or efficacy to an advisory committee, typically a panel that includes clinicians and other experts, for review, evaluation and a recommendation as to whether the application should be approved and under what conditions, if any. The FDA is not bound by recommendations of an advisory committee, but it considers such recommendations when making decisions on approval. The FDA likely will reanalyze the clinical trial data, which could result in extensive discussions between the FDA and the applicant during the review process. After the FDA evaluates a BLA, it will issue an approval letter or a Complete Response Letter. An approval letter authorizes commercial marketing of the biologic with specific prescribing information for specific indications. A Complete Response Letter indicates that the review cycle of the application is complete and the application will not be approved in its present form. A Complete Response Letter usually describes all of the specific deficiencies in the BLA identified by the FDA. The Complete Response Letter may require additional clinical data, pivotal Phase 3 clinical trial(s) as well as other significant and time-consuming requirements related to clinical trials, preclinical studies or manufacturing. If a Complete Response Letter is issued, the applicant may either resubmit the BLA, addressing all of the deficiencies identified in the letter, or withdraw the application. Even if such data and information are submitted, the FDA may decide that the BLA does not satisfy the criteria for approval. Data obtained from clinical trials are not always conclusive and the FDA may interpret data differently than we interpret the same data.

Orphan Drug Designation

Under the Orphan Drug Act, the FDA may grant orphan designation to a drug or biological product intended to treat a rare disease or condition, which is generally a disease or condition that affects fewer than 200,000 individuals in the United States, or more than 200,000 individuals in the United States and for which there is no reasonable expectation that the cost of developing and making the product available in the United States for this type of disease or condition will be recovered from sales of the product.

Orphan drug designation for a biologic must be requested before submitting a BLA. After the FDA grants orphan drug designation, the identity of the therapeutic agent and its potential orphan use are disclosed publicly by the FDA. Orphan drug designation does not convey any advantage in or shorten the duration of the regulatory review and approval process.

If a product that has orphan drug designation subsequently receives the first FDA approval for the disease or condition for which it has such designation, the product is entitled to orphan drug exclusivity, which means that the FDA may not approve any other applications to market the same drug for the same indication for seven years from the date of such approval, except in limited circumstances, such as a showing of clinical superiority to the product with orphan exclusivity by means of greater effectiveness, greater safety or providing a major contribution to patient care or in instances of drug supply issues. Competitors, however, may receive approval of either a different product for the same indication or the same product for a different indication but that could be used off-label in the orphan indication. Orphan drug exclusivity also could block the approval of one of our products for seven years if a competitor obtains approval before we do for the same product, as defined by the FDA, for the same indication we are seeking approval, or if our product is determined to be contained within the scope of the competitor's product for the same indication or disease. If one of our products designated as an orphan drug receives marketing approval for an indication broader than that which is designated, it may not be entitled to orphan drug exclusivity. Orphan drug status in the European Union has similar, but not identical, requirements and benefits.

Expedited Development and Review Programs

The FDA has a fast track program that is intended to expedite or facilitate the process for reviewing new drugs and biologics that meet certain criteria. Specifically, new drugs and biologics are eligible for fast track designation if they are intended to treat a serious or life-threatening condition and preclinical or clinical data demonstrate the potential to address unmet medical needs for the condition. Fast track designation applies to both the product and the specific indication for which it is being studied. The sponsor of a biologic can request the FDA to designate the product for fast track status any time before receiving BLA approval, but ideally no later than the pre-BLA meeting.

Any product submitted to the FDA for marketing, including under a fast track program, may be eligible for other types of FDA programs intended to expedite development and review, such as priority review and accelerated approval. Any product is eligible for priority review if it treats a serious or life-threatening condition and, if approved, would provide a significant improvement in safety and effectiveness compared to available therapies. The FDA will attempt to direct additional resources to the evaluation of an application for a new drug or biologic designated for priority review in an effort to facilitate the review.

A product may also be eligible for accelerated approval, if it treats a serious or life-threatening condition and generally provides a meaningful advantage over available therapies. In addition, it must demonstrate an effect on a surrogate endpoint that is reasonably likely to predict clinical benefit or on a clinical endpoint that can be measured earlier than irreversible morbidity or mortality, or IMM, that is reasonably likely to predict an effect on IMM or other clinical benefit. As a condition of approval, the FDA may require that a sponsor of a drug or biologic receiving accelerated approval perform adequate and well-controlled post-marketing clinical trials. If the FDA concludes that a drug or biologic shown to be effective can be safely used only if distribution or use is restricted, it will require such post-marketing restrictions, as it deems necessary to assure safe use of the product. If the FDA determines that the conditions of approval are not being met, the FDA can withdraw its accelerated approval for such drug or biologic.

Additionally, a drug or biologic may be eligible for designation as a breakthrough therapy if the product is intended, alone or in combination with one or more other drugs or biologics, to treat a serious or life-threatening condition and preliminary clinical evidence indicates that the product may demonstrate substantial improvement over currently approved therapies on one or more clinically significant endpoints. The benefits of breakthrough therapy designation include the same benefits as fast track designation, plus intensive guidance from the FDA to ensure an efficient drug development program.

Fast track designation, priority review, accelerated approval and breakthrough therapy designation do not change the standards for approval, but may expedite the development or approval process.

Pediatric Information

Under the Pediatric Research Equity Act, or PREA, a BLA or supplement to a BLA must contain data to assess the safety and efficacy of the biologic for the claimed indications in all relevant pediatric subpopulations and to support dosing and administration for each pediatric subpopulation for which the product is safe and effective. The FDA may grant deferrals for submission of pediatric data or full or partial waivers. The Food and Drug Administration Safety and Innovation Act, or FDASIA, amended the FDCA to require that a sponsor who is planning to submit a marketing application for a drug that includes a new active ingredient, new indication, new dosage form, new dosing regimen or new route of administration submit an initial Pediatric Study Plan, or PSP, within 60 days of an end-of-Phase 2 meeting or, if there is no such meeting, as early as practicable before the initiation of the Phase 3 or Phase 2/3 study. The initial PSP must include an outline of the pediatric study or studies that the sponsor plans to conduct, including study objectives and design, age groups, relevant endpoints and statistical approach, or a justification for not including such detailed information, and any request for a deferral of pediatric assessments or a full or partial waiver of the requirement to provide data from pediatric studies along with supporting information. The FDA and the sponsor must reach an agreement on the PSP. A sponsor can submit amendments to an agreed-upon initial PSP at any time if changes to the pediatric plan need to be considered based on data collected from preclinical studies, early phase clinical trials as well as other clinical development programs.

Post-Marketing Requirements

Following approval of a new product, the manufacturer and the approved product are subject to continuing regulation by the FDA, including, among other things, monitoring and record-keeping activities, reporting of adverse experiences, complying with promotion and advertising requirements, which include restrictions on promoting products for unapproved uses or patient populations (known as "off-label use") and limitations on industry-sponsored scientific and educational activities. Although physicians may prescribe legally available products for off-label uses, manufacturers may not market or promote such uses. Prescription drug and biologic promotional materials must be submitted to the FDA in conjunction with their first use. Further, if there are any modifications to the biologic, including changes in indications, labeling or manufacturing processes or facilities, the applicant may be required to submit and obtain FDA approval of a new BLA or BLA supplement, which may require the development of additional data or preclinical studies and clinical trials.

The FDA may also place other conditions on approvals including the requirement for a Risk Evaluation and Mitigation Strategy, or REMS, to assure the safe use of the product. If the FDA concludes a REMS is needed, the sponsor of the BLA must submit a proposed REMS. The FDA will not approve the BLA without an approved REMS, if required. A REMS could include medication guides, physician communication plans or elements to assure safe use, such as restricted distribution methods, patient registries and other risk minimization tools. Any of these limitations on approval or marketing could restrict the commercial promotion, distribution, prescription or dispensing of products. Product approvals may be withdrawn for non-compliance with regulatory standards or if problems occur following initial marketing.

FDA regulations require that products be manufactured in specific facilities and in accordance with cGMP regulations. We rely, and expect to continue to rely, on third parties for the production of clinical and commercial quantities of our products in accordance with cGMP regulations. These manufacturers must comply with cGMP regulations that require, among other things, quality control and quality assurance, the maintenance of records and documentation and the obligation to investigate and correct any deviations from cGMP. Manufacturers and other entities involved in the manufacture and distribution of approved drugs or biologics are required to register their establishments with the FDA and certain state agencies, and are subject to periodic unannounced inspections by the FDA and certain state agencies for compliance with cGMP requirements and other laws. Accordingly, manufacturers must continue to expend time, money and effort in the area of production and quality control to maintain cGMP compliance. The discovery of violations, including failure to conform to cGMP regulations, could result in enforcement actions, and the discovery of post-approval problems with a product may result in restrictions on a product, manufacturer or holder of an approved BLA, including recall.

U.S. Healthcare Reform and Other U.S. Healthcare Laws

Manufacturing, sales, promotion and other activities following product approval are also subject to regulation by numerous regulatory authorities in the United States in addition to the FDA, including the Centers for Medicare & Medicaid Services, other divisions of the Department of Health and Human Services, the Department of Justice, the Drug Enforcement Administration, the Consumer Product Safety Commission, the Federal Trade Commission, the Occupational Safety & Health Administration, the Environmental Protection Agency and state and local governments.

Healthcare providers, physicians and third-party payors in the United States and elsewhere play a primary role in the recommendation and prescription of pharmaceutical products. Arrangements with third-party payors and customers can expose pharmaceutical manufactures to broadly applicable fraud and abuse and other healthcare laws and regulations, including, without limitation, the federal Anti-Kickback Statute and the federal False Claims Act, or FCA, which may constrain the business or financial arrangements and relationships through which companies sell, market and distribute pharmaceutical products. In addition, transparency laws and patient privacy regulations by federal and state governments and by governments in foreign jurisdictions can apply to the manufacturing, sales, promotion and other activities of pharmaceutical manufactures. The applicable federal, state and foreign healthcare laws and regulations that can affect a pharmaceutical company's operations include:

- The federal Anti-Kickback Statute, which prohibits, among other things, knowingly and willfully soliciting, receiving, offering or paying any remuneration (including any kickback, bribe, or rebate), directly or indirectly, overtly or covertly, in cash or in kind, to induce, or in return for, either the referral of an individual, or the purchase, lease, order or recommendation of any good, facility, item or service for which payment may be made, in whole or in part, under the Medicare and Medicaid programs, or other federal healthcare programs. A person or entity can be found guilty of violating the statute without actual knowledge of the statute or specific intent to violate it. In addition, the government may assert that a claim including items or services resulting from a violation of the federal Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the FCA. The Anti-Kickback Statute has been interpreted to apply to arrangements between pharmaceutical manufacturers on the one hand and prescribers, purchasers, and formulary managers on the other. There are a number of statutory exceptions and regulatory safe harbors protecting some common activities from prosecution;

- The federal civil and criminal false claims laws and civil monetary penalty laws, including the FCA, which prohibit any person or entity from, among other things, knowingly presenting, or causing to be presented, a false, fictitious or fraudulent claim for payment to, or approval by, the federal government or knowingly making, using or causing to be made or used a false record or statement, including providing inaccurate billing or coding information to customers or promoting a product off-label, material to a false or fraudulent claim to the federal government. As a result of a modification made by the Fraud Enforcement and Recovery Act of 2009, a claim includes "any request or demand" for money or property presented to the federal government. In addition, manufacturers can be held liable under the FCA even when they do not submit claims directly to government payors if they are deemed to "cause" the submission of false or fraudulent claims. The FCA also permits a private individual acting as a "whistleblower" to bring actions on behalf of the federal government alleging violations of the FCA and to share in any monetary recovery;

- The federal Health Insurance Portability and Accountability Act of 1996, or HIPAA, which created federal criminal statutes that prohibit knowingly and willfully executing, or attempting to execute, a scheme to defraud any healthcare benefit program or obtain, by means of false or fraudulent pretenses, representations, or promises, any of the money or property owned by, or under the custody or control of, any healthcare benefit program, regardless of the payor (e.g., public or private) and knowingly and willfully falsifying, concealing or covering up by any trick or device a material fact or making any materially false statements in connection with the delivery of, or payment for, healthcare benefits, items or services relating to healthcare matters. Similar to the federal Anti-Kickback Statute, a person or entity can be found guilty of violating HIPAA without actual knowledge of the statute or specific intent to violate it;

- HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act of 2009, or HITECH, and their respective implementing regulations, which impose, among other things, specified requirements relating to the privacy, security and transmission of individually identifiable health information held by covered entities and their business associates. HITECH also created new tiers of civil monetary penalties, amended HIPAA to make civil and criminal penalties directly applicable to business associates, and gave state attorneys general new authority to file civil actions for damages or injunctions in federal courts to enforce the federal HIPAA laws and seek attorneys' fees and costs associated with pursuing federal civil actions;

- The federal legislation commonly referred to as the Physician Payments Sunshine Act, created under the Patient Protection and Affordable Care Act, or ACA, and its implementing regulations, 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 (with certain exceptions) to report annually to the Centers for Medicare & Medicaid Services, or CMS, information related to payments or other transfers of value made to physicians (defined to include doctors, dentists, optometrists, podiatrists and chiropractors) and teaching hospitals, as well as ownership and investment interests held by physicians and their immediate family members;

- Federal consumer protection and unfair competition laws, which broadly regulate marketplace activities and activities that potentially harm consumers; and

- Analogous state laws and regulations, including: state anti-kickback and false claims laws, which may apply to our business practices, including, but not limited to, research, distribution, sales and marketing arrangements and claims involving healthcare items or services reimbursed by any third-party payor, including private insurers; state laws that require pharmaceutical companies to comply with the pharmaceutical industry's voluntary compliance guidelines and the relevant compliance guidance promulgated by the U.S. federal government, or otherwise restrict payments that may be made to healthcare providers and other potential referral sources.

Pricing and rebate programs must comply with the Medicaid rebate requirements of the U.S. Omnibus Budget Reconciliation Act of 1990 and more recent requirements in the ACA. If products are made available to authorized users of the Federal Supply Schedule of the General Services Administration, additional laws and requirements apply. Products must meet applicable child-resistant packaging requirements under the U.S. Poison Prevention Packaging Act. Manufacturing, sales, promotion and other activities also are potentially subject to federal and state consumer protection and unfair competition laws.

The distribution of pharmaceutical products is subject to additional requirements and regulations, including extensive record-keeping, licensing, storage and security requirements intended to prevent the unauthorized sale of pharmaceutical products.

The scope and enforcement of each of these laws is uncertain and subject to rapid change in the current environment of healthcare reform, especially in light of the lack of applicable precedent and regulations with respect to certain laws. Federal and state enforcement bodies have recently increased their scrutiny of interactions between healthcare companies and healthcare providers, which has led to a number of investigations, prosecutions, convictions and settlements in the healthcare industry. Prohibitions or restrictions on sales or withdrawal of future marketed products could materially affect our business in an adverse way. Changes in regulations, statutes or the interpretation of existing regulations could impact our business in the future by requiring, for example: (i) changes to our manufacturing arrangements; (ii) additions or modifications to product labeling; (iii) the recall or discontinuation of our products; or (iv) additional record-keeping requirements. If any such changes were to be imposed, they could adversely affect the operation of our business.

Ensuring our business arrangements comply with applicable healthcare laws, as well as responding to possible investigations by government authorities, can be time- and resource-consuming and can divert a company's attention from the business.

The failure to comply with any of these laws or regulatory requirements subjects companies to possible legal or regulatory action. Depending on the circumstances, failure to meet applicable regulatory requirements can result in civil, criminal and administrative penalties, damages, fines, disgorgement, individual imprisonment, possible exclusion from participation in federal and state funded healthcare programs, contractual damages and the curtailment or restricting of our operations, as well as additional reporting obligations and oversight if we become subject to a corporate integrity agreement or other agreement to resolve allegations of non-compliance with these laws. Any action for violation of these laws, even if successfully defended, could cause a pharmaceutical company to incur significant legal expenses and divert management's attention from the operation of the business.

In the United States, there have been and continue to be a number of legislative initiatives to contain healthcare costs. For example, in March 2010, the ACA was passed, which substantially changes the way healthcare is financed by both governmental and private insurers, and significantly impacts the U.S. pharmaceutical industry. The ACA, among other things, subjects biological products to potential competition by lower-cost biosimilars, addresses a new methodology by which rebates owed by manufacturers under the Medicaid Drug Rebate Program are calculated for drugs that are inhaled, infused, instilled, implanted or injected, increases the minimum Medicaid rebates owed by manufacturers under the Medicaid Drug Rebate Program extends the rebate program to individuals enrolled in Medicaid managed care organizations, establishes annual fees and taxes on manufacturers of certain branded prescription drugs, and creates a new Medicare Part D coverage gap discount program, in which manufacturers must agree to offer 50% (70% commencing January 1, 2019) point-of-sale discounts off negotiated prices of applicable brand drugs to eligible beneficiaries during their coverage gap period, as a condition to coverage under Medicare Part D for the manufacturer's outpatient drugs.

Some of the provisions of the ACA have yet to be fully implemented, while certain provisions have been subject to judicial and congressional challenges, as well as efforts by the Trump administration to repeal or replace certain aspects of the ACA. Since assuming the presidency in January 2017, President Trump has signed two Executive Orders 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, or 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." Additionally, 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 so-called "Cadillac" tax on certain high cost employer-sponsored insurance plans, the annual fee imposed on certain high cost employer-sponsored insurance plans, the annual fee imposed on certain health insurance providers based on market share, and the medical device excise tax on non-exempt medical devices. Further, the Bipartisan Budget Act of 2018 among other things, amends the ACA, effective January 1, 2019, to reduce the coverage gap in most Medicare drug plans, commonly referred to as the "donut hole."

Other legislative changes have been proposed and adopted in the United States since the ACA was enacted. On August 2, 2011, the Budget Control Act of 2011, among other things, created measures for spending reductions by Congress. A Joint Select Committee on Deficit Reduction, tasked with recommending a targeted deficit reduction of at least $1.2 trillion for the years 2013 through 2021, was unable to reach required goals, thereby triggering the legislation's automatic reduction to several government programs. This includes aggregate reductions of Medicare payments to providers of 2% per fiscal year. These reductions went into effect on April 1, 2013 and, due to subsequent legislative amendments to the statute, will remain in effect through 2027 unless additional congressional action is taken. On January 2, 2013, the American Taxpayer Relief Act of 2012 was signed into law, which, among other things, further reduced Medicare payments to several types of providers.

Moreover, payment methodologies may be subject to changes in healthcare legislation and regulatory initiatives which could limit the amounts that federal and state governments will pay for healthcare products and services and result in reduced demand for certain pharmaceutical products or additional pricing pressures.

Additionally, there has been increasing legislative and enforcement interest in the United States with respect to specialty drug pricing practices. Specifically, there have been several recent U.S. congressional inquiries and proposed and enacted federal and state legislation designed to, among other things, bring more transparency to drug pricing, reduce the cost of prescription drugs under Medicare, review the relationship between pricing and manufacturer patient programs, and reform government program reimbursement methodologies for drugs.

U.S. Patent-Term Restoration and Marketing Exclusivity

Depending upon the timing, duration and specifics of FDA approval of our product candidates and any future product candidates we develop, some of our U.S. patents may be eligible for limited patent term extension under the Drug Price Competition and Patent Term Restoration Act of 1984, commonly referred to as the Hatch-Waxman Amendments. The Hatch-Waxman Amendments permit restoration of the patent term of up to five years as compensation for patent term lost during product development and FDA regulatory review process. Patent-term restoration, however, cannot extend the remaining term of a patent beyond a total of 14 years from the product's approval date. The patent-term restoration period is generally one-half the time between the effective date of an IND and the submission date of a BLA plus the time between the submission date of a BLA and the approval of that application, except that the review period is reduced by any time during which the applicant failed to exercise due diligence. Only one patent applicable to an approved drug is eligible for the extension and the application for the extension must be submitted prior to the expiration of the patent. The U.S. Patent and Trademark Office, or USPTO, in consultation with the FDA, reviews and approves the application for any patent term extension or restoration. In the future, we may apply for restoration of patent term for our currently owned or licensed patents to add patent life beyond its current expiration date, depending on the expected length of the clinical trials and other factors involved in the filing of the relevant BLA.

An abbreviated approval pathway for biological products shown to be similar to, or interchangeable with, an FDA-licensed reference biological product was created by the Biologics Price Competition and Innovation Act of 2009 as part of the ACA. This amendment to the PHSA, in part, attempts to minimize duplicative testing. Biosimilarity, which requires that the biological product be highly similar to the reference product notwithstanding minor differences in clinically inactive components and that there be no clinically meaningful differences between the product and the reference product in terms of safety, purity and potency, can be shown through analytical studies, animal studies and a clinical trial or trials. Interchangeability requires that a biological product be biosimilar to the reference product and that the product can be expected to produce the same clinical results as the reference product in any given patient and, for products administered multiple times to an individual, that the product and the reference product may be alternated or switched after one has been previously administered without increasing safety risks or risks of diminished efficacy relative to exclusive use of the reference biological product without such alternation or switch. A reference biological product is granted 12 years of data exclusivity from the time of first licensure of the product, and the FDA will not accept an application for a biosimilar or interchangeable product based on the reference biological product until four years after the date of first licensure of the reference product. "First licensure" typically means the initial date the particular product at issue was licensed in the United States. Date of first licensure does not include the date of licensure of (and a new period of exclusivity is not available for) a biological product if the licensure is for a supplement for the biological product or for a subsequent application by the same sponsor or manufacturer of the biological product (or licensor, predecessor in interest, or other related entity) for a change (not including a modification to the structure of the biological product) that results in a new indication, route of administration, dosing schedule, dosage form, delivery system, delivery device or strength, or for a modification to the structure of the biological product that does not result in a change in safety, purity, or potency. Therefore, one must determine whether a new product includes a modification to the structure of a previously licensed product that results in a change in safety, purity, or potency to assess whether the licensure of the new product is a first licensure that triggers its own period of exclusivity. Whether a subsequent application, if approved, warrants exclusivity as the "first licensure" of a biological product is determined on a case-by-case basis with data submitted by the sponsor.

Pediatric exclusivity is another type of regulatory market exclusivity in the United States. Pediatric exclusivity, if granted, adds six months to existing regulatory exclusivity periods. This six-month exclusivity may be granted based on the voluntary completion of a pediatric trial in accordance with an FDA-issued "Written Request" for such a trial.

European Union Drug Development

In the European Union, or EU, our future products also may be subject to extensive regulatory requirements. As in the United States, medicinal products can be marketed only if a marketing authorization from the competent regulatory agencies has been obtained.

Similar to the United States, the various phases of preclinical and clinical research in the European Union are subject to significant regulatory controls. Although the EU Clinical Trials Directive 2001/20/EC has sought to harmonize the EU clinical trials regulatory framework, setting out common rules for the control and authorization of clinical trials in the EU, the EU member states have transposed and applied the provisions of the Directive differently. This has led to significant variations in the member state regimes. Under the current regime, before a clinical trial can be initiated it must be approved in each of the EU countries where the trial is to be conducted by two distinct bodies: the National Competent Authority, or NCA, and one or more Ethics Committees, or ECs. Under the current regime all suspected unexpected serious adverse reactions to the investigated drug that occur during the clinical trial have to be reported to the NCA and ECs of the member state where they occurred.

The EU clinical trials legislation currently is undergoing a transition process mainly aimed at harmonizing and streamlining clinical-trial authorization, simplifying adverse-event reporting procedures, improving the supervision of clinical trials and increasing their transparency. Recently enacted Clinical Trials Regulation EU No 536/2014 ensures that the rules for conducting clinical trials in the EU will be identical.

European Union Drug Review and Approval

In the European Economic Area, or EEA, which is comprised of the 28 member states of the EU and Iceland, Liechtenstein, Norway, medicinal products can only be commercialized after obtaining a Marketing Authorization, or MA. There are two types of marketing authorizations.

- The Community MA is issued by the European Commission through the Centralized Procedure, based on the opinion of the Committee for Medicinal Products for Human Use, or CHMP, of the EMA and is valid throughout the entire territory of the EEA. The Centralized Procedure is mandatory for certain types of products, such as biotechnology medicinal products, orphan medicinal products, advanced-therapy medicines such as gene-therapy, somatic cell-therapy or tissue-engineered medicines and medicinal products containing a new active substance indicated for the treatment of HIV, AIDS, cancer, neurodegenerative disorders, diabetes, auto-immune and other immune dysfunctions and viral diseases. The Centralized Procedure is optional for products containing a new active substance not yet authorized in the EEA, or for products that constitute a significant therapeutic, scientific or technical innovation or which are in the interest of public health in the EU.

- National MAs, which are issued by the competent authorities of the Member States of the EEA and only cover their respective territory, are available for products not falling within the mandatory scope of the Centralized Procedure. Where a product has already been authorized for marketing in a member state of the EEA, this National MA can be recognized in other member states through the Mutual Recognition Procedure. If the product has not received a National MA in any member state at the time of application, it can be approved simultaneously in various member state through the Decentralized Procedure. Under the Decentralized Procedure an identical dossier is submitted to the competent authorities of each of the member state in which the MA is sought, one of which is selected by the applicant as the Reference Member State, or RMS. The competent authority of the RMS prepares a draft assessment report, a draft summary of the product characteristics, or SPC, and a draft of the labeling and package leaflet, which are sent to the other member state, referred to as the Member States Concerned, for their approval. If the Member States Concerned raise no objections, based on a potential serious risk to public health, to the assessment, SPC, labeling, or packaging proposed by the RMS, the product is subsequently granted a national MA in all the member states (i.e., in the RMS and the Member States Concerned).

Under the above described procedures, before granting the MA, the EMA or the competent authorities of the member states of the EEA make an assessment of the risk-benefit balance of the product on the basis of scientific criteria concerning its quality, safety and efficacy.

European Union Orphan Designation and Exclusivity

In the European Union, the EMA's Committee for Orphan Medicinal Products grants orphan drug designation to promote the development of products that are intended for the diagnosis, prevention or treatment of life-threatening or chronically debilitating conditions affecting not more than five in 10,000 persons in the European Union community (or where it is unlikely that the development of the medicine would generate sufficient return to justify the investment) and for which no satisfactory method of diagnosis, prevention or treatment has been authorized (or, if a method exists, the product would be a significant benefit to those affected).

In the European Union, orphan drug designation entitles a party to financial incentives such as reduction of fees or fee waivers and ten years of market exclusivity is granted following medicinal product approval. This period may be reduced to six years if the orphan drug designation criteria are no longer met, including where it is shown that the product is sufficiently profitable not to justify maintenance of market exclusivity. Orphan drug designation must be requested before submitting an application for MA. Orphan drug designation does not convey any advantage in, or shorten the duration of, the regulatory review and approval process.

European Union Drug Marketing

Much like the Anti-Kickback Statute prohibition in the United States, the provision of benefits or advantages to physicians to induce or encourage the prescription, recommendation, endorsement, purchase, supply, order or use of medicinal products is also prohibited in the EU. The provision of benefits or advantages to physicians is governed by the national anti-bribery laws of European Union member states, such as the U.K. Bribery Act 2010. Infringement of these laws could result in substantial fines and imprisonment.

Payments made to physicians in certain EU member states must be publicly disclosed. Moreover, agreements with physicians often must be the subject of prior notification and approval by the physician's employer, his or her competent professional organization as well as the regulatory authorities of the individual EU member states. These requirements are provided in the national laws, industry codes or professional codes of conduct, applicable in the EU member states. Failure to comply with these requirements could result in reputational risk, public reprimands, administrative penalties, fines or imprisonment.

European Data Collection

The collection and use of personal health data in the EU is governed by the provisions of the Data Protection Directive, and as of May 2018 the General Data Protection Regulation, or GDPR. This directive imposes several requirements relating to the consent of the individuals to whom the personal data relates, the information provided to the individuals, notification of data processing obligations to the competent national data protection authorities and the security and confidentiality of the personal data. The Data Protection Directive and GDPR also impose strict rules on the transfer of personal data out of the EU to the United States. Failure to comply with the requirements of the Data Protection Directive, the GDPR, and the related national data protection laws of the EU member states may result in fines and other administrative penalties. The GDPR introduces new data protection requirements in the EU and substantial fines for breaches of the data protection rules. The GDPR regulations may impose additional responsibility and liability in relation to personal data that we process and we may be required to put in place additional mechanisms ensuring compliance with the new data protection rules. This may be onerous and adversely affect our business, financial condition, results of operations and prospects.

Rest of the World Regulation

For other countries outside of the EU and the United States, such as countries in Eastern Europe, Latin America or Asia, the requirements governing the conduct of clinical trials, product licensing, pricing and reimbursement vary from country to country. Additionally, the clinical trials must be conducted in accordance with GCP requirements and the applicable regulatory requirements and the ethical principles that have their origin in the Declaration of Helsinki.

If we fail to comply with applicable foreign regulatory requirements, we may be subject to, among other things, fines, suspension or withdrawal of regulatory approvals, product recalls, seizure of products, operating restrictions and criminal prosecution.

Reimbursement

Sales of our products, when and if approved, will depend, in part, on the extent to which our products will be covered by third-party payors, such as government health programs, commercial insurance and managed healthcare organizations. In the United States, no uniform policy of coverage and reimbursement for drug or biological products exists. Accordingly, decisions regarding the extent of coverage and amount of reimbursement to be provided for any of our products will be made on a payor-by-payor basis. As a result, coverage determination is often a time-consuming and costly process that will require us to provide scientific and clinical support for the use of our products to each payor separately, with no assurance that coverage and adequate reimbursement will be obtained.

The U.S. government, state legislatures and foreign governments have shown significant interest in implementing cost containment programs to limit the growth of government-paid health care costs, including price-controls, restrictions on reimbursement and requirements for substitution of biosimilars for branded prescription drugs. For example, the ACA contains provisions that may reduce the profitability of drug products through increased rebates for drugs reimbursed by Medicaid programs, extension of Medicaid rebates to Medicaid managed care plans, mandatory discounts for certain Medicare Part D beneficiaries and annual fees based on pharmaceutical companies' share of sales to federal healthcare programs. Adoption of general controls and measures, coupled with the tightening of restrictive policies in jurisdictions with existing controls and measures, could limit payments for pharmaceutical drugs.

The Medicaid Drug Rebate Program requires pharmaceutical manufacturers to enter into and have in effect a national rebate agreement with the Secretary of the Department of Health and Human Services as a condition for states to receive federal matching funds for the manufacturer's outpatient drugs furnished to Medicaid patients. The ACA made several changes to the Medicaid Drug Rebate Program, including increasing pharmaceutical manufacturers' rebate liability by raising the minimum basic Medicaid rebate on most branded prescription drugs from 15.1% of average manufacturer price, or AMP, to 23.1% of AMP and adding a new rebate calculation for "line extensions" (i.e., new formulations, such as extended release formulations) of solid oral dosage forms of branded products, as well as potentially impacting their rebate liability by modifying the statutory definition of AMP. The ACA also expanded the universe of Medicaid utilization subject to drug rebates by requiring pharmaceutical manufacturers to pay rebates on Medicaid managed care utilization and by enlarging the population potentially eligible for Medicaid drug benefits.

The Medicare Prescription Drug, Improvement, and Modernization Act of 2003, or the MMA, established the Medicare Part D program to provide a voluntary prescription drug benefit to Medicare beneficiaries. Under Part D, Medicare beneficiaries may enroll in prescription drug plans offered by private entities that provide coverage of outpatient prescription drugs. Unlike Medicare Part A and B, Part D coverage is not standardized. While all Medicare drug plans must give at least a standard level of coverage set by Medicare, Part D prescription drug plan sponsors are not required to pay for all covered Part D drugs, and each drug plan can develop its own drug formulary that identifies which drugs it will cover and at what tier or level. However, Part D prescription drug formularies must include drugs within each therapeutic category and class of covered Part D drugs, though not necessarily all the drugs in each category or class. Any formulary used by a Part D prescription drug plan must be developed and reviewed by a pharmacy and therapeutic committee. Government payment for some of the costs of prescription drugs may increase demand for products for which we receive marketing approval. However, any negotiated prices for our products covered by a Part D prescription drug plan likely will be lower than the prices we might otherwise obtain. Moreover, while the MMA applies only to drug benefits for Medicare beneficiaries, private payors often follow Medicare coverage policy and payment limitations in setting their own payment rates. Any reduction in payment that results from the MMA may result in a similar reduction in payments from non-governmental payors.

For a drug product to receive federal reimbursement under the Medicaid or Medicare Part B programs or to be sold directly to U.S. government agencies, the manufacturer must extend discounts to entities eligible to participate in the 340B drug pricing program. The required 340B discount on a given product is calculated based on the AMP and Medicaid rebate amounts reported by the manufacturer. As of 2010, the ACA expanded the types of entities eligible to receive discounted 340B pricing, although, under the current state of the law, with the exception of children's hospitals, these newly eligible entities will not be eligible to receive discounted 340B pricing on orphan drugs. In addition, as 340B drug pricing is determined based on AMP and Medicaid rebate data, the revisions to the Medicaid rebate formula and AMP definition described above could cause the required 340B discount to increase.

As noted above, the marketability of any products for which we receive regulatory approval for commercial sale may suffer if the government and third-party payors fail to provide coverage and reimbursement. Obtaining coverage and reimbursement for newly approved drugs and biologics is a time-consuming and costly process, and coverage may be more limited than the purposes for which a drug is approved by the FDA or comparable foreign regulatory authorities. Assuming coverage is obtained for a given product by a third-party payor, the resulting reimbursement payment rates may not be adequate or may require co-payments that patients find unacceptably high. Additionally, coverage policies and third-party reimbursement rates may change at any time. Patients who are prescribed medications for the treatment of their conditions, and their prescribing physicians, generally rely on third-party payors to reimburse all or part of the costs associated with their prescription drugs. Patients are unlikely to use products unless coverage is provided and reimbursement is adequate to cover all or a significant portion of the cost of prescribed products.

In addition, in most foreign countries, the proposed pricing for a drug must be approved before it may be lawfully marketed. The requirements governing drug pricing and reimbursement vary widely from country to country. For example, the EU provides options for its member states to restrict the range of medicinal products for which their national health insurance systems provide reimbursement and to control the prices of medicinal products for human use. A member state may approve a specific price for the medicinal product or it may instead adopt a system of direct or indirect controls on the profitability of the company placing the medicinal product on the market. There can be no assurance that any country that has price controls or reimbursement limitations for pharmaceutical products will allow favorable reimbursement and pricing arrangements for any of our products. Historically, products launched in the European Union do not follow price structures of the United States and generally prices tend to be significantly lower.

Employees

As of September 30, 2018, we had 52 full-time employees and 14 part-time employees. Of our 66 full and part-time employees, 19 have Ph.D. or M.D. degrees and 54 are engaged in research and development activities. Pursuant to Austrian law, all of our Austrian employees are covered by a collective bargaining agreement. We consider our relationship with our employees to be good.

Facilities

Our principal executive offices are located in New York, New York, pursuant to a lease that expires in July 2019, which automatically renews for successive 12 month periods unless terminated by either party. Our European research and preclinical development operations are located in Vienna, Austria, where we lease and occupy approximately 13,207 square feet of office and laboratory space. This facility is leased pursuant to three operating leases, comprised of (i) a lease of unlimited duration for approximately 8,880 square feet of office and laboratory space, (ii) a lease set to expire in May 2028 and with no option to extend for approximately 2,820 square feet of office space and (iii) a lease set to expire in September 2028 and with no option to extend for approximately 1,506 square feet of storage space. We believe that our current facilities are adequate to meet our ongoing needs, and that, if we require additional space, we will be able to obtain additional facilities on commercially reasonable terms.

Legal Proceedings

We are not currently a party to any material legal proceedings. From time to time, we may become involved in other litigation or legal proceedings relating to claims arising from the ordinary course of business.

MANAGEMENT

Executive Officers and Directors

The following table sets forth the name, age, and position of each of our current executive officers and directors as of December 1, 2018:

Name	Age	Position
Executive Officers:		
Jörn Aldag	59	Chief Executive Officer, Director
Reinhard Kandera	49	Chief Financial Officer, Director
Igor Matushansky, M.D., Ph.D.	46	Chief Medical Officer and Global Head of Research and Development
Daniel Pinschewer, M.D.	44	Chief Scientific Officer
Non-Employee Directors:		
Jan van de Winkel, Ph.D.	57	Chairman of the Board, Director
Christoph Lengauer, Ph.D.	53	Director
Sander van Deventer, M.D., Ph.D	64	Director
Paul-Henri Lambert, M.D.	80	Director
Graziano Seghezzi	49	Director
Julie O'Neill	52	Director

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

Executive Officers

Jörn Aldag has served as our Chief Executive Officer and a member of our board of directors since HOOKIPA Pharma's inception to date. Mr. Aldag served as the Chief Executive Officer at uniQure N.V. (Nasdaq: QURE, formerly, Amsterdam Molecular Therapeutics N.V.), or uniQure, from October 2009 to December 2015 and as an advisor to the board from January 2016 to May 2016. Prior to his tenure at uniQure, Mr. Aldag was President and Chief Executive Officer of Evotec AG from November 1997 to December 2008. Mr. Aldag serves as a non-executive director on the board of Unum Therapeutics, Boston, USA, since January 2016. Mr. Aldag also served as the Chairman of Molecular Partners AG, Zurich, Switzerland (SWIX: MOLN) from 2007 to 2018. He co-founded G7 Therapeutics AG in 2014, which was acquired by Heptares Therapeutics Ltd. in 2016. Mr. Aldag received business degrees from the Harvard Business School (Advanced Management Program) in 1994 and from the European Business School (Diplom Betriebswirt) in 1982. Our board of directors believes that Mr. Aldag's experience gained from serving as our Chief Executive Officer, combined with his previous qualifications and the skills and experience he has developed during his extensive career in the life sciences industry, qualify him to serve as a member of our board of directors.

Reinhard Kandera has served as our Chief Financial Officer since April 2017 and as a member of our board of directors since June 2018. Mr. Kandera served as the Chief Financial Officer and Member of the Management Board of Valneva SE, or Valneva, from May 2013 to March 2017. Prior to Valneva, he served as Chief Financial Officer of Intercell AG, or Intercell, from March 2009 to May 2013 and as Member of Intercell's Management Board from November 2011 to May 2013, which merged with Vivalis SA to become Valneva in May 2013. Mr. Kandera received doctorate degrees in Business Administration and in Law from the Vienna University. Our board of directors believes that Mr. Kandera's experience gained from serving as our Chief Financial Officer, combined with his previous qualifications and the skills and experience he has developed during his extensive career in the life sciences industry, qualify him to serve as a member of our board of directors.

Igor Matushansky, M.D., Ph.D., has served as our Chief Medical Officer and Global Head of Research and Development since February 2017. Dr. Matushansky served as the Global Head of Translational Development for Oncology at Daiichi Sankyo from 2015 to 2017, where he led Daiichi Sankyo's international research unit that focused on early oncology therapeutic programs, strategy and development and was also responsible for a range of development activities, including post-target identification, clinical trials and proof-of-concept research. Before this, Dr. Matushansky worked at Novartis from 2012 to 2015 as both Global Head for Clinical and Scientific Development in the Gene & Cell Therapy Unit and as Global Clinical Program Lead within the Oncology Translational Medicine Unit. Prior to this, he was a Professor at Columbia University Medical Center from 2007 to 2012 where he ran an independent laboratory that focused on the molecular biology of sarcomas, including translational opportunities and clinical trials. Dr. Matushansky received a B.A. degree, summa cum laude, from Columbia University, and a M.D. and Ph.D. in Molecular Biology from the Albert Einstein College of Medicine. He performed his internal medicine residency at New York Presbyterian Hospital/Weill Cornell Medical Center and then completed a fellowship in Medical Oncology as well as a post-doctoral research fellowship in Cancer Biology at the Memorial Sloan Kettering Cancer Center. He is currently a Clinical Assistant Professor of Medical Oncology at Columbia University. He has also been a non-executive director on the board of directors of Crescendo Biologics Ltd since June 2018.

Daniel Pinschewer, M.D., has served as our Chief Scientific Officer since January 2017 and is our founder. Since 2013, he has served as a professor of virology at the University of Basel Medical School. From 2007 to 2013, Dr. Pinschewer served as associate professor of immunology at the University of Geneva Medical School. Dr. Pinschewer received his M.D. from the University of Zurich.

Non-Employee Directors

Jan van de Winkel, Ph.D., has served as Chairman of our board of directors since October 2017. Dr. van de Winkel is a co-founder of Genmab A/S and has served as the company's President and Chief Executive Officer since June 2010. Prior to June 2010, he served as Genmab's President Research & Development and Chief Scientific Officer. Dr. van de Winkel serves on the board of directors of Celdara Medical Inc. and LEO Pharma, as well as the scientific advisory board of Thuja Capital Healthcare Fund and the advisory board of Capricorn Healthtech Fund. Our board of directors believes that Dr. van de Winkel's experience in biopharmaceutical research and development and his experience in managerial and director roles in life sciences companies qualify him to serve on our board of directors.

Christoph Lengauer, Ph.D., has served as a member of our board of directors since June 2018. Dr. Lengauer is currently a venture partner at Third Rock Ventures and President of Celsius Therapeutics, Cambridge, USA. He was the Chief Scientific Officer and Chief Drug Hunter at Blueprint Medicines from January 2012 to November 2016, the Vice President and Global Head of Oncology Drug Discovery and Preclinical Development at Sanofi S.A., a multinational pharmaceutical company, from May 2008 to January 2012 and Executive Director and Senior Unit Head of Oncology Discovery at the Novartis Institutes for Biomedical Research from 2005 to 2008. Prior to his experience at Novartis, Dr. Lengauer was a member of the faculty at the Sidney Kimmel Comprehensive Cancer Center at the Johns Hopkins University School of Medicine from 1997 to 2005. Dr. Lengauer received an M.Sc. from the University of Salzburg, Austria, a Ph.D. in biology from the University of Heidelberg, Germany and an M.B.A. in medical services management from The Johns Hopkins University. Our board of directors believes that Dr. Lengauer's experience in biopharmaceutical research and development and his experience in venture capital qualify him to serve on our board of directors.

Sander van Deventer, M.D., Ph.D., has served as a member of our board of directors since October 2011. Dr. van Deventer has been a general partner of Forbion Capital Partners (formerly ABN AMRO Capital) since 2006. He has also been the Chief Scientific Officer of uniQure since August 2018. From 2008 to 2009, he served as the Chief Executive Officer of Amsterdam Molecular Therapeutics, or AMT, a gene therapy company that he co-founded in 1998. From 2012 to 2013, he was the Chief Executive Officer of Dezima Pharma, which was acquired by Amgen Inc. In addition, Dr. van Deventer has also served as a member of AMT's board of directors since 2007. He previously served as a member of the board of directors of Argos Therapeutics, Inc. from 2001 until 2018 and a member of the board of directors of uniQure from February 2014 until August 2018. Dr. van Deventer has also served as a professor of translational gastroenterology at Leiden University since 2008. He received an M.D. and Ph.D. from the University of Amsterdam. Our board of directors believes that Dr. van Deventer's experience serving on the boards of directors of life science companies and his experience in venture capital qualify him to serve on our board of directors.

Paul-Henri Lambert, M.D., has served as a member of our board of directors since December 2011. Dr. Lambert currently serves as senior advisor and honorary professor within the Centre of Vaccinology in the Department of Pathology and Immunology at the University of Geneva and is a director of the International Advanced Course of Vaccinology. He also serves as a member of the governing board of the Tuberculosis Vaccine Initiative. He previously served as chairman of the Human Vaccine Committee of the International Association for Biologicals and chairman of the Global Advisory Committee on Vaccine Safety of the World Health Organization. From 1987 to 1999, he was Chief of Microbiology and Immunology and of Vaccine Research and Development at the World Health Organization. Our board of directors believes that Dr. Lambert's extensive experience in the healthcare industry qualify him to serve on our board of directors.

Graziano Seghezzi has served as a member of our board of directors since March 2011. Mr. Seghezzi is currently Managing Partner of Sofinnova Partners, which he joined in 2006. Previously, he seed funded and was a member of the board of directors of GlycoVaxyn (Switzerland), which was sold to GlaxoSmithKline in 2015, and Omthera Pharmaceuticals, which went public on Nasdaq in 2013 and was then sold to AstraZeneca later that year. Mr. Seghezzi was a principal at Index Ventures in Geneva, Switzerland from 2003 to 2006, and previously began his career at Sofinnova Partners from 2001 to 2003. Mr. Seghezzi also serves as a member of the board of directors of Creabilis Therapeutics (Italy), Crescendo Biologics (United Kingdom) and BiovelocITA (Milan). Mr. Seghezzi holds a degree in genetics and microbiology from the University of Pavia (Italy) and an M.B.A. from the RSM-Erasmus University (Netherlands). Our board of directors believes that Mr. Seghezzi's experience as a venture capital investor in biopharmaceutical companies and his training in both business and biology qualify him to serve as a member of our board of directors.

Julie O'Neill has served as a member of our board of directors since November 2018. Ms. O'Neill previously served as the Executive Vice President, Global Operations of Alexion Pharmaceuticals, Inc., a position she has held from 2015 to September 2018. From 2014 to 2015, Ms. O'Neill was Senior Vice President of Global Manufacturing Operations and General Manager of Alexion Pharma International Trading. Prior to joining Alexion, Ms. O'Neill served in various leadership positions at Gilead Sciences, Inc., or Gilead, from 1997 to 2014 including Vice President of Operations and General Manager of Ireland from 2011 to 2014. Prior to Gilead, Ms. O'Neill held leadership positions at Burnil Pharmacies and Helsinn Birex Pharmaceuticals. She was previously Chairperson for the National Standards Authority of Ireland and is a member of the board and chairs the audit committee of the National Institute for Bioprocessing Research & Training. Ms. O'Neill serves as member of the board of directors of DBV Technologies S.A. (Nasdaq: DBVT). Ms. O'Neill received a Bachelor of Science in Pharmacy from University of Dublin, Trinity College and a Masters of Business Administration from University College Dublin (Smurfit School of Business) and is a Chartered Director. The board of directors believes that Ms. O'Neill's experience in the life sciences industry and her knowledge of corporate development matters allow her to make valuable contributions to the board of directors.

Family Relationships

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

Composition of Our Board of Directors

Our board of directors currently consists of eight members, each of whom are members pursuant to the board composition provisions of our amended and restated certificate of incorporation and agreements with our stockholders, which agreements are described under "Certain Relationships and Related Party Transactions." These board composition provisions will terminate upon the closing of this offering. Upon the termination of these provisions, there will be no further contractual obligations regarding the election of our directors. Our nominating and corporate governance committee and our board of directors may therefore consider a broad range of factors relating to the qualifications and background of nominees, which may include diversity, which is not only limited to race, gender, or national origin. Our nominating and corporate governance committee's and our board of directors' priority in selecting board members is identification of persons who will further the interests of our stockholders through his or her established record of professional accomplishment, the ability to contribute positively to the collaborative culture among board members, knowledge of our business, understanding of the competitive landscape, and professional and personal experiences and expertise relevant to our growth strategy. Our directors hold office until their successors have been elected and qualified or until the earlier of their resignation or removal. Our amended and restated certificate of incorporation and amended and restated bylaws that will become effective upon the closing of this offering also provide that our directors may be removed only for cause by the affirmative vote of the holders of at least 66.67% of the votes that all our stockholders would be entitled to cast in an annual election of directors, and that any vacancy on our board of directors, including a vacancy resulting from an enlargement of our board of directors, may be filled only by vote of a majority of our directors then in office.

Director Independence

The Nasdaq Stock Market LLC, or Nasdaq, Marketplace Rules, or the Nasdaq Listing Rules, require a majority of a listed company's board of directors to be comprised of independent directors within one year of listing. In addition, the Nasdaq Listing Rules require that, subject to specified exceptions and phase in periods following the initial public offering, each member of a listed company's audit, compensation and nominating and corporate governance committees be independent under the Securities Exchange Act of 1934, as amended, or the Exchange Act. Audit committee members must also satisfy the independence criteria set forth in Rule 10A-3 under the Exchange Act and compensation committee members must also satisfy the independence criteria set forth in Rule 10C-1 under the Exchange Act. Under the Nasdaq Listing Rules, a director will only qualify as an "independent director" if, in the opinion of the listed company's board of directors, that person does not have a relationship that would interfere with the exercise of independent judgment in carrying out the responsibilities of a director.

In order to be considered independent for purposes of Rule 10A-3, a member of an audit committee of a listed company may not, other than in his or her capacity as a member of the audit committee, the board of directors, or any other board committee: (1) accept, directly or indirectly, any consulting, advisory, or other compensatory fee from the listed company or any of its subsidiaries; or (2) otherwise be an affiliated person of the listed company or any of its subsidiaries. In order to be considered independent for purposes of Rule 10C-1, the board must consider, for each member of a compensation committee of a listed company, all factors specifically relevant to determining whether a director has a relationship to such company which is material to that director's ability to be independent from management in connection with the duties of a compensation committee member, including, but not limited to: (1) the source of compensation of the director, including any consulting, advisory or other compensatory fee paid by such company to the director; and (2) whether the director is affiliated with the company or any of its subsidiaries or affiliates.

In , our board of directors undertook a review of the composition of our board of directors and its committees and the independence of each director. Based upon information requested from and provided by each director concerning his or her background, employment, and affiliations, including family relationships, our board of directors has determined that each of our directors, with the exception of Messrs. is an "independent director" as defined under the Nasdaq Listing Rules. In making such determination, our board of directors considered the relationships that each such non-employee director has with our company and all other facts and circumstances that our board of directors deemed relevant in determining his or her independence, including the beneficial ownership of our capital stock by each non-employee director.

Staggered Board

In accordance with the terms of our amended and restated certificate of incorporation and amended and restated bylaws that will become effective upon the closing of this offering, will provide that the number of our directors shall be fixed from time to time by a resolution of the majority of our board of directors and that our board of directors will be divided into three staggered classes of directors and each director will be assigned to one of the three classes. At each annual meeting of the stockholders, a class of directors will be elected for a three-year term to succeed the directors of the same class whose terms are then expiring. The terms of the directors will expire upon the election and qualification of successor directors at the annual meeting of stockholders to be held during the years 2020 for Class I directors, 2021 for Class II directors and 2022 for Class III directors.

- Our Class I directors will be and ;
- Our Class II directors will be and ; and
- Our Class III directors will be and .

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

Board Leadership Structure and the Role of the Board in Risk Oversight

Board Leadership Structure

The positions of our chairperson of the board and chief executive officer are separated, with Mr. Aldag serving as our chief executive officer and Dr. van de Winkel serving as the chairperson of our board of directors. Separating these positions allows Mr. Aldag, as our chief executive officer, to focus on our day-to-day business, while allowing the chairperson of the board to lead the board of directors in its fundamental role of providing advice to and independent oversight of management. Our board of directors recognizes the time, effort, and energy that Mr. Aldag, as our chief executive officer, must devote to his position in the current business environment, as well as the commitment required to serve as our chairperson, particularly as the board of directors' oversight responsibilities continue to grow. Our board of directors also believes that this structure ensures a greater role for the independent directors in the oversight of our company and active participation of the independent directors in setting agendas and establishing priorities and procedures for the work of our board of directors. Our board of directors believes its administration of its risk oversight function has not affected its leadership structure. Our board of directors believes that having separate positions is the appropriate leadership structure for us at this time and demonstrates our commitment to good corporate governance.

Role of the Board in Risk Oversight

Risk is inherent with every business, and how well a business manages risk can ultimately determine its success. We face a number of risks, including those described under the section titled "Risk Factors" in this prospectus. Our board of directors is actively involved in oversight of risks that could affect us. This oversight is conducted primarily by our full board of directors, which has responsibility for general oversight of risks.

Following the closing of this offering, our board of directors will satisfy this responsibility through full reports by each committee chair regarding the committee's considerations and actions, as well as through regular reports directly from officers responsible for oversight of particular risks within our company. Our board of directors believes that full and open communication between management and the board of directors is essential for effective risk management and oversight.

Committees of Our Board of Directors

Our board of directors has established an audit committee, a compensation committee, and a nominating and corporate governance committee, each of which will operate pursuant to a charter to be adopted by our board of directors and will be effective upon the effectiveness of the registration statement of which this prospectus is a part. Our board of directors may establish other committees to facilitate the management of our business. Upon the effectiveness of the registration statement of which this prospectus is a part, the composition and functioning of all of our committees will comply with all applicable requirements of the Sarbanes-Oxley Act of 2002, Nasdaq and the Securities and Exchange Commission's, or the SEC, rules and regulations.

Audit Committee

will serve on the audit committee, which will be chaired by . Our board of directors has determined that , and are "independent" for audit committee purposes as that term is defined in the rules of the SEC and the applicable Nasdaq rules, and each has sufficient knowledge in financial and auditing matters to serve on the audit committee. Our board of directors has designated as an "audit committee financial expert," as defined under the applicable rules of the SEC. The audit committee's responsibilities upon closing of this offering include:

- appointing, approving the compensation of, and assessing the independence of our independent registered public accounting firm;
- pre-approving auditing and permissible non-audit services, and the terms of such services, to be provided by our independent registered public accounting firm;
- reviewing the overall audit plan with our independent registered public accounting firm and members of management responsible for preparing our financial statements;
- reviewing and discussing with management and our independent registered public accounting firm our annual and quarterly financial statements and related disclosures as well as critical accounting policies and practices used by us;
- coordinating the oversight and reviewing the adequacy of our internal control over financial reporting;

- establishing policies and procedures for the receipt and retention of accounting-related complaints and concerns;
- recommending based upon the audit committee's review and discussions with management and our independent registered public accounting firm whether our audited financial statements shall be included in our Annual Report on Form 10-K;
- monitoring the integrity of our financial statements and our compliance with legal and regulatory requirements as they relate to our financial statements and accounting matters;
- preparing the audit committee report required by SEC rules to be included in our annual proxy statement;
- reviewing all related person transactions for potential conflict of interest situations and approving all such transactions; and
- reviewing quarterly earnings releases.

Compensation Committee

will serve on the compensation committee, which will be chaired by . Our board of directors has determined that , and are "independent" as defined in the applicable Nasdaq rules. The compensation committee's responsibilities upon closing of this offering include:

- annually reviewing and approving corporate goals and objectives relevant to the compensation of our chief executive officer;
- evaluating the performance of our chief executive officer in light of such corporate goals and objectives and determining the compensation of our chief executive officer;
- reviewing and approving the compensation of our other executive officers;
- reviewing and establishing our overall management compensation, philosophy, and policy;
- overseeing and administering our compensation and similar plans;
- evaluating and assessing potential and current compensation advisors in accordance with the independence standards identified in the applicable Nasdaq rules;
- retaining and approving the compensation of any compensation advisors;
- reviewing and approving our policies and procedures for the grant of equity-based awards;
- evaluating director compensation and making recommendations on director compensation to the Board;
- preparing the compensation committee report required by SEC rules, if and when required, to be included in our annual proxy statement; and
- reviewing and approving the retention or termination of any consulting firm or outside advisor to assist in the evaluation of compensation matters.

Nominating and Corporate Governance Committee

will serve on the nominating and corporate governance committee, which will be chaired by . Our board of directors has determined that , and are "independent" as defined in the applicable Nasdaq rules. The nominating and corporate governance committee's responsibilities upon closing of this offering include:

- developing and recommending to the board of directors criteria for board and committee membership;
- establishing procedures for identifying and evaluating board of director candidates, including nominees recommended by stockholders;
- reviewing the size and composition of the board of directors to ensure that it is composed of members containing the appropriate skills and expertise to advise us;
- identifying individuals qualified to become members of the board of directors;
- recommending to the board of directors the persons to be nominated for election as directors and to each of the board's committees;
- developing and recommending to the board of directors a code of business conduct and ethics and a set of corporate governance guidelines; and
- overseeing the evaluation of our board of directors and management.

Our board of directors may from time to time establish other committees.

Compensation Committee Interlocks and Insider Participation

None of the members of our compensation committee has at any time during the prior three years been one of our officers or employees. None of our executive officers currently serves, or in the past fiscal year has served, as a member of the board of directors or compensation committee of any entity that has one or more executive officers serving on our board of directors or compensation committee. For a description of transactions between us and members of our compensation committee and affiliates of such members, please see "Certain Relationships and Related Party Transactions."

Code of Business Conduct and Ethics

We plan to adopt a written code of business conduct and ethics that applies to all of our employees, officers, and directors, including those officers responsible for financial reporting, which will become effective upon closing of this offering. Upon the closing of this offering, our code of business conduct and ethics will be available on the Corporate Governance section of our website at *www.hookipapharma.com*. We intend to disclose any amendments to the code, or any waivers of its requirements, on our website or in a Current Report on Form 8-K as may be required by SEC or Nasdaq rules. We do not incorporate the information on or accessible through our website into this prospectus, and you should not consider any information on, or that can be accessed through, our website as part of this prospectus.

EXECUTIVE COMPENSATION

Overview

This section provides an overview of the compensation awarded to, earned by, or paid to our principal executive officer and our next two most highly compensated executive officers in respect of their service to us for our fiscal year ended December 31, 2017. We refer to these individuals as our named executive officers. We are an "emerging growth company" within the meaning of the Jumpstart Our Business Startups Act of 2012, as amended, or the JOBS Act, and have elected to comply with the reduced compensation disclosure requirements available to emerging growth companies under the JOBS Act. Our named executive officers are:

- Jörn Aldag, our Chief Executive Officer;
- Reinhard Kandera, our Chief Financial Officer; and
- Igor Matushansky, our Chief Medical Officer.

This section contains certain forward-looking statements that are based on our current intentions and expectations regarding compensatory plans or arrangements we may adopt in the future. Actual plans or arrangements that we adopt following the closing of this offering may be materially different from those described in this section.

Our executive compensation program is based on a pay for performance philosophy. Compensation for our executive officers is composed primarily of the following components: base salary, cash bonus, and long-term equity incentives. Our executive officers, like all full-time employees, are eligible to participate in our retirement and health and welfare benefit plans.

2017 Summary Compensation Table

The following table presents information regarding the total compensation awarded to, earned by, and paid to our named executive officers for services rendered to us in all capacities for the year ended December 31, 2017.

Name and Principal Position	Year	Salary ($)	Option Awards ($)(1)	Non-Equity Incentive Plan Compensation ($)(2)	All Other Compensation ($)	Total ($)
Jörn Aldag(3) *Chief Executive Officer*	2017	339,007	—	203,400	—	542,407
Reinhard Kandera(3) *Chief Financial Officer*	2017	195,725	224,547	94,129	8,678(4)	523,079
Igor Matushansky *Chief Medical Officer*	2017	262,500	326,427	140,000	9,518(5)	738,445

(1) Amounts reflect the grant-date fair value of option awards granted in 2017 in accordance with ASC Topic 718. Such grant-date fair value does not take into account any estimated forfeitures related to service-vesting conditions. For information regarding assumptions underlying the valuation of equity awards, see Note 10 to our consolidated financial statements. These amounts do not correspond to the actual value that may be recognized by the executives upon vesting.

(2) Amounts represent incentive compensation earned by our named executive officers for 2017 performance, based upon achievement of corporate and individual goals.

(3) The compensation paid to Messrs. Aldag and Kandera in Euro have been converted to USD at an exchange rate of 1 Euro to 1.13 USD based on the average exchange rate published by the Federal Reserve Bank for 2017.

(4) Mr. Kandera was provided with a car for his business and personal use, and reimbursement of all related insurance, maintenance, and fuel expenses for the car. The value of these automobile benefits provided to Mr. Kandera is equal to $8,678.

(5) Amount represents a $8,207 Company matching 401(k) plan contribution, $398 in life insurance premium payments, and $913 in disability insurance premium payments.

Narrative Disclosure to Summary Compensation Table

Base Salary. Each named executive officer's base salary is a fixed component of annual compensation for performing specific duties and functions, and has been established by our board of directors taking into account each individual's role, responsibilities, skills, and expertise. In 2017, we paid annual base salaries of €300,000 to Mr. Aldag, €245,000 to Mr. Kandera, and $350,000 to Dr. Matushansky. None of our named executive officers is currently party to an employment agreement or other agreement or arrangement that provides for automatic or scheduled increases in base salary. For additional information regarding the employment agreements of our named executive officers, see subsection entitled "Employment Arrangements with our Named Executive Officers."

Cash Bonus. Our annual bonus program is intended to reward our named executive officers for meeting individual or corporate performance goals for a fiscal year. For 2017, the target bonus for Mr. Aldag was equal to 50 percent of his base salary and the target bonus for each of Mr. Kandera and Dr. Matushansky was equal to 40 percent of his respective base salary.

Long-Term Equity Incentives. Our equity grant program is intended to align the interests of our named executive officers with those of our stockholders and to motivate them to make important contributions to our performance. Generally, all stock option awards vest over four years, with 25% of each option award vesting upon the first anniversary of a vesting commencement date, and the remaining shares vesting in 12 equal quarterly installments thereafter, subject to the executive officer's continuing service relationship.

Employment Arrangements with our Named Executive Officers

Jörn Aldag. In May 2016, we entered into a management contract with Mr. Aldag. For the year ended December 31, 2017, the annual base salary for Mr. Aldag was €300,000. For 2017, Mr. Aldag was eligible to earn an annual cash incentive bonus of up to 50 percent of his base salary. Additionally, Mr. Aldag was provided with a Company laptop and mobile phone, and entitled to receive reimbursement for business travel expenses between his place of employment in Hamburg, Germany and other Company office locations.

Mr. Aldag's employment agreement contains standard confidentiality, assignment of intellectual property work product and twelve (12) months' post-termination noncompetition and non-solicitation of employees covenants.

Pursuant to Mr. Aldag's employment agreement with the Company, in the event that Mr. Aldag's employment is terminated by us without any fault on the part of Mr. Aldag, he is entitled to receive (i) a lump sum payment in the amount of his annual gross salary, and (ii) if such termination occurs before May 31, 2018, acceleration of 50 percent of his stock option, granted December 20, 2016. Alternatively, in the event that Mr. Aldag's employment as a member of our Management Board is terminated by his resignation for 'good cause', he is entitled to receive (i) a lump sum payment in the amount of his annual gross salary, and (ii) full acceleration of his stock option, granted December 20, 2016.

Upon the effectiveness of the registration statement of which this prospectus is a part, we anticipate entering into a new employment agreement with Mr. Aldag that will amend and restate his prior agreement in its entirety.

Reinhard Kandera. In March 2017, we entered into a management contract with Mr. Kandera. For the year ended December 31, 2017, the annual base salary for Mr. Kandera was €245,000. For 2017, Mr. Kandera was eligible to earn an annual cash incentive bonus of up to 40 percent of his base salary. Payment of Mr. Kandera's base salary and annual cash incentive bonus were each pro-rated based on the date that he commenced employment with the Company. Additionally, Mr. Kandera was provided with a car for his business and personal use, and reimbursement of all related insurance, maintenance, and fuel expenses for the car. Mr. Kandera was provided with a Company laptop and mobile phone, and is also entitled to receive reimbursement for business travel expenses.

Mr. Kandera's employment agreement contains standard confidentiality, assignment of intellectual property work product and twelve (12) months' post-termination noncompetition and non-solicitation of employees covenants.

Pursuant to Mr. Kandera's employment agreement with the Company, in the event that Mr. Kandera's employment as a member of our Management Board is terminated by us without any fault on the part of Mr. Kandera, he is entitled to receive a lump sum payment in the amount of one month of his base salary.

Upon the effectiveness of the registration statement of which this prospectus is a part, we anticipate entering into a new employment agreement with Mr. Kandera that will amend and restate his prior agreement in its entirety.

Igor Matushansky. In February 2017, we entered into an employment agreement with Dr. Matushansky. For the year ended December 31, 2017, the annual base salary for Dr. Matushansky was $350,000. For 2017, Dr. Matushansky was eligible to earn an annual cash incentive bonus of up to 40 percent of his base salary. Payment of Dr. Matushansky's base salary and annual cash incentive bonus were each pro-rated based on the date that he commenced employment with the Company. Additionally, Dr. Matushansky received reimbursement for (i) premiums paid on a life insurance policy on the life of Dr. Matushansky, (ii) expenses incurred to maintain his professional liability insurance and his medical license, (iii) the cost of automobile tolls and parking incurred from commuting to the Company's principal offices, and (iv) the costs of premium payments for long-term disability insurance in an amount up to 200 percent of his base salary.

Dr. Matushansky's employment agreement contains standard confidentiality, assignment of intellectual property work product and twelve (12) months' post-termination noncompetition and non-solicitation of employees covenants.

Pursuant to Dr. Matushansky's employment agreement with the Company, in the event that Dr. Matushansky's employment is terminated by us without "cause" or Dr. Matushansky resigns for "good reason" (as each term is defined in his employment agreement), subject to the execution and effectiveness of a general release of all claims in our favor and the continued compliance with the restrictive covenants in his agreement, he will be entitled to receive (i) his base salary for a period of 12 months following his termination date, and (ii) a pro-rata portion of his annual bonus for the year of termination, to the extent that the applicable performance requirements have been met.

Upon the effectiveness of the registration statement of which this prospectus is a part, we anticipate entering into a new employment agreement with Dr. Matushansky that will amend and restate his prior agreement in its entirety.

Outstanding Equity Awards at 2017 Fiscal Year-End

The following table sets forth information concerning outstanding equity awards held by each of our named executive officers as of December 31, 2017.

Name	Vesting Commencement Date(1)	Number of Securities Underlying Unexercised Options (#) Exercisable	Number of Securities Underlying Unexercised Options (#) Unexercisable(1)	Option Exercise Price ($)(2)	Option Expiration Date(3)
Jörn Aldag	6/1/2016	12,750	21,249	1.20	12/31/2026
Reinhard Kandera	6/1/2017	—	6,375	1.20	12/31/2026
	12/1/2017	—	3,008	1.20	12/31/2026
Igor Matushansky	3/1/2017	—	11,098	1.20	12/31/2026
	1/1/2018	—	3,905	1.20	12/31/2026
	1/1/2019	—	1,171	1.20	12/31/2026

(1) Each option vests with respect to 25% of the shares upon the first anniversary of the vesting commencement date, with the remaining shares vesting in 12 equal quarterly installments thereafter, subject to the executive's continuing service relationship.

(2) Each option exercise price has been converted to USD at an exchange rate of 1 Euro to 1.20 USD based on the exchange rate published by the Federal Reserve Bank for December 29, 2017, the most recently published exchange rate by the Federal Reserve Bank as of December 31, 2017.

(3) All options outstanding as of December 31, 2017 were granted pursuant to the 2016 Stock Option Plan, which provided for an expiration date of December 31, 2026.

Employee Benefit and Equity Compensation Plans

2019 Stock Option and Incentive Plan

Our 2019 Stock Option and Incentive Plan, or the 2019 Plan, was adopted by our board of directors on , 2019 and approved by our stockholders on , 2019 and will become effective upon the date immediately preceding the date of the effectiveness of the registration statement of which this prospectus is a part. The 2019 Plan allows the board of directors' compensation committee to make equity-based incentive awards to our officers, employees, directors, and other key persons (including consultants).

We have initially reserved shares of our common stock for the issuance of awards under the 2019 Plan, or the Initial Limit, which shall be cumulatively increased on January 1, 2020 and each January 1 thereafter by the lesser of (i) % of the number of shares of our common stock issued and outstanding on the immediately preceding December 31, or (ii) such lesser number of shares as determined by the administrator, or the Annual Increase. These limits are subject to adjustment in the event of a stock split, stock dividend, or other change in our capitalization.

The shares we issue under the 2019 Plan will be authorized but unissued shares or shares underlying any awards that are forfeited, cancelled, held back upon exercise or settlement of an award to satisfy the exercise price or tax withholding, reacquired by us prior to vesting, satisfied without the issuance of stock, expire, or are otherwise terminated (other than by exercise) under the 2019 Plan or the 2018 Plan.

The maximum number of shares that may be issued as incentive stock options may not exceed the Initial Limit, as cumulatively increased on January 1, 2020 and each January 1 thereafter by the lesser of the Annual Increase or shares.

The 2019 Plan will be administered by our compensation committee. Our compensation committee has full power to select, from among the individuals eligible for awards, the individuals to whom awards will be granted, to make any combination of awards to participants, and to determine the specific terms and conditions of each award, subject to the provisions of the 2019 Plan. Persons eligible to participate in the 2019 Plan will be those full- or part-time officers, employees, non-employee directors, and other key persons (including consultants) as selected from time to time by our compensation committee in its discretion.

The 2019 Plan permits the granting of both options to purchase common stock intended to qualify as incentive stock options under Section 422 of the Code and options that do not so qualify. The option exercise price of each option will be determined by our compensation committee but may not be less than 100% of the fair market value of our common stock on the date of grant. The term of each option will be fixed by our compensation committee and may not exceed ten years from the date of grant. Our compensation committee will determine at what time or times each option may be exercised.

Our compensation committee may award stock appreciation rights subject to such conditions and restrictions as it may determine. Stock appreciation rights entitle the recipient to shares of common stock, or cash, equal to the value of the appreciation in our stock price over the exercise price. The exercise price may not be less than 100% of the fair market value of our common stock on the date of grant. The term of each stock appreciation right will be fixed by our compensation committee and may not exceed ten years from the date of grant. Our compensation committee will determine at what time or times each stock appreciation right may be exercised.

Our compensation committee may award restricted shares of common stock and restricted stock units to participants subject to such conditions and restrictions as it may determine. These conditions and restrictions may include the achievement of certain performance goals and/or continued employment with us through a specified vesting period. Our compensation committee may also grant shares of common stock that are free from any restrictions under the 2019 Plan. Unrestricted stock may be granted to participants in recognition of past services or for other valid consideration and may be issued in lieu of cash compensation due to such participant.

Our compensation committee may grant dividend equivalent rights to participants that entitle the recipient to receive credits for dividends that would be paid if the recipient had held a specified number of shares of common stock.

Our compensation committee may grant cash bonuses under the 2019 Plan to participants, subject to the achievement of certain performance goals.

The 2019 Plan provides that upon the effectiveness of a "sale event," as defined in the 2019 Plan, an acquirer or successor entity may assume, continue or substitute outstanding awards under the 2019 Plan. To the extent that awards granted under the New 2018 Plan are not assumed or continued or substituted by the successor entity, upon the effective time of the sale event, such awards under the New 2018 Plan shall terminate. In such case, except as may be otherwise provided in the relevant award certificate, all options and stock appreciation rights with time-based vesting that are not exercisable immediately prior to the sale event shall become fully exercisable as of the effective time of the sale event, all other awards with time-based vesting, conditions or restrictions shall become fully vested and non-forfeitable as of the effective time of the sale event, and all awards with conditions and restrictions relating to the attainment of performance goals may become vested and non-forfeitable in connection with a sale event in the administrator's discretion or to the extent specified in the relevant award certificate. In the event of such termination, individuals holding options and stock appreciation rights will be permitted to exercise such options and stock appreciation rights (to the extent exercisable) within a specified period of time prior to the sale event. In addition, in connection with the termination of the 2019 Plan upon a sale event, we may make or provide for a cash payment to participants holding vested and exercisable options and stock appreciation rights equal to the difference between the per share cash consideration payable to stockholders in the sale event and the exercise price of the options or stock appreciation rights and we may make or provide for a cash payment to participants holding other vested awards.

Our board of directors may amend or discontinue the 2019 Plan, and our compensation committee may amend or cancel outstanding awards for purposes of satisfying changes in law or any other lawful purpose, but no such action may adversely affect rights under an award without the holder's consent. Certain amendments to the 2019 Plan require the approval of our stockholders.

No awards may be granted under the 2019 Plan after the date that is ten years from the date of stockholder approval of the 2019 Plan. No awards under the 2019 Plan have been made prior to the date hereof.

2018 Stock Option and Grant Plan

The 2018 Stock Option and Grant Plan, or the 2018 Plan, was adopted by our board of directors and approved by our stockholders on May 23, 2018. Under the 2018 Plan, we may grant equity-based incentive awards to eligible employees in order to attract, retain and motivate the employees who make important contributions to our company. The material terms of the 2018 Plan are summarized below.

Shares Available for Awards. The 2018 has reserved for issuance an aggregate of 183,237 shares of our common stock. This number of shares of common stock reserved for issuance is subject to adjustment in the event of a stock split, reverse stock split, stock dividend, recapitalization, combination of shares, reclassification of shares, reorganization, or other similar change in our capitalization, or any dividend or distribution to holders of common stock other than an ordinary cash dividend.

The shares of common stock underlying awards that are forfeited, canceled, reacquired by us prior to vesting, satisfied without the issuance of stock or otherwise terminated (other than be exercise) are added back to the shares of common stock available for issuance under the 2018 Plan. In addition, shares of common stock that are withheld upon exercise of an option or settlement of an award to cover the exercise price or tax withholding are added back to the shares available for grant under the 2018 Plan.

Administration; Eligibility. Our board of directors has acted as administrator of the 2018 Plan. The administrator has full power to select, from among the individuals eligible for awards, the individuals to whom awards will be granted, and to determine the specific terms and conditions of each award, subject to the provisions of the 2018 Plan. Persons eligible to participate in the 2018 Plan are those employees, officers and directors of, and consultants and advisors to, our company as selected from time to time by the administrator in its discretion.

Awards. The 2018 Plan permits the granting of (1) options to purchase common stock intended to qualify as incentive stock options under Section 422 of the Internal Revenue Code of 1986, as amended, (2) options that do not so qualify, (3) restricted stock, (4) unrestricted stock, or (5) restricted stock units. For stock options issued prior to an initial public offering, the 2018 Plan provides that the per share option exercise price will be equal to the U.S. dollar equivalent of one euro and the administrator has discretion to determine at what time or times each option may be exercised.

Sale Event. The 2018 Plan provides that upon the occurrence of a "sale event" (as defined in the 2018 Plan), our board of directors may take one or more of the following actions (or a combination of the following actions) as to some or any stock option awards outstanding under the 2018 Plan: (i) provide that unexercised options will be assumed or substituted by the acquiring or successor corporation, (ii) upon written notice to participants, provide that all unexercised options will terminate immediately prior to the consummation of such transaction unless exercised (to the extent exercisable) within a specified period following the date of such notice, (iii) provide that options shall become exercisable (in whole or in part) prior to or upon such transaction, or (iv) make or provide for a cash payment to holders of unexercised options equal to the number of shares subject to outstanding options being cancelled (to the extent exercisable) times the difference between the per share consideration in the transaction and the per share exercise price of the outstanding option. Similarly, upon the occurrence of a "sale event," our board of directors may take one or more of the following actions (or a combination of the following actions) as to some or any restricted stock or restricted stock unit awards outstanding under the 2018 Plan: (i) provide that unvested restricted stock and restricted stock unit awards will be assumed or substituted by the acquiring or successor corporation, (ii) provide that unvested restricted stock and restricted stock unit awards shall be forfeited, (iii) make or provide for a cash payment to holders of unvested restricted stock or restricted stock unit awards equal to the number of shares subject to such award times the per share consideration in the transaction. The 2018 Plan provides that an initial public offering and any subsequent public offering will not constitute a "sale event."

Amendment; Termination. Our board of directors may amend or discontinue the 2018 Plan at any time, subject to stockholder approval where such approval is required by applicable law. Our board of directors may also amend or cancel any outstanding award, provided that no amendment to an award may adversely affect a participant's rights without his or her consent.

As of September 30, 2018, options to purchase 133,850 shares of common stock were outstanding under the 2018 Plan. Our board of directors has determined not to make any further awards under the 2018 Plan following the closing of this offering.

Stock Option Plan 2016 of Hookipa Biotech AG

Prior to our acquisition of all of the shares of Hookipa Biotech AG, our business provided long-term equity incentives under the Stock Option Plan 2016 of Hookipa Biotech AG, or the 2016 Plan. In connection with our acquisition of all of the shares of Hookipa Biotech AG, the 2016 Plan has been discontinued and each option granted under the 2016 Plan has been cancelled and substituted with an equivalent option award under the 2018 Plan.

2019 Employee Stock Purchase Plan

Our 2019 Employee Stock Purchase Plan, or the ESPP, was adopted by our board of directors on , 2019 and approved by our stockholders on , 2019, and will become effective upon the effectiveness of the registration statement of which this prospectus is a part. The ESPP is intended to qualify as an "employee stock purchase plan" within the meaning of Section 423 of the Code. The ESPP initially reserves and authorizes the issuance of up to a total of shares of common stock to participating employees. The ESPP provides that the number of shares reserved and available for issuance will automatically increase on January 1, 2020, and each January 1 thereafter through January 1, 2028, by the lesser of (i) shares of common stock, (ii) 1% of the outstanding number of shares of our common stock issued and outstanding on the immediately preceding December 31, or (iii) such lesser number of shares as determined by the ESPP administrator. The number of shares reserved under the ESPP is subject to adjustment in the event of a stock split, stock dividend or other change in our capitalization.

All employees who have been employed at least 30 days and whose customary employment is for more than 20 hours per week are eligible to participate in the ESPP. However, any employee who owns 5% or more of the total combined voting power or value of all classes of stock is not eligible to purchase shares under the ESPP.

We will make one or more offerings each year to our employees to purchase shares under the ESPP. Except as the ESPP administrator may otherwise determine, Offerings will usually begin on each January 1 and July 1 and will continue for six-month periods, referred to as offering periods. Each eligible employee may elect to participate in any offering by submitting an enrollment form at least 15 days before the relevant offering date.

Each employee who is a participant in the ESPP may purchase shares by authorizing payroll deductions of up to 15% of his or her base compensation during an offering period. Unless the participating employee has previously withdrawn from the offering, his or her accumulated payroll deductions will be used to purchase shares on the last business day of the offering period at a price equal to 85% of the fair market value of the shares on the first business day or the last business day of the offering period, whichever is lower, subject to a cap of   shares, or such other lesser number of shares as determined by the ESPP administrator. Under applicable tax rules, an employee may purchase no more than $25,000 worth of shares 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. An employee's rights under the ESPP terminate upon voluntary withdrawal from the plan or when the employee ceases employment with us for any reason.

The ESPP may be terminated or amended by our board of directors at any time. Other than as already provided in the ESPP, an amendment that increases the number of shares of common stock authorized under the ESPP and certain other amendments require the approval of our stockholders.

Senior Executive Incentive Bonus Plan

On   , 2019, our board of directors adopted the Senior Executive Cash Incentive Bonus Plan, or the Bonus Plan. Our Bonus Plan provides for bonus payments based upon the attainment of performance targets established by our compensation committee. The payment targets will be related to financial and operational measures or objectives with respect to our company, or the Corporate Performance Goals, as well as individual performance objectives.

Our compensation committee may select Corporate Performance Goals from among the following: cash flow (including, but not limited to, operating cash flow and free cash flow); revenue; corporate revenue; earnings before interest, taxes, depreciation and amortization; net income (loss) (either before or after interest, taxes, depreciation and/or amortization); changes in the market price of our common stock; economic value-added; development, clinical, regulatory or commercial milestones; acquisitions or strategic transactions; operating income (loss); return on capital, assets, equity, or investment; stockholder returns; return on sales; gross or net profit levels; productivity; expense efficiency; margins; operating efficiency; customer satisfaction; working capital; earnings (loss) per share of our common stock; bookings, new bookings or renewals; sales or market shares; number of customers; number of new customers or customer references; operating income and/or net annual recurring revenue, any of which may be measured in absolute terms, as compared to any incremental increase, in terms of growth, as compared to results of a peer group, against the market as a whole, compared to applicable market indices and/or measured on a pre-tax or post-tax basis.

Each executive officer who is selected to participate in our Bonus Plan will have a target bonus opportunity set for each performance period. The bonus formulas will be adopted in each performance period by the compensation committee and communicated to each executive. The Corporate

Performance Goals will be measured at the end of each performance period after our financial reports have been published. If the Corporate Performance Goals and individual performance objectives are met, payments will be made as soon as practicable following the end of each performance period. Subject to the rights contained in any agreement between the executive officer and us, an executive officer must be employed by us on the bonus payment date to be eligible to receive a bonus payment. Our Bonus Plan also permits the compensation committee to approve additional bonuses to executive officers in its sole discretion.

Retirement Plans

401(k) Plan

We maintain a tax-qualified retirement plan that provides eligible U.S. employees, including our named executive officers, with an opportunity to save for retirement on a tax-advantaged basis. All participants' interests in their contributions are 100% vested when contributed. Contributions are allocated to each participant's individual account and are then invested in selected investment alternatives according to the participants' directions. The retirement plan is intended to qualify under Section 401(a) of the Code. We match 100 percent of employee contributions, up to 4 percent of each employee's compensation (as defined in the plan).

DIRECTOR COMPENSATION

2017 Director Compensation

Except as set forth below, in the year ended December 31, 2017, we did not pay any compensation, make any equity or non-equity awards to, or pay any other compensation to any of the non-employee members of our board of directors for their service as a director in 2017. Jörn Aldag, our Chief Executive Officer and a member of our board of directors, did not receive any compensation for his service as a member of our board of directors during 2017. Mr. Aldag's compensation for service as an employee for fiscal year 2017 is presented above in the "2017 Summary Compensation Table."

Name	Fees Earned or Paid in Cash ($)(5)	Option Awards ($)(1)	Total ($)
Paul-Henri Lambert(2)	45,478	—	45,478
Jan van de Winkel(3)	16,950	224,469	241,419
John Lambert(4)	67,800	—	67,800

(1) Amounts reflect the grant-date fair value of option awards granted in 2017 in accordance with ASC Topic 718. Such grant-date fair value does not take into account any estimated forfeitures related to service-vesting conditions. For information regarding assumptions underlying the valuation of equity awards, see Note 9 to our consolidated financial statements. These amounts do not correspond to the actual value that may be recognized by the directors upon vesting.

(2) In April 2012, we entered into an agreement with Dr. Lambert for his services as a member of our board of directors. For the year ended December 31, 2017, the annual compensation for his services was 45,000 Swiss Francs. As of December 31, 2017, Dr. Lambert held an unexercised option to purchase 1,054 shares.

(3) In September 2017, we entered into an agreement with Dr. van de Winkel for his services as a member of our board of directors. For the year ended December 31, 2017, the annual compensation for his services as a member of our board of directors was 40,000 Euros, plus an additional 20,000 Euros for service as the chairman of our board of directors. Payment of Dr. Van de Winkel's annual compensation was pro-rated based on the date that he commenced service as a member of our board. As of December 31, 2017, Dr. van de Winkel held an unexercised option to purchase 7,040 shares.

(4) In August 2014, we entered into an agreement with Mr. Lambert for his services as a member of our board of directors. For the year ended December 31, 2017, the annual compensation for his services was 60,000 Euros. As of December 31, 2017, Mr. Lambert held an unexercised option to purchase 5,775 shares.

(5) The compensation paid to Dr. Lambert in Swiss Francs was converted to Euros at the actual exchange rate as of the date of payment charged by banks (excluding bank charges), which has been converted to USD at an exchange rate of 1 Euro to 1.13 USD based on the average exchange rate published by the Federal Reserve Bank for 2017. The compensation paid to Dr. van de Winkel and Mr. John Lambert in Euro have been converted to USD at an exchange rate of 1 Euro to 1.13 USD based on the average exchange rate published by the Federal Reserve Bank for 2017.

We expect to grant options to purchase an aggregate of   shares of our common stock to each of our non-employee directors in connection with this offering. These options will be issued with an exercise price per share equal to the initial public offering price in this offering, and such options will vest and become exercisable in equal installments at the end of each month following the vesting start date until the third anniversary of the vesting start date.

Non-Employee Director Compensation Policy

Our board of directors adopted a non-employee director compensation policy, effective as of the closing of this offering, that is designed to enable us to attract and retain, on a long-term basis, highly qualified non-employee directors. Under the policy, each director who is not an employee will be paid cash compensation from and after the closing of this offering, as set forth below:

	Annual Retainer
Board of Directors:	
Members	$
Additional retainer for non-executive chair	$
Audit Committee:	
Members (other than chair)	$
Retainer for chair	$
Compensation Committee:	
Members (other than chair)	$
Retainer for chair	$
Corporate Governance Committee:	
Members (other than chair)	$
Retainer for chair	$

Directors will be given the opportunity to elect to receive all or a portion of their retainer and committee fees in the form of an equity award of (a) unrestricted shares having a grant date fair value equal to the amount (or portion thereof) of such retainer and committee fees or (b) stock options to purchase common stock based on the Black-Scholes option-pricing model as of the date of grant. Any such election shall be made (i) for any continuing non-employee director, before the start of the calendar year with respect to any cash compensation for such calendar year and (ii) for any new non-employee director, within 30 days of her or his election to the board of directors. Any such stock options shall be vested upon grant and shall expire ten years from the date of grant.

Upon his or her election to the board of directors, each non-employee director will receive an initial, one-time stock option grant to purchase shares of our common stock, which will vest in equal monthly installments over three years, subject to continued service as a member of the board of directors, or the Initial Award. In addition, each continuing non-employee member of the board will receive, at the time of the Company's annual meeting, an annual equity grant of options to purchase shares of our common stock, which will vest in full upon the earlier of the first anniversary of the date of grant or the date of the next annual meeting of the Company's stockholders, subject to continued service as a member of the board of directors through such date. Each of the foregoing grants will vest in full upon the death or disability of the applicable director or upon a change in control of the Company. In addition, any stock options awarded to non-employee directors pursuant to the non-employee director compensation policy will be exercisable until the earlier of one year following the termination of the director's service on the board of directors or the original expiration date of the option.

CERTAIN RELATIONSHIPS AND RELATED PARTY TRANSACTIONS

Other than the compensation agreements and other arrangements described under "Executive Compensation" and "Director Compensation" in this prospectus and the transactions described below, since January 1, 2015 there has not been and there is not currently proposed, any transaction or series of similar transactions to which we were, or will be, a party in which the amount involved exceeded, or will exceed, $120,000 and in which any director, executive officer, holder of five percent or more of any class of our capital stock or any member of the immediate family of, or entities affiliated with, any of the foregoing persons, had, or will have, a direct or indirect material interest.

We believe the terms obtained or consideration that we paid or received, as applicable, in connection with the transactions described below were comparable to terms available or the amounts that we would pay or receive, as applicable, in arm's-length transactions.

Sales and Purchases of Securities

Series B Preferred Stock Extension Financing

In October 2016 and March 2017, we issued and sold an aggregate of 164,064 shares of our Series B preferred stock at a price of €60.95 per share. The following table sets forth the number of shares of our Series B preferred stock purchased by our directors, executive officers and five percent stockholders and their affiliates and the aggregate purchase price paid for such shares.

Purchaser	Shares of Series B Preferred Stock Purchased	Aggregate Purchase Price (€)
Sofinnova Capital VI FCPR(1)	49,219	3,000,000.00
Forbion Capital Fund II Coöperatief U.A.(2)	32,813	2,000,000.00
Boehringer Ingelheim Venture Fund GmbH	41,016	2,500,000.00
Takeda Ventures, Inc.	20,508	1,250,000.00
BioMedInvest II LP	20,508	1,250,000.00
Total	164,064	10,000,000.00

(1) Mr. Seghezzi, a member of our board of directors, is a managing partner at Sofinnova Partners, an entity affiliated with Sofinnova Capital VI FCPR.

(2) Dr. van Deventer, a member of our board of directors, is a general partner at Forbion Capital Partners, an entity affiliated with Forbion Capital Fund II Coöperatief U.A.

Series C Preferred Stock Financing

In December 2017, we issued and sold an aggregate of 693,500 shares of our Series C preferred stock at a price of €72.10 per share. The following table sets forth the number of shares of our Series C preferred stock purchased by our directors, executive officers and five percent stockholders and their affiliates and the aggregate purchase price paid for such shares.

Purchaser	Shares of Series C Preferred Stock Purchased	Aggregate Purchase Price (€)
Sofinnova Capital VI FCPR(1)	76,283	5,500,004.30
Forbion Capital Fund II Coöperatief U.A.(2)	51,318	3,700,027.80
Boehringer Ingelheim Venture Fund GmbH	20,111	1,450,003.10
Takeda Ventures, Inc.	20,111	1,450,003.10
BioMedInvest II LP	20,111	1,450,003.10
667, L.P.(3)	27,864	2,008,994.40
Baker Brothers Life Sciences, L.P.	249,536	17,991,545.60
HBM BioCapital II LP	89,466	6,450,498.60
Total	554,800	40,001,080.00

(1) Mr. Seghezzi, a member of our board of directors, is a managing partner at Sofinnova Partners, an entity affiliated with Sofinnova Capital VI FCPR.

(2) Dr. van Deventer, a member of our board of directors, is a general partner at Forbion Capital Partners, an entity affiliated with Forbion Capital Fund II Coöperatief U.A.

(3) 667, L.P. is an entity affiliated with Baker Brothers Life Sciences, L.P.

Employment Agreements

We have employment agreements or offer letters with our executive officers. For more information regarding our agreements with our named executive officers for the fiscal year ended December 31, 2017, see the section titled "Executive Compensation—Narrative Disclosure to Summary Compensation Table—Employment Arrangements With Our Named Executive Officers."

Indemnification Agreements

Prior to the closing of this offering, we intend to enter agreements to indemnify our directors and certain executive officers. These agreements will, among other things, require us to indemnify these individuals for certain expenses (including attorneys' fees), judgments, fines and settlement amounts reasonably incurred by such person in any action or proceeding, including any action by or in our right, on account of any services undertaken by such person on behalf of our company or that person's status as a member of our board of directors to the maximum extent allowed under Delaware law.

Agreements with our Stockholders

We entered into the shareholders' agreement in connection with our Series B preferred stock financing in 2013, which was further amended and restated in 2016 in connection with our Series B preferred stock extension financing, in 2017 in connection with our Series C preferred stock financing and in June 2018 in connection with our reorganization as Hookipa Biotech, Inc., or the Shareholders' Agreement. The Shareholders' Agreement will automatically terminate upon the closing of this offering, other than with respect to the registration rights and board nomination rights provided for therein. See the section titled "Description of Capital Stock—Registration Rights.

The Shareholders' Agreement provides for the voting of shares with respect to the constituency of our board of directors and the voting of shares in favor of specified matters. The agreement provides these holders with certain rights relating to the registration of their shares under the Securities Act of 1933, as amended. For a more detailed description of these registration rights, see the section titled "Description of Capital Stock—Registration Rights."

The Shareholder Agreement also establishes certain board observer rights, reporting and information rights, drag-along rights and tag-along rights, and sets forth certain covenants relating to insurance, employee agreements, employee stock and related matters.

Participation Right

Pursuant to the Shareholders' Agreement, we shall use commercially reasonable efforts to cause the underwriters to provide Baker Brothers Life Sciences, L.P., or Baker Brothers, a greater than 5% stockholder, the right to participate in this offering in such amount equal to the pro rata share of the total outstanding number of shares held by it prior to this offering. Despite our commercially reasonable efforts, the underwriters may in their sole discretion determine that Baker Brothers' participation in such proportion is not advisable and designate a reduced number of or no shares to Baker Brothers.

Policies for Approval of Related Party Transactions

Our board of directors reviews and approves transactions with directors, officers and holders of five percent or more of our voting securities and their affiliates, each a related party. Prior to this offering, the material facts as to the related party's relationship or interest in the transaction are disclosed to our board of directors prior to their consideration of such transaction, and the transaction is not considered approved by our board of directors unless a majority of the directors who are not interested in the transaction approve the transaction. Further, when stockholders are entitled to vote on a transaction with a related party, the material facts of the related party's relationship or interest in the transaction are disclosed to the stockholders, who must approve the transaction in good faith.

In connection with this offering, we intend to adopt a formal written policy that our executive officers, directors, holders of more than five percent of any class of our voting securities, and any member of the immediate family of and any entity affiliated with any of the foregoing persons, are not permitted to enter into a related party transaction with us without the prior consent of our audit committee, or other independent members of our board of directors in the event it is inappropriate for our audit committee to review such transaction due to a conflict of interest. Any request for us to enter into a transaction with an executive officer, director, holders of more than 5% of any class of our voting securities, or any of their immediate family members or affiliates, in which the amount involved exceeds $120,000 must first be presented to our audit committee for review, consideration and approval. In approving or rejecting any such proposal, our audit committee will consider the relevant facts and circumstances available and deemed relevant to our audit committee, including, but not limited to, whether the transaction will be on terms no less favorable than terms generally available to an unaffiliated third party under the same or similar circumstances and the extent of the related party's interest in the transaction. All of the transactions described in this section were entered into prior to the adoption of this policy.

PRINCIPAL STOCKHOLDERS

The following table sets forth certain information known to us regarding beneficial ownership of our capital stock as of November 15, 2018, as adjusted to reflect the sale of common stock offered by us in this offering, for:

- each person or group of affiliated persons known by us to be the beneficial owner of more than five percent of our capital stock;
- each of our named executive officers;
- each of our directors; and
- all of our executive officers and directors as a group.

To the extent that the underwriters sell more than shares in this offering, the underwriters have the option to purchase up to an additional shares at the initial public offering price less the underwriting discount.

Beneficial ownership is determined in accordance with the rules of the SEC and generally includes voting or investment power with respect to securities. Under those rules, beneficial ownership includes any shares as to which the individual or entity has sole or shared voting power or investment power. Except as noted by footnote, and subject to community property laws where applicable, we believe, based on the information provided to us, that the persons and entities named in the table below have sole voting and investment power with respect to all common stock shown as beneficially owned by them.

The percentage of beneficial ownership prior to this offering in the table below is based on 1,401,817 shares of common stock deemed to be outstanding as of November 15, 2018, assuming the conversion of all outstanding shares of our preferred stock upon the closing of this offering, and the percentage of beneficial ownership after this offering in the table below is based on shares of common stock assumed to be outstanding after the closing of the offering. The information in the table below assumes no exercise of the underwriters' option to purchase additional shares. Options to purchase shares of common stock that are exercisable within 60 days of November 15, 2018 are deemed to be beneficially owned by the persons holding these options for the purpose of computing percentage ownership of that person, but are not treated as outstanding for the purpose of computing any other person's ownership percentage.

Name and Address of Beneficial Owner(1)	Shares Beneficially Owned	Percentage of Shares Beneficially Owned Before Offering	Percentage of Shares Beneficially Owned After Offering
5% Stockholders:			
Sofinnova Capital VI FCPR(2)	308,973	22.04%	%
Baker Brothers Life Sciences, L.P.(3)	277,400	19.80%	%
Forbion Capital Fund II Coöperatief U.A.(4)	208,830	14.90%	%
Boehringer Ingelheim Venture Fund GmbH(5)	143,159	10.21%	%
HBM BioCapital II LP(6)	89,466	6.38%	%
Takeda Ventures, Inc.(7)	81,635	5.82%	%
BioMedInvest II LP(8)	81,635	5.82%	%
Named Executive Officers and Directors:			
Jörn Aldag(9)	21,249	1.49%	%
Reinhard Kandera(10)	3,142	*	%
Igor Matushansky(11)	5,831	*	%
Jan van de Winkel(12)	1,760	*	%
Christoph Lengauer	—	—	%
Sander van Deventer	—	—	%
Paul-Henri Lambert(13)	1,054	*	%
Graziano Seghezzi	—	—	%
Julie O'Neill	—	—	%
All executive officers and directors as a group (10 persons)	46,078	3.21%	%

* Represents beneficial ownership of less than one percent.

(1) Unless otherwise indicated, the address for each beneficial owner is c/o HOOKIPA Pharma Inc., 430 East 29th Street, 14th Floor, New York, New York 10016.

(2) Consists of (i) 78,751 shares of common stock issuable upon conversion of shares of Series A preferred stock; (ii) 147,657 shares of common stock issuable upon conversion of shares of Series B preferred stock; (iii) 76,283 shares of common stock issuable upon conversion of shares of Series C preferred stock; and (iv) 6,282 shares of common stock. All shares are held directly by Sofinnova Capital VI FCPR. Sofinnova Partners SAS, a French corporation and the management company of Sofinnova Capital VI FCPR, may be deemed to have sole voting and investment power, and Dennis Lucquin, Antoine Papiernik and Monique Saulnier, the managing partners of Sofinnova Partners SAS, may be deemed to have shared voting and investment power with respect to such shares. Graziano Seghezzi is a managing partner of Sofinnova Partners SAS and is also a member of our board of directors. Mr. Seghezzi disclaims beneficial ownership of such shares, except to the extent of his proportionate pecuniary interest therein, if any. The address for Sofinnova Capital VI FCPR is 16-18 rue de 4 Septembre, 75002 Paris, France.

(3) Consists of (i) 249,536 shares of common stock issuable upon conversion of shares of Series C preferred stock held directly by Baker Brothers Life Sciences, L.P.; and (ii) 27,864 shares of common stock issuable upon conversion of shares of Series C preferred stock held by 667, L.P., together with Baker Brothers Life Sciences, L.P., the Baker Funds. Baker Bros. Advisors LP, or BBA, is the management company and investment advisor to the Baker Funds and has sole voting and investment power with respect to the shares held by the Baker Funds. Baker Bros.

Advisors (GP) LLC, or BBA-GP, is the sole general partner of BBA. Felix J. Baker and Julian C. Baker are the managing members of BBA-GP, and, as such, may be deemed to have voting and dispositive power with respect to the shares of common stock held by the Baker Funds. Julian C. Baker, Felix J. Baker, BBA and BBA-GP disclaim beneficial ownership of all shares held by the Baker Funds, except to the extent of their indirect pecuniary interest therein. The address for BBA, BBA-GP and the Baker Funds is 860 Washington Street, 3rd Floor, New York, New York 10014.

(4) Consists of (i) 59,063 shares of common stock issuable upon conversion of shares of Series A preferred stock; (ii) 98,439 shares of common stock issuable upon conversion of shares of Series B preferred stock; and (iii) 51,318 shares of common stock issuable upon conversion of shares of Series C preferred stock. All shares are held directly by Forbion Capital Fund II Coöperatief U.A, or Coöperatief. Forbion II Management B.V., or Forbion, the director of Coöperatief, may be deemed to have voting and dispositive power over the ordinary shares held by Coöperatief. Sander van Deventer is an operating partner of Forbion and a member of the investment committee of Forbion and is also a member of our board of directors. The address for Forbion Capital Fund II Coöperatief U.A. is Gooimeer 2-35, 1411 DC Naarden, the Netherlands.

(5) Consists of (i) 123,048 shares of common stock issuable upon conversion of shares of Series B preferred stock; and (ii) 20,111 shares of common stock issuable upon conversion of shares of Series C preferred stock. All shares are held directly by Boehringer Ingelheim Venture Fund GmbH. The address for Boehringer Ingelheim Venture Fund GmbH is Binger Strasse 173, 55216 Ingelheim am Rhein, Germany.

(6) Consists of 89,466 shares of common stock issuable upon conversion of shares of Series C preferred stock held by by HBM BioCapital II LP. The board of directors of HBM BioCapital II Management Ltd., the general partner of the HBM BioCapital II LP, has sole voting and investment power with respect to such shares. The address for HBM BioCapital II LP is c/o HBM BioCapital II Management Ltd., Aztec Group House 11-15, Seaton Place, St. Helier JE4 0QH, Jersey.

(7) Consists of (i) 61,524 shares of common stock issuable upon conversion of shares of Series B preferred stock; and (ii) 20,111 shares of common stock issuable upon conversion of shares of Series C preferred stock. All shares are held directly by Takeda Ventures, Inc. The address for Takeda Ventures, Inc. is 435 Tasso Street, Suite 300, Palo Alto, California 94301.

(8) Consists of (i) 61,524 shares of common stock issuable upon conversion of shares of Series B preferred stock; and (ii) 20,111 shares of common stock issuable upon conversion of shares of Series C preferred stock. All shares are held directly by BioMedInvest II LP. BioMed Partners Limited, registered with the Guernsey Registry under the number 49638, as General Partner is deemed to have voting and investment power over the shares held by BioMedInvest II L.P. The address for BioMedInvest II L.P. is St Peters House, Le Bordage, St. Peter Port, Guernsey GYI 1BR (registered with Guernsey Registry under the number 1140).]

(9) Consists of options to purchase 21,249 shares of common stock that are exercisable within 60 days of November 15, 2018.

(10) Consists of options to purchase 3,142 shares of common stock that are exercisable within 60 days of November 15, 2018.

(11) Consists of options to purchase 5,831 shares of common stock that are exercisable within 60 days of November 15, 2018.

(12) Consists of options to purchase 1,760 shares of common stock that are exercisable within 60 days of November 15, 2018.

(13) Consists of options to purchase 1,054 shares of common stock that are exercisable within 60 days of November 15, 2018.

DESCRIPTION OF CAPITAL STOCK

The following descriptions are summaries of the material terms of our amended and restated certificate of incorporation and amended and restated bylaws which will become effective immediately upon the closing of this offering. The descriptions of the common stock and preferred stock give effect to changes to our capital structure that will occur immediately upon the closing of this offering. We refer in this section to our amended and restated certificate of incorporation as our certificate of incorporation, and we refer to our amended and restated bylaws as our bylaws.

General

Upon closing of this offering, our authorized capital stock will consist of shares of common stock, par value $0.0001 per share, and shares of preferred stock, par value $0.0001 per share, all of which shares of preferred stock will be undesignated.

As of December 31, 2018, shares of our common stock were outstanding and held by stockholders of record. This amount assumes the conversion of all outstanding shares of our preferred stock into common stock, which will occur immediately upon the closing of this offering. In addition, as of December 31, 2018, we had outstanding options to purchase shares of our common stock under our 2018 Stock Option and Grant Plan, at a weighted average exercise price of $ per share, of which were exercisable.

Common Stock

The holders of our common stock are entitled to one vote for each share held on all matters submitted to a vote of the stockholders. The holders of our common stock do not have any cumulative voting rights. Holders of our common stock are entitled to receive ratably any dividends declared by our board of directors out of funds legally available for that purpose, subject to any preferential dividend rights of any outstanding preferred stock or that we may designate or issue in the future. Our common stock has no preemptive rights, conversion rights, or other subscription rights or redemption or sinking fund provisions.

In the event of our liquidation, dissolution, or winding up, holders of our common stock will be entitled to share ratably in all assets remaining after payment of all debts and other liabilities and any liquidation preference of any outstanding preferred stock. The shares to be issued by us in this offering will be, when issued and paid for, validly issued, fully paid and non-assessable. The rights, preferences and privileges of holders of common stock are subject to and may be adversely affected by the rights of the holders of shares of any series of preferred stock that we may designate and issue in the future.

Preferred Stock

Immediately upon the closing of this offering, all outstanding shares of our preferred stock will be converted into shares of our common stock. Upon the closing of this offering, our board of directors will have the authority, without further action by our stockholders, to issue up to shares of preferred stock in one or more series and to fix the rights, preferences, privileges and restrictions thereof. These rights, preferences and privileges could include dividend rights, conversion rights, voting rights, terms of redemption, liquidation preferences, sinking fund terms and the number of shares constituting, or the designation of, such series, any or all of which may be greater than the rights of common stock. The issuance of our preferred stock could adversely affect the voting power of holders of common stock and the likelihood that such holders will receive dividend payments and payments upon our liquidation. In addition, the issuance of preferred stock could have the effect of delaying, deferring or preventing a change in control of our company or other corporate action. Immediately after closing of this offering, no shares of preferred stock will be outstanding, and we have no present plan to issue any shares of preferred stock.

Registration Rights

Upon the closing of this offering, the holders of 1,401,817 shares of our common stock, including those issuable upon the conversion of preferred stock, are entitled to rights with respect to the registration of such securities under the Securities Act of 1933, as amended, or the Securities Act. These rights are provided under the terms of our Shareholders' Agreement between us and certain holders our capital stock. All fees, costs and expenses of underwritten registrations under these agreements will be borne by us and all selling expenses, including underwriting discounts and selling commissions, will be borne by the holders of the shares being registered.

Demand Registration Rights

Beginning 180 days after the closing of this offering, the holders of 1,401,817 shares of our common stock, including those issuable upon the conversion of shares of our preferred stock, are entitled to demand registration rights.

Short-Form Registration Rights

The holders of 1,401,817 shares of our common stock, including those issuable upon the conversion of shares of our preferred stock, are entitled to short-form registration rights. If we are eligible to file a registration statement on Form S-3, upon the written request of a majority of the preferred stock to sell securities at an anticipated aggregate price of at least $10.0 million, we will be required to use commercially reasonable efforts to effect a registration of such shares. We are not obligated to file a registration statement pursuant to this provision on more than two occasions in any 12-month period.

Piggyback Registration Rights

The holders of 1,401,817 shares of our common stock, including those issuable upon the conversion of shares of our preferred stock, are entitled to piggyback registration rights. If we register any of our securities either for our own account or for the account of other security holders, the holders of these shares are entitled to include their shares in the registration. We and the underwriters may limit the number of shares included in the underwritten offering to the number of shares which we and the underwriters determine in our sole discretion will not jeopardize the success of the offering.

Indemnification

Our Shareholders' Agreement contains customary cross-indemnification provisions, under which we are obligated to indemnify holders of registrable securities in the event of material misstatements or omissions in the registration statement attributable to us, and they are obligated to indemnify us for material misstatements or omissions attributable to them.

Expenses of Registration

We are generally required to bear all registration and selling expenses incurred in connection with the demand, short-form and piggyback registration described above, other than underwriting discounts and selling commissions.

Expiration of Registration Rights

The demand registration rights and short form registration rights will terminate as to a given holder of registrable securities at such time as Rule 144 or another similar exemption under the Securities Act is available for the sale of all of such holder's shares without limitation during a three-month period without registration.

Participation and Drag Right in a Qualified Initial Public Offering

Pursuant to the Shareholders' Agreement, we shall use commercially reasonable efforts to cause the underwriters to provide Baker Brothers, a greater than 5% stockholder, the right to participate in any initial public offering we consummate in amount equal to its pro rata share of the total number of shares outstanding prior to this offering held by it. Despite our commercially reasonable efforts, the underwriters may in their sole discretion determine that Baker Brothers' participation in such proportion is not advisable and designate a reduced number of or no shares to Baker Brothers. See "Certain Relationships and Related Party Transactions—Participation Right."

In the event we consummate an initial public offering prior to December 31, 2021, in which the per share price is at least €65.90 with minimum aggregate proceeds of $60.0 million, Gilead Sciences, Inc., or Gilead, is required to subscribe to purchase shares in such offering in an amount of at least €5.0 million, but not to exceed either €10.0 million or such number of shares which would cause it to hold more than 9.9% of our outstanding common stock upon the consummation of the offering. Gilead's obligation to participate in the initial public offering does not obligate the underwriters to actually allocate any shares to Gilead.

Anti-Takeover Effects of our Certificate of Incorporation and Bylaws and Delaware Law

Our amended and restated certificate of incorporation and amended and restated bylaws include a number of provisions that may have the effect of delaying, deferring or preventing another party from acquiring control of us and encouraging persons considering unsolicited tender offers or other unilateral takeover proposals to negotiate with our board of directors rather than pursue non-negotiated takeover attempts. These provisions include the items described below.

Undesignated Preferred Stock

Our certificate of incorporation provides for   authorized shares of preferred stock. The existence of authorized but unissued shares of preferred stock may enable our board of directors to discourage an attempt to obtain control of us by means of a merger, tender offer, proxy contest or otherwise. For example, if in the due exercise of its fiduciary obligations, our board of directors were to determine that a takeover proposal is not in the best interests of our stockholders, our board of directors could cause shares of preferred stock to be issued without stockholder approval in one or more private offerings or other transactions that might dilute the voting or other rights of the proposed acquirer or insurgent stockholder or stockholder group. In this regard, our certificate of incorporation grants our board of directors broad power to establish the rights and preferences of authorized and unissued shares of preferred stock. The issuance of shares of preferred stock could decrease the amount of earnings and assets available for distribution to holders of shares of common stock. The issuance may also adversely affect the rights and powers, including voting rights, of these holders and may have the effect of delaying, deterring, or preventing a change in control.

Exclusive Jurisdiction for Certain Actions

Our amended and restated bylaws provide that, unless we consent in writing to an alternative forum, 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 our behalf, (ii) any action asserting a claim of breach of a fiduciary duty owed by any of our current or former directors, officers and employees to us or our stockholders, (iii) any action asserting a claim against us or any of our current or former directors, officers, or other employees or stockholders arising pursuant to any provision of the Delaware General Corporation Law, or the DGCL, our certificate of incorporation or our bylaws, (iv) any action to interpret, apply, enforce or determine the validity of our certificate of incorporation or our bylaws, or (v) any action asserting a claim against us or any of our current or former directors or officers or other employees that is governed by the internal affairs doctrine. Our amended and restated bylaws will further provide that the U.S. District Court for the Southern District of New York will be the exclusive forum for resolving any complaint asserting a cause of action arising under the Securities Act. Although we believe this provision benefits us by providing increased consistency in the application of New York law in the types of lawsuits to which it applies, the provision may have the effect of discouraging lawsuits against our directors and officers. The enforceability of similar exclusive forum provisions in other companies' bylaws has been challenged in legal proceedings, and it is possible that a court could rule that this provision in our bylaws is inapplicable or unenforceable.

Section 203 of the Delaware General Corporation Law

Upon closing of this offering, we will be subject to the provisions of Section 203 of the Delaware General Corporation Law. In general, Section 203 prohibits a publicly held Delaware corporation from engaging in a "business combination" with an "interested stockholder" for a three-year period following the time that this stockholder becomes an interested stockholder, unless the business combination is approved in a prescribed manner. Under Section 203, a business combination between a corporation and an interested stockholder is prohibited unless it satisfies one of the following conditions:

- before the stockholder became interested, our board of directors approved either the business combination or the transaction which resulted in the stockholder becoming an interested stockholder;

- upon consummation of the transaction which resulted in the stockholder becoming an interested stockholder, the interested stockholder owned at least 85% of the voting stock of the corporation outstanding at the time the transaction commenced, excluding for purposes of determining the voting stock outstanding, shares owned by persons who are directors and also officers, and employee stock plans, in some instances, but not the outstanding voting stock owned by the interested stockholder; or

- at or after the time the stockholder became interested, the business combination was approved by our board of directors and authorized at an annual or special meeting of the stockholders by the affirmative vote of at least two-thirds of the outstanding voting stock which is not owned by the interested stockholder.

In general, Section 203 defines a business combination to include the following:

- any merger or consolidation involving the corporation and the interested stockholder;

- any sale, transfer, lease, pledge or other disposition involving the interested stockholder of 10% or more of the assets of the corporation;

- subject to exceptions, any transaction that results in the issuance or transfer by the corporation of any stock of the corporation to the interested stockholder;

- subject to exceptions, any transaction involving the corporation that has the effect of increasing the proportionate share of the stock of any class or series of the corporation beneficially owned by the interested stockholder; and

- the receipt by the interested stockholder of the benefit of any loans, advances, guarantees, pledges, or other financial benefits provided by or through the corporation.

In general, Section 203 defines an "interested stockholder" as any entity or person beneficially owning 15% or more of the outstanding voting stock of the corporation and any entity or person affiliated with or controlling or controlled by the entity or person.

Amended and Restated Certificate of Incorporation and Amended and Restated Bylaws

Provisions of our amended and restated certificate of incorporation and our amended and restated bylaws may delay or discourage transactions involving an actual or potential change in our control or change in our management, including transactions in which stockholders might otherwise receive a premium for their shares or transactions that our stockholders might otherwise deem to be in their best interests. Therefore, these provisions could adversely affect the price of our common stock. Among other things, our amended and restated certificate of incorporation and amended and restated bylaws:

- permit our board of directors to issue up to shares of preferred stock, with any rights, preferences and privileges as they may designate;
- provide that the authorized number of directors may be changed only by resolution adopted by a majority of the board of directors;
- provide that the board of directors or any individual director may only be removed with cause and the affirmative vote of the holders of at least 66.67% of the voting power of all of our then outstanding common stock;
- provide that all vacancies, including newly created directorships, may, except as otherwise required by law or subject to the rights of holders of preferred stock as designated from time to time, be filled by the affirmative vote of a majority of directors then in office, even if less than a quorum;
- divide our board of directors into three classes;
- require that any action to be taken by our stockholders must be effected at a duly called annual or special meeting of stockholders and not be taken by written consent or electronic transmission;
- provide that stockholders seeking to present proposals before a meeting of stockholders or to nominate candidates for election as directors at a meeting of stockholders must provide notice in writing in a timely manner and also specify requirements as to the form and content of a stockholder's notice;
- do not provide for cumulative voting rights (therefore allowing the holders of a majority of the shares of common stock entitled to vote in any election of directors to elect all of the directors standing for election, if they should so choose);
- provide that special meetings of our stockholders may be called only by the chairperson of the board, our chief executive officer, or by the board of directors pursuant to a resolution adopted by a majority of the total number of authorized directors (whether or not there exists any vacancies);
- provide that 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 our behalf, (ii) any action asserting a claim of breach of a fiduciary duty owed by any of our current or former directors, officers and employees to us or our stockholders, (iii) any action asserting a claim against us or any of our current or former directors, officers, or other employees or stockholders arising pursuant to any provision of the Delaware General Corporation Law, or the DGCL, our certificate of incorporation or our bylaws, (iv) any action to interpret, apply, enforce or determine the validity of our amended and restated certificate of incorporation or our amended and restated bylaws, or (v) any action asserting a claim against us or any of our current or former directors or officers or other employees that is governed by the internal affairs doctrine; and

- provide that the U.S. District Court for the Southern District of New York will be the exclusive forum for resolving any complaint asserting a cause of action arising under the Securities Act.

The amendment of any of these provisions, with the exception of the ability of our board of directors to issue shares of preferred stock and designate any rights, preferences, and privileges thereto, would require the affirmative vote of the holders of at least 66.67% of the voting power of all of our then outstanding common stock.

Nasdaq Global Market Listing

We intend to apply to list our common stock on The Nasdaq Global Market under the trading symbol "HOOK."

Transfer Agent and Registrar

The transfer agent and registrar for our common stock will be .

SHARES ELIGIBLE FOR FUTURE SALE

Prior to this offering, there has been no public market for shares of our common stock. Future sales of our common stock in the public market, or the availability of such shares for sale in the public market, could adversely affect market prices prevailing from time to time. As described below, only a limited number of shares will be available for sale shortly after this offering due to contractual and legal restrictions on resale. Nevertheless, sales of our common stock in the public market after such restrictions lapse, or the perception that those sales may occur, could adversely affect the prevailing market price at such time and our ability to raise equity capital in the future.

Based on the number of shares outstanding as of December 31, 2018, upon the closing of this offering, shares of our common stock will be outstanding, assuming no exercise of the underwriters' option to purchase additional shares and no exercise of outstanding options. Of the outstanding shares, all of the shares sold in this offering will be freely tradable, except that any shares held by our affiliates, as that term is defined in Rule 144 under the Securities Act of 1933, as amended, or the Securities Act, may only be sold in compliance with the limitations described below. The remaining outstanding shares of our common stock will be "restricted securities" as that term is defined under Rule 144 of the Securities Act.

As a result of the lock-up agreements described below and the provisions of Rules 144 and 701 under the Securities Act, the shares of common stock that will be deemed restricted securities after this offering will be available for sale in the public market as follows:

- no shares will be available for sale until 180 days after the date of this prospectus, subject to certain limited exceptions provided for in the lock-up agreements; and

- shares will be eligible for sale beginning more than 180 days after the date of this prospectus, subject, in the case of shares held by our affiliates, to the volume limitations under Rule 144.

Rule 144

In general, under Rule 144, beginning 90 days after the date of this prospectus, a person who has beneficially owned restricted stock for at least six months would be entitled to sell their 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 Securities Exchange Act of 1934, as amended, or the Exchange Act, periodic reporting requirements for at least 90 days before the sale. Additionally, a person who has beneficially owned restricted shares for at least one year and who is not deemed to have been one of our affiliates at the time of, or at any time during the 90 days before the sale, would be entitled to sell those securities subject at any time. Persons who have beneficially owned restricted shares 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 then outstanding, which will equal approximately shares immediately after this offering assuming no exercise of the underwriters' option to purchase additional shares, based on the number of shares outstanding as of December 31, 2018; 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.

Rule 701

Rule 701 under the Securities Act, as in effect on the date of this prospectus, permits resales of shares in reliance upon Rule 144 but without compliance with certain restrictions of Rule 144, including the holding period requirement. Most of our employees, executive officers or directors who purchased shares under a written compensatory plan or contract may be entitled to rely on the resale provisions of Rule 701, but all holders of Rule 701 shares are required to wait until 90 days after the date of this prospectus before selling their shares. However, substantially all Rule 701 shares are subject to lock-up agreements as described below and under "Underwriters" included elsewhere in this prospectus and will become eligible for sale upon the expiration of the restrictions set forth in those agreements.

Lock-Up Agreements

All of our directors and officers and substantially all the holders of all of our outstanding capital stock and stock options have signed lock-up agreements which prevent them from selling any of our common stock or any securities convertible into or exercisable or exchangeable for common stock for a period of not less than 180 days from the date of this prospectus without the prior written consent of Merrill Lynch, Pierce, Fenner & Smith Incorporated and Leerink Partners LLC, subject to certain exceptions. See "Underwriting."

Registration Rights

Upon closing of this offering, certain holders of our securities will be entitled to various rights with respect to registration of their shares under the Securities Act. Registration of these shares under the Securities Act would result in these shares becoming fully tradable without restriction under the Securities Act immediately upon the effectiveness of the registration. See "Description of Capital Stock—Registration Rights" for additional information. Shares covered by a registration statement will be eligible for sale in the public market upon the expiration or release from the terms of the lock-up agreements described above.

Equity Incentive Plans

We intend to file one or more registration statements on Form S-8 under the Securities Act to register our shares issued or reserved for issuance under our equity incentive plans. The first such registration statement is expected to be filed soon after the date of this prospectus and will automatically become effective upon filing with the Securities and Exchange Commission. Accordingly, shares registered under such registration statement will be available for sale in the open market, unless such shares are subject to vesting restrictions with us or the lock-up restrictions described above.

10b5-1 Plans

After the offering, certain of our employees, including our executive officers and/or directors may enter into written trading plans that are intended to comply with Rule 10b5-1 under the Exchange Act. Sales under these trading plans would not be permitted until the expiration of the lock-up agreements relating to the offering described above.

MATERIAL U.S. FEDERAL INCOME TAX CONSIDERATIONS FOR NON-U.S. HOLDERS OF COMMON STOCK

The following discussion is a summary of the material U.S. federal income tax considerations applicable to non-U.S. holders (as defined below) with respect to their ownership and disposition of shares of our common stock issued pursuant to this offering. For purposes of this discussion, a non-U.S. holder means a beneficial owner of our common stock that is for U.S. federal income tax purposes:

- a non-resident alien individual;
- a foreign corporation or any other foreign organization taxable as a corporation for U.S. federal income tax purposes; or
- a foreign estate or trust, the income of which is not subject to U.S. federal income tax on a net income basis.

This discussion does not address the tax treatment of partnerships or other pass-through entities or arrangements for U.S. federal income tax purposes or persons that hold their common stock through partnerships or other pass-through entities or arrangements. A partner in a partnership or other pass-through entity or arrangement that will hold our common stock should consult his, her or its own tax advisor regarding the tax consequences of acquiring, holding and disposing of our common stock through a partnership or other pass-through entity or arrangement, as applicable.

This discussion is based on current provisions of the U.S. Internal Revenue Code of 1986, as amended, or the Code, existing and proposed U.S. Treasury Regulations promulgated thereunder, current administrative rulings and judicial decisions, all as in effect as of the date of this prospectus and, all of which are subject to change or to differing interpretation, possibly with retroactive effect. Any such change or differing interpretation could alter the tax consequences to non-U.S. holders described in this prospectus. There can be no assurance that the Internal Revenue Service, or the IRS, will not challenge one or more of the tax consequences described herein or that a court would not sustain such challenge. We assume in this discussion that a non-U.S. holder holds shares of our common stock as a capital asset, generally property held for investment.

This discussion does not address all aspects of U.S. federal income taxation that may be relevant to a particular non-U.S. holder in light of that non-U.S. holder's individual circumstances nor does it address any aspects of any U.S. federal tax other than the income and estate tax, U.S. state, local or non-U.S. taxes, the alternative minimum tax, or the Medicare tax on net investment income. This discussion also does not consider any specific facts or circumstances that may apply to a non-U.S. holder and does not address the special tax rules applicable to particular non-U.S. holders, such as:

- insurance companies;
- tax-exempt or governmental organizations;
- financial institutions;
- brokers or dealers in securities;
- regulated investment companies;
- pension plans;
- "controlled foreign corporations," "passive foreign investment companies," and corporations that accumulate earnings to avoid U.S. federal income tax;
- "qualified foreign pension funds," or entities wholly owned by a "qualified foreign pension fund";

- partnerships or other entities or arrangements treated as partnerships for U.S. federal income tax purposes (and partners and investors therein);
- persons deemed to sell our common stock under the constructive sale provisions of the Code;
- persons that hold our common stock as part of a straddle, hedge, conversion transaction, synthetic security, or other integrated investment;
- persons who hold or receive our common stock pursuant to the exercise of any employee stock option or otherwise as compensation;
- persons for whom our stock constitutes "qualified small business stock" within the meaning of Section 1202 of the Code; and
- certain U.S. expatriates.

This discussion is for general information only and is not tax advice. Accordingly, all prospective non-U.S. holders of our common stock should consult their own tax advisors with respect to the U.S. federal, state, local, and non-U.S. tax consequences of the purchase, ownership and disposition of our common stock.

Distributions on Our Common Stock

Distributions, if any, on our common stock will constitute dividends for U.S. federal income tax purposes to the extent paid from our current or accumulated earnings and profits, as determined under U.S. federal income tax principles. If a distribution exceeds our current and accumulated earnings and profits, the excess will be treated as a tax-free return of the non-U.S. holder's investment, and will first reduce a Non-U.S. Holder's basis in the common stock, but not below zero and then will be treated as capital gain, subject to the U.S. federal income tax treatment described below in "Gain on sale, exchange or other disposition of our common stock." Any such distributions will also be subject to the discussions below under the sections titled "—Backup Withholding and Information Reporting" and "—Withholding and Information Reporting Requirements—FATCA."

Subject to the discussion in the following two paragraphs in this section, dividends paid to a non-U.S. holder generally will be subject to withholding of U.S. federal income tax at a 30% rate or such lower rate as may be specified by an applicable income tax treaty between the United States and such holder's country of residence. If we or another withholding agent apply over-withholding or if a non-U.S. holder does not timely provide us with the required certification, the non-U.S. holder may be entitled to a refund or credit of any excess tax withheld by timely filing an appropriate claim with the IRS.

Dividends that are treated as effectively connected with a trade or business conducted by a non-U.S. holder within the United States and, if an applicable income tax treaty so provides, that are attributable to a permanent establishment or a fixed base maintained by the non-U.S. holder within the United States, are generally exempt from the 30% withholding tax if the non-U.S. holder satisfies applicable certification requirements. To obtain this exemption, a non-U.S. holder must generally provide a properly executed IRS Form W-8ECI properly certifying such exemption. However, such U.S. effectively connected income, net of specified deductions and credits, is taxed at the same graduated U.S. federal income tax rates applicable to United States persons (as defined in the Code). Any U.S. effectively connected income received by a non-U.S. holder that is a corporation may also, under certain circumstances, be subject to an additional "branch profits tax" at a 30% rate or such lower rate as may be specified by an applicable income tax treaty between the United States and such holder's country of residence.

A non-U.S. holder of our common stock who claims the benefit of an applicable income tax treaty between the United States and such holder's country of residence generally will be required to provide a properly executed IRS Form W-8BEN or W-8BEN-E (or successor form) to the applicable withholding agent and satisfy applicable certification and other requirements. Non-U.S. holders are urged to consult their tax advisors regarding their entitlement to benefits under a relevant income tax treaty. A non-U.S. holder that is eligible for a reduced rate of U.S. withholding tax under an income tax treaty may obtain a refund or credit of any excess amounts withheld by timely filing an appropriate claim with the IRS.

Any documentation provided to an applicable withholding agent may need to be updated in certain circumstances. The certification requirements described above may also require a non-U.S. holder to provide its U.S. taxpayer identification number.

Gain on Sale or Other Taxable Disposition of Our Common Stock

Subject to the discussions below under "—Backup Withholding and Information Reporting" and "—Withholding and Information Reporting Requirements—FATCA," a non-U.S. holder generally will not be subject to any U.S. federal income tax on any gain realized upon such holder's sale or other taxable disposition of shares of our common stock unless:

- the gain is effectively connected with the non-U.S. holder's conduct of a U.S. trade or business and, if an applicable income tax treaty so provides, is attributable to a permanent establishment or a fixed-base maintained by such non-U.S. holder in the United States, in which case the non-U.S. holder generally will be taxed on a net income basis at the graduated U.S. federal income tax rates applicable to United States persons (as defined in the Code) and, if the non-U.S. holder is a foreign corporation, the branch profits tax described above in "—Distributions on Our Common Stock" also may apply;

- the non-U.S. holder is a nonresident alien individual who is present in the United States for 183 days or more in the taxable year of the disposition and certain other conditions are met, in which case the non-U.S. holder will be subject to a 30% tax (or such lower rate as may be specified by an applicable income tax treaty between the United States and such holder's country of residence) on the net gain derived from the disposition, which may be offset by certain U.S. source capital losses of the non-U.S. holder, if any (even though the individual is not considered a resident of the United States), provided that the non-U.S. holder has timely filed U.S. federal income tax returns with respect to such losses; or

- we are, or have been, at any time during the five-year period preceding such sale or other taxable disposition (or the non-U.S. holder's holding period, if shorter) a "U.S. real property holding corporation," unless our common stock is regularly traded on an established securities market and the non-U.S. holder holds no more than 5% of our outstanding common stock, directly or indirectly, actually or constructively, during the shorter of the 5-year period ending on the date of the disposition or the period that the non-U.S. holder held our common stock. In such case, such non-U.S. holder generally will be taxed on its net gain derived from the disposition at the graduated U.S. federal income tax rates applicable to United States persons (as defined in the Code). Generally, a corporation is a U.S. real property holding corporation only if the fair market value of its U.S. real property interests equals or exceeds 50% of the sum of the fair market value of its worldwide real property interests plus its other assets used or held for use in a trade or business. Although there can be no assurance, we do not believe that we are, or have been, a U.S. real property holding corporation, or that we are likely to become one in the future. No assurance can be provided that our common stock will be regularly traded on an established securities market for purposes of the rules described above.

Backup Withholding and Information Reporting

We must report annually to the IRS and to each non-U.S. holder the gross amount of the distributions on our common stock paid to such holder and the tax withheld, if any, with respect to such distributions. Non-U.S. holders may have to comply with specific certification procedures to establish that the holder is not a United States person (as defined in the Code) in order to avoid backup withholding at the applicable rate with respect to dividends on our common stock. Dividends paid to non-U.S. holders subject to withholding of U.S. federal income tax, as described above in "—Distributions on Our Common Stock," generally will be exempt from U.S. backup withholding.

Information reporting and backup withholding will generally apply to the proceeds of a disposition of our common stock by a non-U.S. holder effected by or through the U.S. office of any broker, U.S. or foreign, unless the holder certifies its status as a non-U.S. holder and satisfies certain other requirements, or otherwise establishes an exemption. Generally, information reporting and backup withholding will not apply to a payment of disposition proceeds to a non-U.S. holder where the transaction is effected outside the United States through a non-U.S. office of a broker. However, for information reporting purposes, dispositions effected through a non-U.S. office of a broker with substantial U.S. ownership or operations generally will be treated in a manner similar to dispositions effected through a U.S. office of a broker. Non-U.S. holders should consult their own tax advisors regarding the application of the information reporting and backup withholding rules to them. Copies of information returns may be made available to the tax authorities of the country in which the non-U.S. holder resides or is incorporated under the provisions of a specific treaty or agreement. Backup withholding is not an additional tax. Any amounts withheld under the backup withholding rules from a payment to a non-U.S. holder can be refunded or credited against the non-U.S. holder's U.S. federal income tax liability, if any, provided that an appropriate claim is filed with the IRS in a timely manner.

Withholding and Information Reporting Requirements—FATCA

The Foreign Account Tax Compliance Act (FATCA) generally imposes a U.S. federal withholding tax at a rate of 30% on payments of dividends on, or gross proceeds from the sale or other disposition of, our common stock paid to a foreign entity unless (i) if the foreign entity is a "foreign financial institution," such foreign entity undertakes certain due diligence, reporting, withholding, and certification obligations, (ii) if the foreign entity is not a "foreign financial institution," such foreign entity identifies certain of its U.S. investors, if any, or (iii) the foreign entity is otherwise exempt under FATCA. Under applicable U.S. Treasury regulations, withholding under FATCA currently applies to payments of dividends on our common stock, but will only apply to payments of gross proceeds from a sale or other disposition of our common stock made after December 31, 2018. Under certain circumstances, a non-U.S. holder may be eligible for refunds or credits of this withholding tax. An intergovernmental agreement between the United States and an applicable foreign country may modify the requirements described in this paragraph. Non-U.S. holders should consult their tax advisors regarding the possible implications of FATCA on their investment in our common stock and the entities through which they hold our common stock, including, without limitation, the process and deadlines for meeting the applicable requirements to prevent the imposition of the 30% withholding tax under FATCA.

Federal Estate Tax

Common stock owned or treated as owned by an individual who is a non-U.S. holder (as specially defined for U.S. federal estate tax purposes) at the time of death will be included in the individual's gross estate for U.S. federal estate tax purposes and, therefore, may be subject to U.S. federal estate tax, unless an applicable estate tax or other treaty provides otherwise.

The preceding discussion of material U.S. federal tax considerations is for general information only. It is not tax advice. Prospective investors should consult their own tax advisors regarding the particular U.S. federal, state, local and non-U.S. tax consequences of purchasing, holding and disposing of our common stock, including the consequences of any proposed changes in applicable laws.

UNDERWRITING

Merrill Lynch, Pierce, Fenner & Smith Incorporated, Leerink Partners LLC and RBC Capital Markets, LLC are acting as representatives of each of the underwriters named below. Subject to the terms and conditions set forth in an underwriting agreement among us and the underwriters, we have agreed to sell to the underwriters, and each of the underwriters has agreed, severally and not jointly, to purchase from us, the number of shares of common stock set forth opposite its name below.

Underwriter	Number of Shares
Merrill Lynch, Pierce, Fenner & Smith Incorporated	
Leerink Partners LLC	
RBC Capital Markets, LLC	
Kempen & Co U.S.A., Inc.	
Total	

Subject to the terms and conditions set forth in the underwriting agreement, the underwriters have agreed, severally and not jointly, to purchase all of the shares sold under the underwriting agreement if any of these shares are purchased. If an underwriter defaults, the underwriting agreement provides that the purchase commitments of the non-defaulting underwriters may be increased or the underwriting agreement may be terminated.

We have agreed to indemnify the underwriters against certain liabilities, including liabilities under the Securities Act of 1933, as amended, or to contribute to payments the underwriters may be required to make in respect of those liabilities.

The underwriters are offering the shares, subject to prior sale, when, as and if issued to and accepted by them, subject to approval of legal matters by their counsel, including the validity of the shares, and other conditions contained in the underwriting agreement, such as the receipt by the underwriters of officer's certificates and legal opinions. The underwriters reserve the right to withdraw, cancel or modify offers to the public and to reject orders in whole or in part. Sales of shares made outside of the United States may be made by affiliates of the underwriters.

Commissions and Discounts

The representatives have advised us that the underwriters propose initially to offer the shares to the public at the public offering price set forth on the cover page of this prospectus and to dealers at that price less a concession not in excess of $ per share. After the initial offering, the public offering price, concession or any other term of the offering may be changed.

The following table shows the public offering price, underwriting discount and proceeds before expenses to us. The information assumes either no exercise or full exercise by the underwriters of their option to purchase additional shares.

	Per Share	Without Option	With Option
Public offering price	$	$	$
Underwriting discount	$	$	$
Proceeds, before expenses, to us	$	$	$

The expenses of the offering, not including the underwriting discount, are estimated at $ and are payable by us. We have also agreed to reimburse the underwriters for their expenses relating to clearance of this offering with the Financial Industry Regulatory Authority in an amount up to $.

Option to Purchase Additional Shares

We have granted an option to the underwriters, exercisable for 30 days after the date of this prospectus, to purchase up to additional shares at the public offering price, less the underwriting discount. If the underwriters exercise this option, each will be obligated, subject to conditions contained in the underwriting agreement, to purchase a number of additional shares proportionate to that underwriter's initial amount reflected in the above table.

No Sales of Similar Securities

We, our executive officers and directors and our other existing security holders have agreed not to sell or transfer any common stock or securities convertible into, exchangeable for, exercisable for, or repayable with common stock, for 180 days after the date of this prospectus without first obtaining the written consent of Merrill Lynch, Pierce, Fenner & Smith Incorporated and Leerink Partners LLC. Specifically, we and these other persons have agreed, with certain limited exceptions, not to directly or indirectly:

- offer, pledge, sell or contract to sell any common stock,
- sell any option or contract to purchase any common stock,
- purchase any option or contract to sell any common stock,
- grant any option, right or warrant for the sale of any common stock,
- lend or otherwise dispose of or transfer any common stock,
- request or demand that we file or make a confidential submission of a registration statement related to the common stock,
- enter into any swap or other agreement that transfers, in whole or in part, the economic consequence of ownership of any common stock whether any such swap or transaction is to be settled by delivery of shares or other securities, in cash or otherwise, or
- publicly disclose the intention to do any of the foregoing.

This lock-up provision applies to common stock and to securities convertible into or exchangeable or exercisable for or repayable with common stock. With limited exceptions, it also applies to common stock owned now or acquired later by the person executing the agreement or for which the person executing the agreement later acquires the power of disposition.

Nasdaq Global Market Listing

We expect the shares to be approved for listing on the Nasdaq Global Market, subject to notice of issuance, under the symbol "HOOK."

Before this offering, there has been no public market for our common stock. The initial public offering price will be determined through negotiations between us and the representatives. In addition to prevailing market conditions, the factors to be considered in determining the initial public offering price are:

- the valuation multiples of publicly traded companies that the representatives believe to be comparable to us;
- our financial information;
- the history of, and the prospects for, our company and the industry in which we compete;

- an assessment of our management, its past and present operations, and the prospects for, and timing of, our future revenues;
- the present state of our development; and
- the above factors in relation to market values and various valuation measures of other companies engaged in activities similar to ours.

An active trading market for the shares may not develop. It is also possible that after the offering the shares will not trade in the public market at or above the initial public offering price.

The underwriters do not expect to sell more than 5% of the shares in the aggregate to accounts over which they exercise discretionary authority.

Price Stabilization, Short Positions and Penalty Bids

Until the distribution of the shares is completed, SEC rules may limit underwriters and selling group members from bidding for and purchasing our common stock. However, the representatives may engage in transactions that stabilize the price of the common stock, such as bids or purchases to peg, fix or maintain that price.

In connection with the offering, the underwriters may purchase and sell our common stock in the open market. These transactions may include short sales, purchases on the open market to cover positions created by short sales and stabilizing transactions. Short sales involve the sale by the underwriters of a greater number of shares than they are required to purchase in the offering. "Covered" short sales are sales made in an amount not greater than the underwriters' option to purchase additional shares described above. The underwriters may close out any covered short position by either exercising their option to purchase additional shares or purchasing shares in the open market. In determining the source of shares to close out the covered short position, the underwriters will consider, among other things, the price of shares available for purchase in the open market as compared to the price at which they may purchase shares through the option granted to them. "Naked" short sales are sales in excess of such option. 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 our common stock in the open market after pricing that could adversely affect investors who purchase in the offering. Stabilizing transactions consist of various bids for or purchases of shares of common stock made by the underwriters in the open market prior to the closing of the offering.

The underwriters may also impose a penalty bid. This occurs when a particular underwriter repays to the underwriters a portion of the underwriting discount received by it because the representatives have repurchased shares sold by or for the account of such underwriter in stabilizing or short covering transactions.

Similar to other purchase transactions, the underwriters' purchases to cover the syndicate short sales may have the effect of raising or maintaining the market price of our common stock or preventing or retarding a decline in the market price of our common stock. As a result, the price of our common stock may be higher than the price that might otherwise exist in the open market. The underwriters may conduct these transactions on the Nasdaq Global Market, in the over-the-counter market or otherwise.

Neither we nor any of the underwriters make any representation or prediction as to the direction or magnitude of any effect that the transactions described above may have on the price of our common stock. In addition, neither we nor any of the underwriters make any representation that the representatives will engage in these transactions or that these transactions, once commenced, will not be discontinued without notice.

Electronic Distribution

In connection with the offering, certain of the underwriters or securities dealers may distribute prospectuses by electronic means, such as e-mail.

Other Relationships

The underwriters and their respective affiliates are full service financial institutions engaged in various activities, which may include sales and trading, commercial and investment banking, advisory, investment management, investment research, principal investment, hedging, market making, brokerage and other financial and non-financial activities and services. Some of the underwriters and their affiliates have engaged in, and may in the future engage in, investment banking and other commercial dealings in the ordinary course of business with us or our affiliates. They have received, or may in the future receive, customary fees and commissions for these transactions.

In addition, in the ordinary course of their business activities, the underwriters and their 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. Such investments and securities activities may involve securities and/or instruments of ours or our affiliates. The underwriters and their affiliates may also make investment recommendations and/or publish or express independent research views in respect of such securities or financial instruments and may hold, or recommend to clients that they acquire, long and/or short positions in such securities and instruments.

Notice to Prospective Investors in the European Economic Area

In relation to each member state of the European Economic Area, no offer of ordinary shares which are the subject of the offering has been, or will be made to the public in that Member State, other than 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 the representatives for any such offer; or

(c) in any other circumstances falling within Article 3(2) of the Prospectus Directive,

provided that no such offer of ordinary shares referred to in (a) to (c) above shall result in a requirement for the Company or any representative to publish a prospectus pursuant to Article 3 of the Prospectus Directive, or supplement a prospectus pursuant to Article 16 of the Prospectus Directive.

Each person located in a Member State to whom any offer of ordinary shares is made or who receives any communication in respect of an offer of ordinary shares, or who initially acquires any ordinary shares will be deemed to have represented, warranted, acknowledged and agreed to and with each representative and the Company that (1) it is a "qualified investor" within the meaning of the law in that Member State implementing Article 2(1)(e) of the Prospectus Directive; and (2) in the case of any ordinary shares acquired by it as a financial intermediary as that term is used in Article 3(2) of the Prospectus Directive, the ordinary shares acquired by it in the offer have not been acquired on behalf of, nor have they been acquired with a view to their offer or resale to, persons in any Member State other than qualified investors, as that term is defined in the Prospectus Directive, or in circumstances in which the prior consent of the representatives has been given to the offer or resale; or where ordinary shares have been acquired by it on behalf of persons in any Member State other than qualified investors, the offer of those ordinary shares to it is not treated under the Prospectus Directive as having been made to such persons.

The Company, the representatives and their respective affiliates will rely upon the truth and accuracy of the foregoing representations, acknowledgments and agreements.

This prospectus has been prepared on the basis that any offer of shares in any Member State will be made pursuant to an exemption under the Prospectus Directive from the requirement to publish a prospectus for offers of shares. Accordingly any person making or intending to make an offer in that Member State of shares which are the subject of the offering contemplated in this prospectus may only do so in circumstances in which no obligation arises for the Company or any of the representatives to publish a prospectus pursuant to Article 3 of the Prospectus Directive in relation to such offer. Neither the Company nor the representatives have authorized, nor do they authorize, the making of any offer of shares in circumstances in which an obligation arises for the Company or the representatives to publish a prospectus for such offer.

For the purposes of this provision, the expression an "offer of ordinary shares to the public" in relation to any ordinary shares in any Member State means the communication in any form and by any means of sufficient information on the terms of the offer and the ordinary shares to be offered so as to enable an investor to decide to purchase or subscribe the ordinary shares, 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) and includes any relevant implementing measure in each Member State.

The above selling restriction is in addition to any other selling restrictions set out below.

Notice to Prospective Investors in the United Kingdom

In addition, in the United Kingdom, this document is being distributed only to, and is directed only at, and any offer subsequently made may only be directed at persons who are "qualified investors" (as defined in the Prospectus Directive) (i) who have professional experience in matters relating to investments falling within Article 19 (5) of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005, as amended (the "Order") and/or (ii) who are high net worth companies (or persons to whom it may otherwise be lawfully communicated) falling within Article 49(2)(a) to (d) of the Order (all such persons together being referred to as "relevant persons"). This document must not be acted on or relied on in the United Kingdom by persons who are not relevant persons. In the United Kingdom, any investment or investment activity to which this document relates is only available to, and will be engaged in with, relevant persons.

Notice to Prospective Investors in Switzerland

The shares may not be publicly offered in Switzerland and will not be listed on the SIX Swiss Exchange ("SIX") or on any other stock exchange or regulated trading facility in Switzerland. This document has been prepared without regard to the disclosure standards for issuance prospectuses under art. 652a or art. 1156 of the Swiss Code of Obligations or the disclosure standards for listing prospectuses under art. 27 ff. of the SIX Listing Rules or the listing rules of any other stock exchange or regulated trading facility in Switzerland. Neither this document nor any other offering or marketing material relating to the shares or the offering may be publicly distributed or otherwise made publicly available in Switzerland.

Neither this document nor any other offering or marketing material relating to the offering, the Company, or the shares have been or will be filed with or approved by any Swiss regulatory authority. In particular, this document will not be filed with, and the offer of shares will not be supervised by, the Swiss Financial Market Supervisory Authority FINMA (FINMA), and the offer of shares has not been and will not be authorized under the Swiss Federal Act on Collective Investment Schemes ("CISA"). The investor protection afforded to acquirers of interests in collective investment schemes under the CISA does not extend to acquirers of shares.

Notice to Prospective Investors in the Dubai International Financial Centre

This prospectus relates to an Exempt Offer in accordance with the Offered Securities Rules of the Dubai Financial Services Authority ("DFSA"). This prospectus is intended for distribution only to persons of a type specified in the Offered Securities Rules of the DFSA. It must not be delivered to, or relied on by, any other person. The DFSA has no responsibility for reviewing or verifying any documents in connection with Exempt Offers. The DFSA has not approved this prospectus nor taken steps to verify the information set forth herein and has no responsibility for the prospectus. The shares to which this prospectus relates may be illiquid and/or subject to restrictions on their resale. Prospective purchasers of the shares offered should conduct their own due diligence on the shares. If you do not understand the contents of this prospectus you should consult an authorized financial advisor.

Notice to Prospective Investors in Australia

No placement document, prospectus, product disclosure statement or other disclosure document has been lodged with the Australian Securities and Investments Commission ("ASIC"), in relation to the offering. This prospectus does not constitute a prospectus, product disclosure statement or other disclosure document under the Corporations Act 2001 (the "Corporations Act"), and does not purport to include the information required for a prospectus, product disclosure statement or other disclosure document under the Corporations Act.

Any offer in Australia of the shares may only be made to persons (the "Exempt Investors") who are "sophisticated investors" (within the meaning of section 708(8) of the Corporations Act), "professional investors" (within the meaning of section 708(11) of the Corporations Act) or otherwise pursuant to one or more exemptions contained in section 708 of the Corporations Act so that it is lawful to offer the shares without disclosure to investors under Chapter 6D of the Corporations Act.

The shares applied for by Exempt Investors in Australia must not be offered for sale in Australia in the period of 12 months after the date of allotment under the offering, except in circumstances where disclosure to investors under Chapter 6D of the Corporations Act would not be required pursuant to an exemption under section 708 of the Corporations Act or otherwise or where the offer is pursuant to a disclosure document which complies with Chapter 6D of the Corporations Act. Any person acquiring shares must observe such Australian on-sale restrictions.

This prospectus contains general information only and does not take account of the investment objectives, financial situation or particular needs of any particular person. It does not contain any securities recommendations or financial product advice. Before making an investment decision, investors need to consider whether the information in this prospectus is appropriate to their needs, objectives and circumstances, and, if necessary, seek expert advice on those matters.

Notice to Prospective Investors in Hong Kong

The shares have not been offered or sold and will not be offered or sold in Hong Kong, by means of any document, other than (a) to "professional investors" as defined in the Securities and Futures Ordinance (Cap. 571) of Hong Kong and any rules made under that Ordinance; or (b) in other circumstances which do not result in the document being a "prospectus" as defined in the Companies Ordinance (Cap. 32) of Hong Kong or which do not constitute an offer to the public within the meaning of that Ordinance. No advertisement, invitation or document relating to the shares has been or may be issued or has been or may be in the possession of any person for the purposes of issue, whether in Hong Kong or elsewhere, which is directed at, or the contents of which are likely to be accessed or read by, the public of Hong Kong (except if permitted to do so under the securities laws of Hong Kong) other than with respect to shares which are or are intended to be disposed of only to persons outside Hong Kong or only to "professional investors" as defined in the Securities and Futures Ordinance and any rules made under that Ordinance.

Notice to Prospective Investors in Japan

The shares have not been and will not be registered under the Financial Instruments and Exchange Law of Japan (Law No. 25 of 1948, as amended) and, accordingly, will not be offered or sold, directly or indirectly, in Japan, or for the benefit of any Japanese Person or to others for re-offering or resale, directly or indirectly, in Japan or to any Japanese Person, except in compliance with all applicable laws, regulations and ministerial guidelines promulgated by relevant Japanese governmental or regulatory authorities in effect at the relevant time. For the purposes of this paragraph, "Japanese Person" shall mean any person resident in Japan, including any corporation or other entity organized under the laws of Japan.

Notice to Prospective Investors in Singapore

This prospectus has not been registered as a prospectus with the Monetary Authority of Singapore. Accordingly, this prospectus and any other document or material in connection with the offer or sale, or invitation for subscription or purchase, of shares may not be circulated or distributed, nor may the shares be offered or sold, or be made the subject of an invitation for subscription or purchase, whether directly or indirectly, to persons in Singapore other than (i) to an institutional investor under Section 274 of the Securities and Futures Act, Chapter 289 of Singapore (the "SFA"), (ii) to a relevant person pursuant to Section 275(1), or any person pursuant to Section 275(1A), and in accordance with the conditions specified in Section 275, of the SFA, or (iii) otherwise pursuant to, and in accordance with the conditions of, any other applicable provision of the SFA.

Where the shares are subscribed or purchased under Section 275 of the SFA by a relevant person which is:

(a) a corporation (which is not an accredited investor (as defined in Section 4A of the SFA)) the sole business of which is to hold investments and the entire share capital of which is owned by one or more individuals, each of whom is an accredited investor; or

(b) a trust (where the trustee is not an accredited investor) whose sole purpose is to hold investments and each beneficiary of the trust is an individual who is an accredited investor,

securities (as defined in Section 239(1) of the SFA) of that corporation or the beneficiaries' rights and interest (howsoever described) in that trust shall not be transferred within six months after that corporation or that trust has acquired the shares pursuant to an offer made under Section 275 of the SFA except:

(a) to an institutional investor or to a relevant person defined in Section 275(2) of the SFA, or to any person arising from an offer referred to in Section 275(1A) or Section 276(4)(i)(B) of the SFA;

(b) where no consideration is or will be given for the transfer;

(c) where the transfer is by operation of law;

(d) as specified in Section 276(7) of the SFA; or

(e) as specified in Regulation 32 of the Securities and Futures (Offers of Investments) (Shares and Debentures) Regulations 2005 of Singapore.

Notice to Prospective Investors in 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 (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.

LEGAL MATTERS

The validity of the shares of common stock offered by this prospectus will be passed upon for us by Goodwin Procter LLP, Boston, Massachusetts. Shearman & Sterling LLP, New York, New York, is acting as counsel for the underwriters in connection with this offering.

EXPERTS

The financial statements as of December 31, 2017 and for the year ended December 31, 2017 included in this prospectus have been so included in reliance on the report (which contains an emphasis of matter paragraph relating to the Company's requirement for additional financing to fund future operations as described in Note 2 to the financial statements) of PwC Wirtschaftsprüfung GmbH, an independent registered public accounting firm, given on the authority of said firm as experts in auditing and accounting.

WHERE YOU CAN FIND MORE INFORMATION

We have filed with the SEC a registration statement on Form S-1 (File Number 333-   ) under the Securities Act of 1933, as amended, with respect to the common stock we are offering by this prospectus. This prospectus, which constitutes a part of the registration statement, does not contain all of the information included in the registration statement. For further information pertaining to us and our common stock, you should refer to the registration statement and to its exhibits. Whenever we make reference in this prospectus to any of our contracts, agreements or other documents, the references are not necessarily complete, and you should refer to the exhibits attached to the registration statement for copies of the actual contract, agreement or other document.

Upon the closing of the offering, we will be subject to the informational requirements of the Securities Exchange Act of 1934, as amended, or the Exchange Act, and will file annual, quarterly and current reports, proxy statements and other information with the SEC. You can read our SEC filings, including the registration statement, at the SEC's website at www.sec.gov. We also maintain a website at www.hookipapharma.com. Upon closing of the offering, you may access, free of charge, our annual reports on Form 10-K, quarterly reports on Form 10-Q, current reports on Form 8-K and amendments to those reports filed or furnished pursuant to Section 13(a) or 15(d) of the Exchange Act as soon as reasonably practicable after such material is electronically filed with, or furnished to, the SEC.

You may also request a copy of these filings, at no cost to you, by writing or telephoning us at the following address:

HOOKIPA Pharma Inc.
430 East 29th Street, 14th Floor
New York, New York 10016
+43 1 890 63 60

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Report of Independent Registered Public Accounting Firm

To the Board of Directors and Shareholders of HOOKIPA Pharma Inc.

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheet of HOOKIPA Pharma Inc. and its subsidiaries (the "Company") as of December 31, 2017, and the related consolidated statements of operations and comprehensive loss, of redeemable convertible preferred stock and stockholders' deficit and of cash flows for the year then ended, including 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 as of December 31, 2017, and the results of its operations and its cash flows for the year then ended in conformity with accounting principles generally accepted in the United States of America.

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 audit. 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 audit of these consolidated financial statements in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud.

Our audit 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 audit 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 audit provides a reasonable basis for our opinion.

Emphasis of Matter

As discussed in Note 2 to the consolidated financial statements, the Company will require additional financing to fund future operations. Management's plans in regard to this matter are described in Note 2.

Vienna, Austria
December 13, 2018

PwC Wirtschaftsprüfung GmbH
/s/ Alexandra Rester
Austrian Certified Public Accountant

We have served as the Company's, or its predecessors, auditor since 2012, which includes periods before the Company became subject to SEC reporting requirements.

HOOKIPA PHARMA INC.

CONSOLIDATED BALANCE SHEETS

(In thousands, except share amounts)

	As of December 31, 2017	As of September 30, 2018 (unaudited)	Pro Forma September 30, 2018 (unaudited)
Assets			
Current assets:			
Cash and cash equivalents	$ 61,362	$ 55,792	$ 55,792
Accounts receivable	—	688	688
Prepaid expenses and other current assets	2,076	5,474	5,474
Due from shareholder	6,520	—	—
Total current assets	69,958	61,954	61,954
Non-current assets:			
Property and equipment, net	3,575	4,382	4,382
Other non-current assets	199	207	207
Total non-current assets	3,774	4,589	4,589
Total assets	$ 73,732	$ 66,543	$ 66,543
Liabilities, Redeemable Convertible Preferred Stock and Stockholders' Equity (Deficit)			
Current liabilities			
Accounts payable	$ 1,477	$ 520	$ 520
Deferred revenues	—	7,674	7,674
Accrued expenses and other current liabilities	2,558	3,502	3,502
Total current liabilities	4,035	11,696	11,696
Non-current liabilities			
Loans payable, non-current	3,738	4,272	4,272
Deferred revenues, non-current	—	728	728
Other non-current liabilities	3,841	3,179	3,179
Total non-current liabilities	7,579	8,179	8,179
Total liabilities	11,614	19,875	19,875
Commitments and contingencies (Note 12)			
Redeemable convertible preferred stock (series A, B and C), $0.0001 par value; 1,323,506 shares authorized, issued and outstanding at December 31, 2017 and September 30, 2018 (unaudited); aggregate liquidation preference of $104.6 million at December 31, 2017 and $101.1 million at September 30, 2018 (unaudited); no shares issued and outstanding, pro forma at September 30, 2018 (unaudited)	104,774	104,774	—
Stockholders' equity (deficit):			
Common stock, $0.0001 par value; 1,585,054 shares authorized at December 31, 2017 and September 30, 2018 (unaudited), respectively; 78,311 shares issued and outstanding December 31, 2017 and September 30, 2018 (unaudited); 1,401,817 shares issued and outstanding, pro forma at September 30, 2018 (unaudited)	0	0	1
Additional paid-in capital	2,451	3,068	107,841
Accumulated other comprehensive loss	(1,362)	(3,084)	(3,084)
Accumulated deficit	(43,745)	(58,090)	(58,090)
Total stockholders' equity (deficit)	(42,656)	(58,106)	46,668
Total liabilities, convertible preferred stock and stockholders' equity (deficit)	$ 73,732	$ 66,543	$ 66,543

The accompanying notes are an integral part of these consolidated financial statements.

HOOKIPA PHARMA INC.

CONSOLIDATED STATEMENTS OF OPERATIONS AND COMPREHENSIVE LOSS

(In thousands, except share and per share amounts)

	Year ended December 31, 2017	Nine months ended September 30, 2018 (unaudited)
Revenue from collaboration and licensing	$ —	$ 2,549
Operating expenses:		
Research and development	(9,772)	(17,350)
General and administrative	(4,385)	(4,175)
Total operating expenses	(14,157)	(21,525)
Loss from operations	(14,157)	(18,976)
Other income (expense):		
Grant income	$ 2,069	$ 5,217
Interest expense	(606)	(578)
Other income and expenses, net	(25)	19
Total other income (expense), net	1,438	4,658
Net loss before tax	(12,719)	(14,318)
Income tax expense	(4)	(27)
Net loss	$ (12,723)	$ (14,345)
Other comprehensive loss:		
Foreign currency translation (loss) gain, net of tax	1,764	(1,722)
Comprehensive loss	$ (10,959)	$ (16,067)
Net loss per share—basic and diluted	$ (162.47)	$ (183.18)
Weighted average common shares outstanding—basic and diluted	78,311	78,311
Pro forma net loss per share—basic and diluted (unaudited)		$ (10.23)
Pro forma weighted average common shares outstanding—basic and diluted (unaudited)		1,401,817

The accompanying notes are an integral part of these consolidated financial statements.

HOOKIPA PHARMA INC.

CONSOLIDATED STATEMENTS OF REDEEMABLE CONVERTIBLE PREFERRED STOCK AND STOCKHOLDERS' DEFICIT

(In thousands, except share amounts)

	Redeemable Convertible Preferred Stock		Common Stock		Additional Paid-in Capital	Accumulated Other Comprehensive Income (Loss)	Accumulated Deficit	Total Stockholders' Deficit
	Shares	Amount	Shares	Amount				
Balances as of January 1, 2017	547,974	$ 40,189	78,311	$ 0	$ 1,682	$ (3,126)	$ (31,022)	$ (32,466)
Issuance of Series B preferred stock, net of issuance costs of $0	82,032	5,315	—	—	—	—	—	—
Issuance of Series C convertible preferred stock, net of issuance costs of $93	693,500	59,270	—	—	—	—	—	—
Foreign currency translation adjustment	—	—	—	—	—	1,764	—	1,764
Stock-based compensation expense	—	—	—	—	769	—	—	769
Net loss	—	—	—	—	—	—	(12,723)	(12,723)
Balances as of December 31, 2017	1,323,506	104,774	78,311	0	2,451	(1,362)	(43,745)	(42,656)
Foreign currency translation adjustment (unaudited)	—	—	—	—	—	(1,722)	—	(1,722)
Stock-based compensation expense (unaudited)	—	—	—	—	617	—	—	617
Net loss (unaudited)	—	—	—	—	—	—	(14,345)	(14,345)
Balances as of September 30, 2018 (unaudited)	1,323,506	$ 104,774	78,311	$ 0	$ 3,068	$ (3,084)	$ (58,090)	$ (58,106)

The accompanying notes are an integral part of these consolidated financial statements.

HOOKIPA PHARMA INC.

CONSOLIDATED STATEMENTS OF CASH FLOWS

(In thousands)

	Year ended December 31, 2017	Nine months ended September 30, 2018 (unaudited)
Operating activities:		
Net loss	$ (12,723)	$ (14,345)
Adjustments to reconcile net loss to net cash used in operating activities:		
Stock-based compensation expense	770	617
Depreciation expense	398	462
Other non-cash items	(45)	(1)
Changes in operating assets and liabilities:		
Accounts receivable	—	(613)
Prepaid expenses and other current assets	(67)	(3,584)
Other non-current assets	(83)	(15)
Accounts payable	(1,172)	(447)
Deferred revenues	—	8,638
Accrued expenses and other liabilities	1,009	666
Net cash used in operating activities	(11,913)	(8,622)
Investing activities:		
Purchases of property and equipment	(1,297)	(1,900)
Net cash used in investing activities	(1,297)	(1,900)
Financing activities:		
Proceeds from issuance of redeemable convertible preferred stock	58,145	6,439
Proceeds from borrowings	747	428
Net cash provided by financing activities	58,892	6,867
Net decrease / increase in cash and cash equivalents	45,682	(3,655)
Cash and cash equivalents at beginning of period	13,186	61,362
Effect of exchange rate changes on cash and cash equivalents	2,494	(1,915)
Cash and cash equivalents at end of period	$ 61,362	$ 55,792
Supplemental disclosure of cash flow information:		
Cash paid for interest	$ (60)	$ (39)
Cash paid for income taxes	$ (4)	$ (26)
Supplemental disclosure of non-cash financing activities:		
Due from shareholder for issuance of redeemable convertible preferred stock	$ 6,520	$ —

The accompanying notes are an integral part of these consolidated financial statements.

HOOKIPA PHARMA INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

1. Nature of the business and basis of presentation

HOOKIPA Pharma Inc. ("HOOKIPA" or the "Company") is a clinical stage biopharmaceutical company developing a new class of immunotherapeutics targeting infectious diseases and cancers based on its proprietary arenavirus platform that is designed to reprogram the body's immune system.

The Company was incorporated under the name of Hookipa Biotech, Inc. under the laws of the State of Delaware in February 2017 as a fully-owned subsidiary of Hookipa Biotech AG. In June 2018, the Company changed its name from Hookipa Biotech, Inc. to HOOKIPA Pharma Inc. and in order to effectuate the change of the jurisdiction of incorporation, the Company acquired all of the shares of Hookipa Biotech AG, now Hookipa Biotech GmbH. HOOKIPA is headquartered in New York, with European research and preclinical development operations headquartered in Vienna, Austria.

The Company is subject to risks and uncertainties common to early-stage companies in the biotechnology industry, including, but not limited to, development by competitors of new technological innovations, dependence on key personnel, protection of proprietary technology, compliance with government regulations, the ability to establish clinical- and commercial-scale manufacturing processes and the ability to secure additional capital to fund operations. Product candidates currently under development will require significant additional research and development efforts, including extensive preclinical and clinical testing and regulatory approval prior to commercialization. These efforts require significant amounts of additional capital, adequate personnel and infrastructure and extensive compliance-reporting capabilities. Even if the Company's drug development efforts are successful, it is uncertain when, if ever, the Company will realize significant revenue from product sales.

2. Summary of significant accounting policies

Basis of presentation

The Company's consolidated financial statements have been prepared in conformity with accounting principles generally accepted in the United States of America ("GAAP"). The accompanying consolidated financial statements include the accounts of the Company and its wholly owned subsidiary. All intercompany accounts and transactions have been eliminated in consolidation.

Transaction between entities under common control

In June 2018, the Company acquired all of the shares of its parent company, Hookipa Biotech AG, against issuance of 78,311 shares of common stock and 1,323,506 shares of redeemable convertible preferred stock to the shareholders of Hookipa Biotech AG, who became the sole shareholder of the Company. The transaction was recorded as a transaction between entities under common control that led to a change in the reporting entity. In the accompanying consolidated financial statements, the assets and liabilities and relating operations of the transferring entity are retrospectively presented at their carrying amounts without a change in the basis for all periods during which the transferring entity was under common control. The share capital as well as the share and per share information included in the accompanying consolidated financial statements have been retrospectively adjusted to reflect the share capital of the Company after the transaction. Differences in the par value of common stock between the transferring and the receiving entity were reflected by adjustments to redeemable convertible preferred stock and additional paid-in capital.

HOOKIPA PHARMA INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

2. Summary of significant accounting policies (Continued)

Going concern

Since inception, the Company's activities have consisted primarily of performing research and development to advance its technologies. The Company is still in the development phase and has not been marketing its technologies to date. Through September 30, 2018 the Company has funded its operations with proceeds from sales of redeemable convertible preferred stock, collaboration and licensing agreements, grants and borrowings under various agreements with foreign public funding agencies. Since inception, the Company has incurred recurring losses, including net losses of $12.7 million for the year ended December 31, 2017 and $14.3 million for the nine months ended September 30, 2018. As of September 30, 2018, the Company had an accumulated deficit of $58.1 million. The Company expects to continue to generate operating losses in the foreseeable future. As of December 13, 2018, the issuance date of the consolidated financial statements for the year ended December 31, 2017 and the nine months ended September 30, 2018, the Company expected that its cash and cash equivalents would be sufficient to fund its operating expenses, capital expenditure requirements and debt service payments through at least 12 months from the issuance date of the consolidated financial statements.

The Company will seek additional funding in order to reach its development and commercialization objectives. The Company will seek funds either through an initial public offering or further private equity financings, debt financings, collaborations, strategic alliances and marketing, distribution or licensing arrangements. The Company may not be able to obtain financing on acceptable terms, or at all, and the Company may not be able to enter into collaborations or other arrangements. The terms of any financing may adversely affect the holdings or the rights of the Company's stockholders. If the Company is unable to obtain funding, the Company could be forced to delay, reduce or eliminate some or all of its research and development programs, product portfolio expansion or commercialization efforts, which could adversely affect its business prospects. Although management continues to pursue these plans, there is no assurance that the Company will be successful in obtaining sufficient funding on terms acceptable to the Company to fund continuing operations, if at all.

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 consolidated financial statements do not reflect any adjustments relating to the recoverability and classification of assets or the amounts and classification of liabilities that might be necessary if the Company is unable to continue as a going concern.

Use of estimates

The preparation of financial statements in conformity with GAAP requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, the disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenue, income and expenses during the reporting periods. Significant estimates and assumptions reflected in these consolidated financial statements include, but are not limited to, the recognition of revenue and income, the accrual of research and development expenses, the valuation of common and preferred stock, the valuation of stock-based awards and the valuation of liabilities. The Company bases its estimates on historical experience, known trends and other market-specific or other relevant factors that it believes to be reasonable under the circumstances. On an ongoing basis, management evaluates

HOOKIPA PHARMA INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

2. Summary of significant accounting policies (Continued)

its estimates as there are changes in circumstances, facts and experience. Actual results may differ from those estimates or assumptions.

Unaudited interim financial information

The accompanying Consolidated Balance Sheets as of September 30, 2018, the Consolidated Statements of Operations and Comprehensive Loss and Consolidated Statement of Cash Flows for the nine months ended September 30, 2018, and the Consolidated Statements of Redeemable Convertible Preferred Stock and Stockholders' Deficit for the nine months ended September 30, 2018 are unaudited. The unaudited interim consolidated financial statements have been prepared on the same basis as the audited annual consolidated financial statements and, in the opinion of management, reflect all adjustments, which include only normal recurring adjustments, necessary for the fair statement of the Company's financial position as of September 30, 2018 and the results of its operations and its cash flows for the nine months ended September 30, 2018. The financial data and other information disclosed in these notes related to the nine months ended September 30, 2018 are also unaudited. The results for the nine months ended September 30, 2018 are not necessarily indicative of results to be expected for the year ending December 31, 2018, any other interim periods, or any future year or period.

Unaudited pro forma information

The accompanying unaudited pro forma Consolidated Balance Sheets as of September 30, 2018 have been prepared to give effect, upon the closing of an initial public offering, to the automatic conversion of all outstanding shares of redeemable convertible preferred stock into 1,323,506 shares of common stock as if the proposed initial public offering had occurred on September 30, 2018.

In the accompanying Consolidated Statements of Operations and Comprehensive Loss, unaudited pro forma basic and diluted net loss per share attributable to common stockholders for the nine months ended September 30, 2018 has been prepared to give effect, upon the closing of an initial public offering, to the automatic conversion of all outstanding shares of redeemable convertible preferred stock into 1,323,506 shares of common stock as if the proposed initial public offering had occurred on January 1, 2018.

Foreign currency and currency translation

The functional currency for the Company is the United States dollar and the functional currency for the Company's wholly owned foreign subsidiary, Hookipa Biotech GmbH, is the euro. The Company's Cash and cash equivalents as of December 31, 2017 and September 30, 2018 consisted primarily of cash balances held by Hookipa Biotech GmbH in euros.

Assets and liabilities of Hookipa Biotech GmbH are translated into United States dollars at the exchange rate in effect on the balance sheet date. Income items and expenses are translated at the average exchange rate in effect during the period. Unrealized translation gains and losses are recorded as a cumulative translation adjustment, which is included in the Consolidated Statements of Redeemable Convertible Preferred Stock and Stockholders' Deficit as a component of Accumulated other comprehensive loss. Adjustments that arise from exchange rate changes on transactions denominated in a currency other than the local currency are included in Other income and expenses, net in the Consolidated Statements of Operations and Comprehensive Loss as incurred.

HOOKIPA PHARMA INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

2. Summary of significant accounting policies (Continued)

Concentrations of credit risk and of significant suppliers

Financial instruments that potentially expose the Company to concentrations of credit risk consist primarily of cash, cash equivalents and short-term bank deposits. As of December 31, 2017 and September 30, 2018, the Company's cash and cash equivalents consisted primarily of cash balances held in euros on accounts with European banks in excess of publicly insured limits. The Company does not believe that it is subject to unusual credit risk beyond the normal credit risk associated with commercial banking relationships.

Amounts due from related party consist of payments due from a shareholder in connection with the issuance of Series C convertible preferred stock (the "Series C Preferred Stock"). The Company monitors economic conditions to identify facts or circumstances that may indicate if such amount due is at risk of collection. There was no allowance for doubtful accounts recorded at December 31, 2017 and September 30, 2018.

The Company relies, and expects to continue to rely, on a small number of vendors to manufacture supplies and raw materials for its development programs. These programs could be adversely affected by a significant interruption in these manufacturing services or the availability of raw materials.

Deferred offering costs

The Company capitalizes certain legal, professional accounting and other third-party fees that are directly associated with in-process equity financings as deferred offering costs until such financings are consummated. After consummation of an equity financing, these costs are recorded in stockholders' equity as a reduction of the additional paid-in capital generated as a result of the offering. Should the in-process equity financing be abandoned, the deferred offering costs will be expensed immediately as a charge to operating expenses in the statements of operations and comprehensive loss. The Company did not record any deferred offering costs as of December 31, 2017 and September 30, 2018.

Cash equivalents

The Company considers all highly liquid investments with original maturities of three months or less at the date of purchase to be cash equivalents.

Fair value measurements

Certain assets and liabilities are carried at fair value under GAAP. Fair value is defined as the price that would be received for an asset or paid to transfer a liability (an exit price) in the principal or most advantageous market for the asset or liability in an orderly transaction between market participants on the measurement date. Valuation techniques used to measure fair value must maximize the use of observable inputs and minimize the use of unobservable inputs. Financial assets and liabilities carried at fair value are to be classified and disclosed in one of the following three levels of the fair value hierarchy:

- Level 1—Quoted prices in active markets for identical assets or liabilities.

- Level 2—Observable inputs (other than Level 1 quoted prices), such as quoted prices in active markets for similar assets or liabilities, quoted prices in markets that are not active for

2. Summary of significant accounting policies (Continued)

identical or similar assets or liabilities, or other inputs that are observable or can be corroborated by observable market data.

- Level 3—Unobservable inputs that are supported by little or no market activity and that are significant to determining the fair value of the assets or liabilities, including pricing models, discounted cash flow methodologies and similar techniques.

The Company's cash equivalents are carried at fair value, determined according to the fair value hierarchy described above. The carrying values of the Company's accounts payable and accrued expenses and other current liabilities approximate their fair values due to the short-term nature of these liabilities. The carrying value of the loans received under government funding agreements (see Note 7) approximates their fair value because the Company records imputed interest expense based on rates that approximate market rates of interest as of the issuance date of each loan.

Property and equipment

Property and equipment are stated at cost less accumulated depreciation. Depreciation expense is recognized using the straight-line method over the estimated useful life of each asset as follows:

	Estimated useful life
Leasehold improvements	10 - 25 years
Laboratory equipment	3 - 10 years
Furniture and fixtures	3 - 10 years
Computer equipment and software	3 - 4 years

Costs for capital assets not yet placed into service are capitalized as construction-in-progress and depreciated once placed into service. Expenditures for repairs and maintenance are charged to expense as incurred.

Impairment of long-lived assets

Long-lived assets consist of property and equipment. Long-lived assets to be held and used are tested for recoverability whenever events or changes in business circumstances indicate that the carrying amount of the assets may not be fully recoverable. Factors that the Company considers in deciding when to perform an impairment review include significant underperformance of the business in relation to expectations, significant negative technological, scientific or economic trends and significant changes or planned changes in the use of the assets.

If an impairment review is performed to evaluate a long-lived asset group for recoverability, the Company compares forecasts of undiscounted cash flows expected to result from the use and eventual disposition of the long-lived asset group to its carrying value. An impairment loss would be recognized in loss from operations when estimated undiscounted future cash flows expected to result from the use of an asset group are less than its carrying amount. The impairment loss would be based on the excess of the carrying value of the impaired asset group over its fair value, determined based on discounted cash flows. The Company did not record any impairment losses on long-lived assets during the year ended December 31, 2017 and the nine months ended September 30, 2018.

2. Summary of significant accounting policies (Continued)

Segment information

The Company manages its operations as a single segment for the purposes of assessing performance and making operating decisions. The Company's singular focus is on developing pharmaceutical products to prevent and cure infectious diseases and cancer. The Chief Executive Officer is the chief operating decision maker, and regularly reviews the consolidated operating results to make decisions about the allocation of the Company's resources. Substantially all of the Company's tangible assets are held in Austria.

Revenue recognition from contracts with customers

The Company has entered into a collaboration and license agreement (the "Gilead Agreement") with Gilead Sciences, Inc. ("Gilead"), whereby the parties agreed to collaborate with respect to two preclinical research programs to evaluate potential vaccine products for the treatment, cure, diagnosis or prevention of the hepatitis B virus (HBV) and the human immunodeficiency virus (HIV). The Company's performance obligations under the terms of this agreement include one combined performance obligation for each research program (HBV and HIV) comprised of the transfer of intellectual property rights (licenses) and providing research and development services. The licenses do not represent distinct performance obligations, because they cannot be used without the research and development services. Payments to the Company under this agreement include a non-refundable up-front payment, payments for research and development activities, payments based upon the achievement of defined milestones, and if certain future conditions are met, payments for manufacturing services, commercial milestones and royalties on product sales.

The Company evaluates its collaboration and licensing arrangements pursuant to Accounting Standards Codification (ASC) 606. To determine the recognition of revenue from arrangements that fall 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 Company satisfies a performance obligation.

Under ASC 606, the Company applies significant judgement to evaluate whether the obligations under the collaboration and licensing arrangement, represent separate or one or more combined performance obligations, the allocation of the transaction price to identified performance obligations, and the determination of when milestone payments are probable of being received.

Upfront payment

The non-refundable upfront-payment received by the Company under the Gilead agreement is recorded as deferred revenue and allocated between the two research program performance obligations. Such amounts are recognized as revenue over the performance period of the respective services on a percent of completion basis using total estimated research and development labor hours (input method) for each of the obligations. The percent of completion basis using labor hours was considered the best measure of progress in which control of the combined performance obligations transfers to the customer, due to the short time intervals in which research results are shared with the collaboration partner and the nature of the work being performed.

2. Summary of significant accounting policies (Continued)

Reimbursement for services

Under the collaboration and licensing agreement, the Company incurs employee expenses as well as external costs for research and manufacturing activities presented as operating expenses. Based on the nature of the Company's responsibilities under the collaboration arrangement, reimbursement of those costs are presented as revenue and not deducted from expenses, as the Company controls the research activities. Amounts of consideration allocated to the performance of research or manufacturing services are recognized over the period in which services are performed.

Research and development milestones

The collaboration and license agreement includes contingent milestone payments related to specified preclinical and clinical development milestones. These milestone payments represent variable consideration that are not initially recognized within the transaction price as they are fully constrained under the guidance in ASC 606, due to the scientific uncertainties and the required commitment from Gilead. The Company will continue to assess the probability of significant reversals for any amounts that become likely to be realized prior to recognizing the variable consideration associated with these payments within the transaction price.

Sales-based milestones and royalty payments

The collaboration and licensing arrangement also includes certain sales-based milestone and royalty payments upon successful commercialization of a licensed product. In accordance with ASC 606-10-55-65, the Company recognizes revenues from sales-based milestone and royalty payments at the later of (i) the occurrence of the subsequent sale; or (ii) the performance obligation to which some or all of the sales-based milestone or royalty payments has been allocated has been satisfied. The Company anticipates recognizing these milestones and royalty payments if and when subsequent sales are generated from a licensed product by the collaboration partner.

Cost to fulfill contracts

The Company incurs costs for personnel, supplies and other costs related to its laboratory operations as well as fees from third parties and license expenses in connection with its research and development obligations under the collaboration and licensing agreement. These costs are recognized as research and development expenses over the period in which services are performed. Sublicense fees triggered by the receipt of payments are capitalized as an asset when the obligation to pay the fee arises. The capitalized asset is amortized over the period in which the revenue from the triggering payment is recognized.

Research and development costs

Research and development costs are expensed as incurred. Research and development expenses consist of costs incurred in performing research and development activities, including salaries and bonuses, stock-based compensation, employee benefits, facilities costs, laboratory supplies, depreciation, manufacturing expenses and external costs of vendors engaged to conduct preclinical development activities and clinical trials as well as the cost of licensing technology. Advance payments for goods or services to be received in the future for use in research and development activities are recorded as

2. Summary of significant accounting policies (Continued)

prepaid expenses. The prepaid amounts are expensed as the related goods are delivered or the services are performed.

All patent-related costs incurred in connection with filing and prosecuting patent applications are classified as research and development expenses and expensed as incurred due to the uncertainty about the recovery of the expenditure. Upfront payments, milestone payments and annual payments made for the licensing of technology are generally expensed as research and development in the period in which they are incurred. Incremental sublicense fees triggered by contracts with customers are capitalized and expensed as research and development expenses over the period in which the related revenue is recognized.

Research and manufacturing contract costs and accruals

The Company has entered into various research and development and manufacturing contracts. These agreements are generally cancelable, and related payments are recorded as the corresponding expenses are incurred. The Company records accruals for estimated ongoing costs. When evaluating the adequacy of the accrued liabilities, the Company analyzes progress of the research studies or clinical trials and manufacturing activities, including the phase or completion of events, invoices received and contracted costs. Significant judgments and estimates are made in determining the accrued balances at the end of any reporting period. Actual results could differ from the Company's estimates. The Company's historical accrual estimates have not been materially different from the actual costs.

Government grant agreements and research incentives

The Company recognizes funding from grants and research incentives received from Austrian government agencies as other income. Income from grants and incentives is recognized in the period during which the related qualifying expenses are incurred, provided that the conditions under which the grants or incentives were provided have been met. For grants under funding agreements and for proceeds under research incentive programs, the Company recognizes grant and incentive income in an amount equal to the qualifying expenses incurred in each period multiplied by the applicable reimbursement percentage.

Grant funding that has been received by the Company in advance of incurring qualifying expenses is recorded as deferred income. Grant and incentive income recognized upon incurring qualifying expenses in advance of receipt of grant funding or proceeds from research and development incentives is recorded in the consolidated balance sheets as prepaid expenses and other current assets.

The Company has received loans under funding agreements that bear interest at rates that are below market rates of interest. The Company accounts for the imputed benefit arising from the difference between a market rate of interest and the rate of interest charged as additional grant funding, and records interest expense for the loans at a market rate of interest. On the date that loan proceeds are received, the Company recognizes the portion of the loan proceeds allocated to grant funding as a discount to the carrying value of the loan and as other liability, which is subsequently recognized as additional grant income over the term of the funding agreement.

2. Summary of significant accounting policies (Continued)

Redeemable convertible preferred stock

The Company has applied the guidance in ASC 480-10-S99-3A, *SEC Staff Announcement: Classification and Measurement of Redeemable Securities* and has therefore classified the Series A, Series B and Series C redeemable convertible preferred stock as mezzanine equity. The redeemable convertible preferred stock is recorded outside of stockholders' equity because, in the event of certain deemed liquidation events considered not solely within the Company's control, such as a merger, acquisition and sale of all or substantially all of the Company's assets, the convertible preferred stock will become redeemable at the option of the holders. In the event of a change of control of the Company, proceeds received from the sale of such shares will be distributed in accordance with the liquidation preferences set forth in the Company's Preferred Stock agreements. The Company has determined not to adjust the carrying values of the redeemable convertible preferred stock to the liquidation preferences of such shares because of the uncertainty of whether or when such an event would occur.

Stock-based compensation

The Company measures stock-based awards granted to employees and directors based on the fair value on the date of grant using the Black-Scholes option-pricing model for options or the difference between the purchase price per share of the award, if any, and the fair value of the Company's common stock for restricted common stock awards. Compensation expense for those awards is recognized over the requisite service period, which is generally the vesting period of the respective award. The Company uses the graded-vesting method to record the expense of awards with service-based vesting conditions.

The Company classifies stock-based compensation expense in its Consolidated Statements of Operations and Comprehensive Loss in the same manner in which the recipient's payroll costs are classified.

Comprehensive loss

Comprehensive loss includes Net loss and Foreign currency translation adjustments. For the year ended December 31, 2017 and the nine months ended September 30, 2018, Comprehensive loss included $1.8 million of foreign currency translation gain and $1.7 million of foreign currency translation loss adjustments, respectively.

Basic and diluted net loss per share

Basic net loss per share is calculated by dividing the Net loss by the weighted-average number of shares of common stock outstanding or deemed outstanding during the period, without consideration for common stock equivalents. Diluted net loss per share is the same as Basic net loss per share, since the effects of potentially dilutive securities are antidilutive given the net loss for each period presented.

Income taxes

The Company accounts for income taxes under the asset and liability method, which requires the recognition of deferred tax assets and liabilities for the expected future tax consequences of events that have been included in the consolidated financial statements or in the Company's tax returns. Under this method, deferred tax assets and liabilities are determined on the basis of the differences

HOOKIPA PHARMA INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

2. Summary of significant accounting policies (Continued)

between the financial statement and tax bases of assets and liabilities using enacted tax rates in effect for the year in which the differences are expected to reverse. The effect of a change in tax rates on deferred tax assets and liabilities is recognized in income in the period that includes the enactment date. Changes in deferred tax assets and liabilities are recorded in income tax expense. The Company assesses the likelihood that its deferred tax assets will be recovered from future taxable income and, to the extent it believes, based upon the weight of available evidence, that it is more likely than not that all or a portion of the deferred tax assets will not be realized, a valuation allowance is established through a charge to income tax expense. Potential for recovery of deferred tax assets is evaluated by estimating the future taxable profits expected and considering prudent and feasible tax planning strategies.

The Company accounts for uncertainty in income taxes recognized in the consolidated financial statements by applying a two-step process to determine the amount of tax benefit to be recognized. First, the tax position must be evaluated to determine the likelihood that it will be sustained upon external examination by the taxing authorities. If the tax position is deemed more-likely-than-not to be sustained, the tax position is then assessed to determine the amount of benefit to recognize in the financial statements. The amount of the benefit that may be recognized is the largest amount that has a greater than 50% likelihood of being realized upon ultimate settlement. The provision for income taxes includes the effects of any resulting tax reserves, or unrecognized tax benefits, that are considered appropriate as well as the related net interest and penalties.

Recent accounting pronouncements

From time to time, new accounting pronouncements are issued by the Financial Accounting Standards Board ("FASB") or other standard setting bodies that the Company adopts as of the specified effective date.

Adopted as of current period

In May 2014, the FASB issued Accounting Standards Update (ASU) No. 2014-09 ("ASU 2014-09"), *Revenue from Contracts with Customers* (Topic 606), and further updated through ASU 2016-12 ("ASU 2016-12"), which amends the existing accounting standards for revenue recognition. Under Topic 606, an entity recognizes revenue when its 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 Topic 606, the entity 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. Topic 606 also impacts certain other areas, such as the accounting for costs to obtain or fulfill a contract. The standard also requires disclosure of the nature, amount, timing, and uncertainty of revenue and cash flows arising from contracts with customers. For public entities, this standard is effective for annual reporting periods beginning after December 15, 2017, including interim periods within that reporting period. Effective January 1, 2017, the Company early adopted Topic 606, using the full retrospective transition method. The adoption did not have any impact on the Company's consolidated financial statements as the Company did not have any revenue from contracts with customers before fiscal year 2018.

HOOKIPA PHARMA INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

2. Summary of significant accounting policies (Continued)

In May 2017, the FASB issued ASU 2017-09, *Compensation—Stock Compensation* (Topic 718): Scope of Modification Accounting, which clarifies when to account for a change to the terms or conditions of a share-based payment award as a modification. Under the new guidance, modification accounting is required only if the fair value, the vesting conditions, or the classification of the award (as equity or liability) changes as a result of the change in terms or conditions. For all entities, this standard is effective for fiscal years beginning after December 15, 2017, and interim periods within those fiscal years. Early adoption is permitted. Effective January 1, 2017, the Company early adopted this guidance. The adoption did not have any impact on the Company's consolidated financial statements as the Company had no changes to the terms or conditions of its share-based payment awards.

In June 2018, the FASB issued ASU 2018-07, *Compensation-Stock Compensation* (Topic 718): "Improvements to Nonemployee Share-Based Payment Accounting", which expands the scope of Topic 718 to include share-based payment transactions for acquiring goods and services from nonemployees. An entity should apply the requirements of Topic 718 to nonemployee awards except for specific guidance on inputs to an option pricing model and the attribution of cost (that is, the period of time over which share-based payment awards vest and the pattern of cost recognition over that period). The new guidance is effective for all public business entities for fiscal years beginning after December 15, 2018, including interim periods within that fiscal year. Early adoption is permitted, but no earlier than an entity's adoption date of Topic 606. The Company has elected to early adopt this standard. The adoption of this ASU did not have a material impact on its consolidated loss from operations or cash flows.

To be adopted in future periods:

In February 2016, the FASB issued ASU No. 2016-02, *Leases* (Topic 842) ("ASU 2016-02"), which sets out the principles for the recognition, measurement, presentation and disclosure of leases for both parties to a contract (i.e., lessees and lessors). The 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 may be accounted for similar to existing guidance for operating leases today. For public entities, the guidance is effective for annual reporting periods beginning after December 15, 2018 and for interim periods within those fiscal years. Early adoption is permitted for all entities. On January 1, 2019, the Company will adopt ASU 2016-02 and intends to elect certain practical expedients, including the optional transition method that allows for the application of the new standard at its adoption date. The comparative financial information will not be restated and will continue to be reported under the previous lease standard in effect during those periods. While the Company is currently evaluating the impact of the adoption of this standard on its consolidated financial statements, the Company anticipates recognition of additional assets and corresponding liabilities related to leases on its Consolidated Balance Sheets. However, the Company does not expect to have a material impact on its consolidated statements of operations or cash flows. Upon adoption, the Company expects that its financial statement disclosures will be expanded to present additional details of its leasing arrangements. While the Company continues to evaluate the impact that ASU 2016-02 will have on its

2. Summary of significant accounting policies (Continued)

consolidated financial statement and related disclosures, the actual impact of the standard will be dependent upon the Company's lease portfolio at adoption.

In July 2018, the FASB issued ASU No. 2018-11, Earnings Per Share (Topic 260), Distinguishing Liabilities from Equity (Topic 480), Derivatives and Hedging (Topic 815) I. Accounting for Certain Financial Instruments with Down Round Features II. Replacement of the Indefinite Deferral for Mandatorily Redeemable Financial Instruments of Certain Nonpublic Entities and Certain Mandatorily Redeemable Noncontrolling Interests with a Scope Exception ("ASU 2018-11"). Part I applies to entities that issue financial instruments such as warrants, convertible debt or convertible preferred stock that contain down-round features. Part II replaces the indefinite deferral for certain mandatorily redeemable noncontrolling interests and mandatorily redeemable financial instruments of nonpublic entities contained within Accounting Standards Codification ("ASC") Topic 480 with a scope exception and does not impact the accounting for these mandatorily redeemable instruments. For public entities, this guidance is required to be adopted for annual periods beginning after December 15, 2018, including interim periods within those fiscal years. The Company is currently evaluating the impact that the adoption of ASU 2018-11 will have on its consolidated financial statements.

3. Collaboration and Licensing Agreements

Gilead Collaboration and License Agreement

In June 2018, the Company and Gilead entered into the Gilead Agreement.

Under the Gilead Agreement, the Company granted Gilead an exclusive, royalty-bearing license to the Company's technology platforms. The Company has received a non-refundable $10.0 million upfront payment from Gilead of which $1.6 million was recorded as revenue from collaboration and licensing in the nine months ended September 30, 2018 and $8.4 million was included as a liability in deferred revenues, current and non-current, as of September 30, 2018. Approximately 25% of the deferred revenue is expected to be recognized in the fourth quarter of 2018, 70% in 2019, and the remainder in 2020. Gilead is also obligated to make additional payments to the Company upon the achievement of pre-clinical, development and commercial milestones. The development milestones amount to a total of $280 million. The commercial milestones amount to a total of $100 million. Additionally, Gilead is obligated to pay royalties on net sales for each program. All payments from Gilead have a 60 day payment term.

Upon the receipt of the non-refundable upfront payment, the Company recorded a liability of $0.5 million, for a sublicense fee payable to certain licensors of technologies and capitalized a contract asset in the same amount which will be amortized over the period in which the revenue from the triggering payment is recognized. As of September 30, 2018 the liability and the contract asset relating to the sublicense payment were $0.5 million and $0.4 million, respectively.

4. Cash and cash equivalents

As of December 31, 2017 and September 30, 2018, the Company had cash and cash equivalents of $61.4 million and $55.8 million, respectively. The Company mostly holds its cash and cash equivalents in accounts with foreign banks.

HOOKIPA PHARMA INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

5. Property and equipment, net

Property and equipment, net consisted of the following (in thousands):

	December 31, 2017	September 30, 2018 (unaudited)
Leasehold improvements	$ 926	$ 1,894
Construction in progress	523	—
Laboratory equipment	2,821	3,425
Furniture and fixtures	307	353
Computer equipment and software	539	634
Property and equipment, gross	5,116	6,306
Less: Accumulated depreciation	(1,541)	(1,924)
Property and equipment, net	$ 3,575	$ 4,382

Depreciation expense for the year ended December 31, 2017 and the nine months ended September 30, 2018 was $0.4 million and $0.5 million, respectively. Construction-in-progress as of December 31, 2017 related to leasehold improvements in connection with the expansion of laboratories in the Company's leased facilities.

6. Accrued expenses and other current liabilities

Accrued expenses and other current liabilities consisted of the following (in thousands):

	December 31, 2017	September 30, 2018 (unaudited)
Consulting fees	$ 136	$ 52
Sublicense fees	—	513
Salaries and bonuses	1,069	1,176
Social security contributions	447	632
Unearned grant income (current)	725	990
Other accruals and liabilities	181	139
	$ 2,558	$ 3,502

7. Loans payable

As of December 31, 2017 and September 30, 2018, loans payable consisted of the following (in thousands):

	December 31, 2017	September 30, 2018 (unaudited)
Loans from FFG	$ 8,296	$ 8,437
Unamortized debt discount	(4,558)	(4,165)
Total Loans payable, net	$ 3,738	$ 4,272

HOOKIPA PHARMA INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

7. Loans payable (Continued)

In connection with the funding agreements with the Austrian Research Promotion Agency, (*Österreichische Forschungs- förderungsgesellschaft*, or "FFG"), the Company has received various loans ("FFG Loans"). The FFG Loans were made on a project-by-project basis. Amounts due under the FFG Loans bear interest at rates ranging from 0.75% to 1.0% per annum and mature at various dates between March 2021 and March 2024. Interest on amounts due under the loans is payable semi-annually in arrears, with all principal and remaining accrued interest due upon maturity.

The FFG Loans bear interest at rates that are below market rates of interest. The Company accounts for the imputed benefit arising from the difference between an estimated market rate of interest and the rate of interest charged by FFG as grant income from FFG. On the date that FFG loan proceeds are received, the Company recognizes the portion of the loan proceeds allocated to grant funding as a discount to the carrying value of the loan and as unearned income, which is recognized as grant income over the term of the funding agreement.

The Company recognized grant income of $0.5 million and $0.5 million during the year ended December 31, 2017 and the nine months ended September 30, 2018, respectively, related to the recognition of the unearned income recorded for the imputed benefit of FFG Loans at below-market interest rates. Unearned income (current) related to the imputed benefit of FFG Loans at below-market interest rates was $0.7 million and $1.0 million as of December 31, 2017 and September 30, 2018, respectively, and unearned income (non-current) related to such benefit was $3.8 million and $3.2 million as of December 31, 2017 and September 30, 2018, respectively. The Company classifies current and non-current unearned income as accrued expenses and other liabilities and other non-current liabilities, respectively.

In addition, the Company has recorded a discount to the carrying value of each FFG Loan for the portion of the loan proceeds allocated to grant funding, which is being amortized to interest expense over the term of the loan using the effective interest method. As of December 31, 2017 and September 30, 2018, the unamortized debt discount related to FFG Loans was $4.6 million and $4.2 million, respectively.

The Company recognized interest expense of $0.6 million and $0.6 million during the year ended December 31, 2017 and the nine months September 30, 2018, respectively, related to the FFG Loans, which included interest expense related to the amortization of debt discount of $0.5 million and $0.5 million during the year ended December 31, 2017 and the nine months ended September 30, 2018, respectively. There were no principal payments due or paid under the FFG Loans during the year ended December 31, 2017 and the nine months ended September 30, 2018 and.

The Company uses an estimated market rate of 20%, which was determined based on an average of the available interest rates on unsecured loans to comparable companies. A 10% increase or decrease in the estimated market rate of interest would have no material impact on grant income or liabilities.

In the event that the underlying program research results in a scientific or technical failure, the principal then outstanding under any loan may be forgiven by FFG on a project-by-project basis. The FFG Loans contain no financial covenants and are not secured by any of the Company's assets.

7. Loans payable (Continued)

As of September 30, 2018, the aggregate minimum future principal payments due in connection with the FFG Loans are summarized as follows (in thousands):

Year Ending December 31,	Amount
2018	$ —
2019	—
2020	—
2021	2,199
2022	3,136
2023	638
Thereafter	2,464
Total	$ 8,437

8. Redeemable convertible preferred stock

Redeemable convertible preferred stock

The Company has issued Series A redeemable convertible preferred stock (the "Series A Preferred Stock"), Series B redeemable convertible preferred stock (the "Series B Preferred Stock") and Series C redeemable convertible preferred stock (the "Series C Preferred Stock"). The Series A Preferred Stock, the Series B Preferred Stock and the Series C Preferred Stock (collectively referred to as the "Preferred Stock") were issued in June 2018 in a transaction between entities under common control by which the Company became the reporting entity. In the accompanying consolidated financial statements and notes, the Preferred Stock is retrospectively presented as if the Company had been the reporting entity for all periods during which the previous reporting entity was under common control. The Preferred Stock has certain contingent redemption features based upon the occurrence of events that are not solely within the control of the Company and is therefore also classified as temporary equity.

In November 2011 the Company issued and sold 137,814 shares of Series A Preferred Stock at a price of $68.73 per share for gross proceeds of $9.5 million. The Company did not record any issuance costs in connection with this transaction.

Between November 2013 and June 2015 the Company issued and sold 328,128 shares of Series B Preferred Stock at an average price of $78.02 per share for gross proceeds of $25.6 million. The Company incurred issuance costs in connection with this first tranche of Series B Preferred Stock of $0.1 million. In December 2016, the Company issued and sold 82,032 shares of its Series B Preferred Stock at a price of $63.71 per share for gross proceeds of $5.2 million. In connection with this tranche of Series B Preferred Stock the Company incurred issuance costs of $0.03 million. Subsequently, in March 2017, the Company issued and sold an additional 82,032 shares of its Series B Preferred Stock at a price of $64.79 per share for gross proceeds of $5.3 million.

In December 2017 the Company issued and sold 693,500 shares of Series C Preferred Stock at $85.60 per share for gross proceeds of $59.4 million. An amount of $6.5 million of the gross proceeds from the issuance of Series C Preferred Stock was still due for payment at December 31, 2017 and was subsequently received on January 4, 2018. This amount was included in redeemable convertible preferred stock and shown as receivable due from shareholder in the accompanying consolidated

HOOKIPA PHARMA INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

8. Redeemable convertible preferred stock (Continued)

financial statements at December 31, 2017. The Company incurred issuance costs in connection with the Series C Preferred Stock of $0.1 million.

Upon issuance, the Series A Preferred Stock and Series B Preferred Stock had a liquidation preference corresponding to the issue price and a cumulative return of 8.0%. In connection with the issuance and sale of Series C Preferred Stock, the terms and conditions of the Series A Preferred Stock and Series B Preferred Stock were modified to change the liquidation preferences, including the removal of the cumulative return. The change in the terms of the Series A Preferred Stock and Series B Preferred Stock was accounted for as a modification, which did not have an impact on Redeemable convertible preferred stock or Stockholders' equity.

Upon issuance of each class of Preferred Stock, the Company assessed the embedded conversion and liquidation features of the shares and determined that such features did not require the Company to separately account for these features. The Company also concluded that no beneficial conversion feature existed on the issuance date of each class of Preferred Stock.

As of December 31, 2017 and September 30, 2018, the Preferred Stock consisted of the following (in thousands, except share amounts):

	Preferred shares authorized	Preferred shares issued and outstanding	Carrying value	Common stock issuable upon conversion
Series A Preferred Stock	137,814	137,814	$ 0.014	137,814
Series B Preferred Stock	492,192	492,192	0.049	492,192
Series C Preferred Stock	693,500	693,500	0.069	693,500
	1,323,506	1,323,506	$ 0.132	1,323,506

The rights, preferences, privileges and restrictions for the holders of Preferred Stock are as follows:

Voting rights

The holders of the Preferred Stock are entitled to vote, together with the holders of common stock, on all matters submitted to the stockholders for a vote and are entitled to cast the number of votes equal to the number of whole shares of common stock into which the shares of Preferred Stock are convertible. Holders of Preferred Stock shall vote together with the holders of common stock as a single class. Holders of Preferred Stock, acting exclusively and as a separate class, are entitled to elect three directors of the Company.

Dividends

The holders of Preferred Stock are entitled to receive noncumulative dividends of 6.0% per annum, if any, declared by the Company's board of directors. The Company may not declare, pay or set aside any dividends on shares of any other class or series of capital stock of the Company (other than dividends on shares of common stock payable in shares of common stock) unless the holders of the Preferred Stock first receive, or simultaneously receive, a dividend on each outstanding share of each class or series of Preferred Stock. No dividends were declared or paid during the year ended December 31, 2017 or the nine months ended September 30, 2018.

HOOKIPA PHARMA INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

8. Redeemable convertible preferred stock (Continued)

Liquidation

In the event of any voluntary of involuntary liquidation, dissolution or winding up of the Company or certain deemed liquidation events, the holders of Preferred Shares will receive, in preference to any distribution to the holders of common stock, an amount per share equal to the greater of the original issue price paid for such Preferred Shares, plus any dividends declared but unpaid thereon, plus a preferred participation amount (as defined below), or (ii) such amount per share as would have been payable had all shares of such series of Preferred Stock been converted into common stock prior to a liquidation, dissolution or winding up of the Company or deemed liquidation event. After the payment of all preferential amounts required to be paid to holders of shares of Preferred Stock, the remaining assets of the Company available for distribution to its stockholders shall be distributed (i) until the holders of Preferred Stock receive an amount per share equal to the product of two times the original issue price paid for such Preferred Shares (the preferred participation amount), among the holders of the shares of Preferred Stock and common stock, pro rata based on the number of shares held by each such holder, treating for this purpose all such securities as if they had been converted to common stock and (ii), after the holders of Preferred Stock have received an amount per share equal to the product of two times the original issue price paid for such Preferred Shares, among the holders of the shares of common stock, pro rata based on the numbers of shares of common stock held by each such holder.

The liquidation preference of the Preferred Stock is as follows (in thousands):

	December 31, 2017	September 30, 2018 (unaudited)
Series A Preferred Stock	$ 8,427	$ 8,147
Series B Preferred Stock	36,065	34,866
Series C Preferred Stock	60,112	58,112
	$ 104,604	$ 101,125

Conversion

Each share of Preferred Stock is convertible, at the option of the holder, at any time, and without the payment of additional consideration, into one fully paid and non-assessable shares of common stock as is determined by dividing the original issue price paid for such Preferred Shares by the applicable conversion price in effect at the time of conversion.

The Preferred Stock will automatically convert into common stock upon the closing of an initial public offering on an internationally recognized share exchange or a regulated securities market at a price of at least €72.10 per share ($83.64 as of September 30, 2018), resulting in at least $60.0 million of gross proceeds to the Company. The Preferred Stock will also automatically convert to common stock if 60% or more of the holders of Preferred Stock require such a conversion, and the conversion is approval by the holders of the Series C Preferred Stock.

Preferred Stock rights

A majority of the holders of Series C Preferred Stock are required to approve a liquidation event, sell material assets, intellectual property or technology, issue debt, create, issue or redeem

HOOKIPA PHARMA INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

8. Redeemable convertible preferred stock (Continued)

preferred or common stock, and pay or declare dividends. A majority of all Preferred Stock holders are required to approve a liquidation event, change the articles of incorporation, create or issue new classes of stock, alter or amend any class of existing stock, purchase or redeem any shares, pay or declare dividends, an initial public offering, adopt or amend any stock based compensation plans, and grant options to directors.

9. Common stock

In June 2018 the Company became the reporting entity in a transaction between entities under common control. In the accompanying consolidated financial statements and notes, the common stock is retrospectively presented as if the Company had been the reporting entity for all periods during which the previous reporting entity was under common control.

As of December 31, 2017 and September 30, 2018 the Company had 78,311 shares of common stock outstanding and issued and was authorized to issue 183,237 additional shares of common stock upon exercise of stock options and 1,323,506 additional shares of common stock upon conversion of Preferred Stock.

Holders of common stock are entitled to one vote for each share held on all matters submitted to a vote of the stockholders. The holders of common stock do not have any cumulative voting rights. Subject to any preferential dividend rights of any outstanding preferred stock, holders of common stock are entitled to receive ratably any dividends declared by our board of directors out of funds legally available for that purpose. Common stock has no preemptive rights, conversion rights, or other subscription rights or redemption or sinking fund provisions.

In the event of a liquidation, dissolution, or winding up of the Company, holders of common stock will be entitled to share ratably in all assets remaining after payment of all debts and other liabilities and any liquidation preference of any outstanding preferred stock.

10. Stock-based compensation

2018 Stock Option and Grant Plan

In connection with a transaction between entities under common control by which the Company became the reporting entity in June 2018, the Board of Directors approved the 2018 Stock Option and Grant Plan, by which options granted by the previous reporting entity under the 2016 Stock Option Plan and outstanding at the time of the effectiveness of the transaction were replaced at similar commercial terms. In the accompanying consolidated financial statements and notes, options issued under previous stock option plans and respective compensation expenses are retrospectively presented as if such options had been issued and outstanding under the 2018 Stock Option and Grant Plan for all periods during which the previous reporting entity was under common control.

Under the 2018 Stock Option and Grant Plan, 183,237 shares of common stock have been authorized and reserved for the issuance of incentive stock options or non-qualified stock options to employees, officers, directors, and consultants of the Company as of December 31, 2017 and September 30, 2018.

HOOKIPA PHARMA INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

10. Stock-based compensation (Continued)

The exercise price for options granted as a replacement of the 2016 Stock Option Plan and for new options granted prior to an initial public offering of the Company is the U.S. dollar equivalent of one euro. For any option grant after an initial public offering of the Company, the exercise price shall not be less than 100 percent of the fair market value of the common stock on the grant date.

Options granted under the 2018 Stock Option and Grant Plan generally vest over four years, with 25 percent of the options vesting upon the first anniversary of the grant date and the remaining 75 percent of the options vesting in 12 equal quarterly installments following the first anniversary of the grant date, provided the option holder continues to have an employment or service relationship with the Company on each vesting date.

2016 Stock Option Plan

In December 2016, the Company adopted the 2016 Stock Option Plan, which replaced all of the options then outstanding under the 2012 Stock Option Plan and an additional 28,017 shares of common stock were authorized for the issuance of stock options to directors, officers, employees and consultants. In December 2017, an additional 113,753 shares of common stock were authorized for the issuance of stock options.

In total, 226,548 shares of common stock were authorized for the issuance of stock options under the 2012 and 2016 Stock Option Plans, of which 43,311 stock options were exercised prior to June 2018. In June 2018, the remaining 183,237 authorized shares of common stock for the issuance of stock options under the 2016 Stock Option Plan were replaced by the authorization of 183,237 shares of common stock for issuance of stock options under the 2018 Stock Option and Grant Plan.

Stock option valuation

The Company estimates the option's fair value on the date of grant using the Black-Scholes option-pricing model. Black-Scholes utilizes assumptions related to expected term, forfeitures, volatility, the risk-free interest rate, the dividend and employee exercise behavior. Expected volatilities utilized in the Black-Scholes model are based on historical volatilities of a group of comparable companies. The group of representative companies have characteristics similar to the Company, including the stage of product development and focus of life science industry. Management believes that this represents the most accurate basis for estimating expected future volatilities under the current conditions. The risk-free interest rate is derived from the yields for AAA-rated euro area central government bonds with a remaining term approximating the expected life of the options. The expected life of the grants is derived from the contractual grant and expiration dates and vesting period of the options. As there is no public market for the Company's common stock, estimated fair value of common stock at the option grant date has been determined by management with hindsight, considering both, objective and subjective factors deemed relevant for valuation purposes.

HOOKIPA PHARMA INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

10. Stock-based compensation (Continued)

The assumptions used in the Black-Scholes model to determine fair value for the 2017 stock option grants were:

	Year ended December 31, 2017
Risk-free interest rate	(0.67)%
Expected term (in years)	2.8
Expected volatility	66%
Expected dividends	—

No options were granted in the nine months ended September 30, 2018.

Stock options

The following table summarizes the Company's stock option activity since January 1, 2017 (in thousands, except share and per share amounts):

	Number of Shares	Weighted Average Exercise Price	Weighted Average Remaining Contractual Term (in years)	Aggregate Intrinsic Value
Outstanding as of January 1, 2017	79,063	$ 1.06	3	$ 1,407
Granted	46,932	1.13	3	835
Exercised	—	—	—	—
Forfeited	(2,815)	1.13	3	(50)
Outstanding as of December 31, 2017	123,180	$ 1.20	3	$ 4,055
Options exercisable as of December 31, 2017	34,541	$ 1.20	3	$ 1,137
Options unvested as of December 31, 2017	88,639	$ 1.20	3	$ 2,918

	Number of Shares	Weighted Average Exercise Price	Weighted Average Remaining Contractual Term (in years)	Aggregate Intrinsic Value
Outstanding as of December 31, 2017	123,180	$ 1.20	3	$ 4,055
Granted	—	—	—	—
Exercised	—	—	—	—
Forfeited	(810)	1.19	2	(27)
Outstanding as of September 30, 2018 (unaudited)	122,370	$ 1.16	2	$ 14,573
Options exercisable as of September 30, 2018 (unaudited)	55,297	$ 1.16	2	$ 6,585
Options unvested as of September 30, 2018 (unaudited)	67,073	$ 1.16	2	$ 7,988

The aggregate intrinsic value of stock options is calculated as the difference between the exercise price of the stock options and the fair value of the Company's common stock for those stock options that had exercise prices lower than the fair value of the Company's common stock. The fair

HOOKIPA PHARMA INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

10. Stock-based compensation (Continued)

value per common stock used for calculating the intrinsic values as of December 31, 2017 and September 30, 2018, were $34.12, and $120.25, respectively. The fair value of common stock has been determined by management with hindsight, considering third-party valuations of the Company's common stock with input from management of objective and subjective factors that it believed were relevant.

Stock-based compensation

Stock-based compensation expense was classified in the consolidated statements of operations and comprehensive loss as follows (in thousands):

	Year ended December 31, 2017	Nine months ended September 30, 2018 (unaudited)
Research and development expenses	$ 295	$ 280
General and administrative expenses	475	337
	$ 770	$ 617

As of December 31, 2017 and September 30, 2018, total unrecognized compensation cost related to the unvested stock-based awards was $1.3 million and $0.7 million, respectively, which is expected to be recognized over weighted average periods of 2 and 3 years, respectively.

11. Income taxes

During the year ended December 31, 2017 and the nine months ended September 30, 2018, the Company recorded no income tax benefits for the net operating losses incurred in each year or interim period, due to its uncertainty of realizing a benefit from those items. The Company's losses before income taxes were generated in the United States and Austria.

For financial reporting purposes, losses before income taxes for the year ended December 31, 2017 and the nine months ended September 30, 2018 consisted of the following (in thousands):

	Year ended December 31, 2017	Nine months ended September 30, 2018 (unaudited)
United States	$ (121)	$ (730)
Foreign (Austria)	(12,598)	(13,588)
Net loss before tax	$ (12,719)	$ (14,318)

The Company's worldwide effective tax rate for the year ended December 31, 2017 and the nine months ended September 30, 2018 was 0% and 0.2% respectively. The tax rate is affected by recurring items, such as tax rates in foreign jurisdictions and the relative amounts of income earned in those jurisdictions, which is expected to be fairly consistent in the near term. It is also affected by discrete items that may occur in any given year, but are not consistent from year to year. The following

HOOKIPA PHARMA INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

11. Income taxes (Continued)

items had the most significant impact on the difference between the statutory U.S. federal income tax rate of 35% for the year-ended December 31, 2017 and 21% for the nine months ended September 30, 2018 and the effective tax rate:

	Year ended December 31, 2017	Nine months ended September 30, 2018 (unaudited)
U.S. federal statutory income tax rate	(35.0)%	(21.0)%
State income taxes, net of federal benefit	—	—
Foreign tax rate differential(i)	10.0	(4.0)
Foreign exchange rate(ii)	—	(2.5)
Not taxable government grants(iii)	(3.0)	(8.2)
Stock-based compensation(iv)	(3.5)	(2.1)
Change in deferred tax asset valuation allowance(v)	31.5	37.6
Effective income tax rate	—%	(0.2)%

(i) For the year ended December 31, 2017 the 10% reduction, and for the nine months ended September 30, 2018 the 4% increase, resulted from rate differences between U.S. and non-U.S. jurisdictions. Net loss before tax was principally generated in Austria, where the statutory tax rate is 25%.

(ii) For the year ended December 31, 2017 and the nine months ended September 30, 2018, foreign exchange rate movements resulted in a 0% and 2.5% increase in the effective income tax rate, respectively.

(iii) For the year ended December 31, 2017, and the nine months ended September 30, 2018, 3.0 increase and 8.2% increase, respectively, resulted from non-taxable research subsidies received from Austrian government agencies.

(iv) For the year ended December 31, 2017, and the nine months ended September 30, 2018, 3.5% increase and 2.1% increase, resulted from non-taxable Stock-based compensation expense.

(v) For the year ended December 31, 2017, and the nine months ended September 30, 2018, 31.5% reduction and 37.6% reduction, respectively, resulted from changes in valuation allowance on deferred tax assets. Deferred tax assets will only be recovered when the generation of future taxable income is more likely than not. Due to the nature of the Company's research activities and the inherent uncertainties the deferred tax assets have been fully impaired.

11. Income taxes (Continued)

Components of the net deferred tax assets or liabilities as of December 31, 2017 and September 30, 2018 consisted of the following (in thousands):

	December 31, 2017	September 30, 2018 (unaudited)
Net operating loss carryforwards	$ 13,804	$ 18,399
Accrued expenses and other	(47)	(68)
Stock-based compensation	32	55
Total deferred tax assets	13,789	18,386
Valuation allowance	(13,789)	(18,386)
Net deferred tax assets	$ —	$ —

As of December 31, 2017 and September 30, 2018, the Company had Austrian net operating loss carryforwards of $55.2 million and $73.6 million, respectively, with no expiry date. The Company has evaluated the positive and negative evidence bearing upon its ability to realize the deferred tax assets. Management has considered the Company's history of cumulative net losses incurred since inception and its lack of commercialization of any products or generation of any revenue from product sales since inception and has concluded that it is more likely than not that the Company will not realize the benefits of its deferred tax assets. Accordingly, a full valuation allowance has been established against the deferred tax assets as of December 31, 2017, and September 30, 2018. Management reevaluates the positive and negative evidence at each reporting period.

The amount of the deferred tax asset considered realizable, however, could be adjusted if estimates of future taxable income during the carryforward period are reduced or increased or if objective negative evidence in the form of losses is no longer present and additional weight may be given to subjective evidence. The tax years in which the tax carryforwards were generated may still be adjusted upon examination by the tax authorities. As of September 30, 2018, there were no pending income tax examinations.

A court case is currently pending at the Austrian Administrative Court as to whether servicing granted options by issuing new shares results in an expense-related and deductible personnel expense. As of the date of these financial statements, the Austrian Administrative Court had not issued a decision on this issue. If the court should deny the deductibility, the Company's loss carryforwards will decrease by $8.3 million as of September 30, 2018.

HOOKIPA PHARMA INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

11. Income taxes (Continued)

Changes in the valuation allowance for deferred tax assets during the year ended December 31, 2017, and the nine months ended September 30, 2018 related primarily to the increases in net operating loss carryforwards as follows (in thousands):

	Year ended December 31, 2017	Nine months ended September 30, 2018 (unaudited)
Valuation allowance at beginning of period	$ (8,378)	$ (13,789)
Increases	(5,411)	(4,597)
Valuation allowance at end of period	$ (13,789)	$ (18,386)

On December 22, 2017, the United States enacted the Tax Cuts and Jobs Act ("Tax Reform Legislation" or "TCJA"), which made significant changes to U.S. federal income tax code, including a reduction of the statutory corporate tax rate from 35% to 21%, effective on January 1, 2018. This new legislation also eliminated or reduced certain corporate income tax deductions as well as introduced new provisions that taxed certain foreign income not previously taxed in the United States. The TCJA also includes a provision for a tax on all previously undistributed earnings of U.S. companies located in foreign jurisdictions. Undistributed earnings in the form of cash and cash equivalents is taxed at a rate of 15.5% and all other earnings are taxed at a rate of 8%. This tax is payable over 8 years and will not accrue interest.

The Tax Reform Legislation introduced section 951A, a new tax on so-called "global intangible low-taxed income," or "GILTI". GILTI applies to income of a controlled foreign corporation ("CFC") that is not otherwise subpart F income, and consists of the excess "tested income" over a 10% return on the CFC's "qualified business asset investment," or "QBAI". QBAI is the total tax basis of the CFC's depreciable, tangible property used in the production of tested income. The full amount of GILTI is included in taxable income. The GILTI inclusion is then reduced by 50% (reduced to 37.5% after 2025). However, that reduction in GILTI may be limited based on the level of U.S. taxable income. A limited allowance for foreign tax credits is allowed that would reduce the U.S. tax cost. GILTI foreign tax credits can only reduce U.S. taxes owed on GILTI and are not eligible for carryforward. The Company's Austrian subsidiary falls under the category of a CFC and due to the nature of its business model as a technology company, there may not be a material amount of tangible assets if this subsidiary starts to generate profits. GILTI taxation therefore may be applicable.

The Company is required to recognize the effect of this change on its deferred tax assets and liabilities and deferred tax asset valuation allowances in the period the tax regimen change is enacted. The Company does not expect any material non-cash impact from this change, with adjustments to deferred tax balances offset by adjustments to deferred tax valuation allowances. On December 22, 2017, Staff Accounting Bulletin No. 118 ("SAB 118") was issued to address the application of US GAAP in situations when a registrant does not have the necessary information available, prepared or analyzed (including computations) in reasonable detail to complete the accounting for certain income tax effects of the Tax Reform Legislation. The ultimate impact of the Tax Reform Legislation may differ from this estimate, possibly materially, due to changes in interpretations and assumptions, guidance that may be issued and actions the Company may take in response to the Tax Act. The Tax Act is highly complex and the Company will continue to assess the impact that various provisions will

11. Income taxes (Continued)

have on its business. Any subsequent adjustment to these amounts will be recorded to current tax expense in the accounting period when the analysis is complete.

12. Commitments and contingencies

Operating leases

The Company leases office and laboratory facilities in Vienna, Austria under three operating leases. The Company can generally terminate the leases with three months' notice at the end of each calendar quarter. However, it has waived its termination rights for one of the three leases until March 31, 2023 and for the other two leases until June 30, 2020. Furthermore, the Company leases office equipment, a company car and animal rooms. Rent expense under the leases for the year ended December 31, 2017 and the nine months ended September 30, 2018 was $0.7 million and $0.8 million, respectively.

Future annual minimum lease payments under non-cancellable operating leases are as follows (in thousands):

Year ending December 31,	Amount
2018	$ 221
2019	523
2020	279
2021	43
2022	43
2023	11
Total	$ 1,120

Contract manufacturing arrangements

The Company has entered into arrangements with contract manufacturing organizations (CMOs) for manufacturing of materials for research and development purposes, including manufacturing of clinical trial materials. These contracts generally provide for non-cancellable obligations or cancellation penalties depending on the time of cancellation. As of September 30, 2018, the Company's non-cancellable obligations under contracts with CMOs were $3.4 million, of which $0.6 million relate to deliverables planned for the fourth quarter of 2018 and $2.8 million relate to 2019 deliverables.

Intellectual property licenses

In October 2011, the Company entered into a license agreement with University of Zurich ("Zurich") for an exclusive, worldwide, royalty-bearing license for a propagation-deficient arenavirus vector. The Company is obligated to pay royalties of low single digits on net sales of products licensed under the agreement, and to pay a percentage of the sublicense fees which the Company receives from its sublicensees.

In January 2017, the Company entered into a license agreement with University of Basel ("Basel") for an exclusive, worldwide, royalty-bearing licence for a tri-segmented Pichinde virus vector.

HOOKIPA PHARMA INC.

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (Continued)

12. Commitments and contingencies (Continued)

The Company is required to use reasonable efforts to make commercially available licensed products. In consideration for these rights, the Company is obligated to pay nominal milestone payments for each licensed product upon the achievement of certain development and regulatory milestones and to pay royalties of low single digits on net sales of licensed products. The Company is obligated to pay a percentage of the sublicense fees which the Company receives from its sublicensees.

In February 2017, the Company entered into a license agreement with Université de Genève ("Geneva") for an exclusive, worldwide, royalty-bearing licence for a tri-segmented Arenavirus vector. In consideration for these rights the Company is obligated to pay Geneva an annual fee which is fully deductible from any milestone, royalty or sublicense payments. The Company is also obligated to pay milestone nominal payments for each licensed product upon the achievement of certain development and regulatory milestones and to pay royalties of low single digits on net sales of licensed products. The Company is obligated to pay a percentage of the sublicense fees which the Company receives from its sublicensees.

In the nine months ended September 30, 2018, the Company recorded $0.1 million in licensing fees from intellectual property licenses as research and development expenses. At September 30, 2018 $0.5 million payable from sublicensing fees were included in accrued expenses and other current liabilities. These amounts mainly related to the upfront payment received by the Company under the Gilead collaboration. The calculation of the sublicensing fees according to the Company's intellectual property licenses is subject to interpretation and the amounts recognized as expenses or liability may therefore be subject to change until agreed to by the receiving party.

Indemnification agreements

In the ordinary course of business, the Company may provide indemnification of varying scope and terms to vendors, lessors, business partners and other parties with respect to certain matters including, but not limited to, losses arising out of breach of such agreements or from intellectual property infringement claims made by third parties. In addition, the Company has entered into indemnification agreements with members of its board of directors and senior management that will require the Company, among other things, to indemnify them against certain liabilities that may arise by reason of their status or service as directors or officers. The maximum potential amount of future payments the Company could be required to make under these indemnification agreements is, in many cases, unlimited. To date, the Company has not incurred any material costs as a result of such indemnifications. The Company is not aware of any claims under indemnification arrangements, and it has not accrued any liabilities related to such obligations in its consolidated financial statements as of December 31, 2017 and September 30, 2018.

Legal proceedings

At each reporting date, the Company evaluates whether or not a potential loss amount or a potential range of loss is probable and reasonably estimable under the provisions of the authoritative guidance that addresses accounting for contingencies. While it is not feasible to predict the outcome of these matters with certainty, and some lawsuits, claims or proceedings may be disposed or decided unfavorably, the Company does not expect that any asserted or un-asserted legal claims or proceedings, individually or in the aggregate, will have a material adverse effect on the Company. The Company expenses as incurred the costs related to such legal proceedings.

13. Net loss per share

The following table sets forth the computation of the basic and diluted net loss per share attributable to common stockholders (in thousands, except for per share amounts):

	Year ended December 31, 2017	Nine months ended September 30, 2018 (unaudited)
Numerator:		
Net loss	$ (12,723)	$ (14,345)
Denominator:		
Weighted-average common shares outstanding, basic and diluted	78,311	78,311
Net loss per share, basic and diluted	$ (162.47)	$ (183.18)

Since the Company was in a loss position for all periods presented, basic net loss per share is the same as diluted net loss per share for all periods as the inclusion of all potential common shares outstanding would have been anti-dilutive. Potentially dilutive securities that were not included in the diluted per share calculations because they would be anti-dilutive were as follows:

	Year ended December 31, 2017	Nine months ended September 30, 2018 (unaudited)
Series A Preferred Stock	137,814	137,814
Series B Preferred Stock	492,192	492,192
Series C Preferred Stock	693,500	693,500
Options issued and outstanding	123,180	122,370
Total	1,446,686	1,445,876

14. Related parties

During the year ended December 31, 2017, the Company issued 61,524 shares of Series B preferred stock for total proceeds of $4.0 million and 147,712 shares of Series C convertible preferred stock for total proceeds of $12.6 million to certain stockholders that were related parties. The Due from shareholder amount of $6.5 million as of December 31, 2017 is from one of these related parties.

15. Subsequent events

For the consolidated financial statements as of December 31, 2017 and the consolidated interim financial statements as of September 30, 2018, the Company evaluated subsequent events through December 13, 2018, the date on which those consolidated financial statements were issued.

In December 2018, the Company entered into an agreement with a contract manufacturing organization for the production of clinical trial material, including seed lots, drug substance for toxicology studies, stability studies and clinical studies as well as related technology transfer, quality control and process optimization activities. Under the financial terms of the agreement the Company is obliged to pay non-cancellable minimum service fees totaling $15.7 million through 2021.

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

Shares

HOOKIPA PHARMA

Common Stock

PROSPECTUS

BofA Merrill Lynch

Leerink Partners

RBC Capital Markets

Kempen

, 2019

PART II

Information Not Required in Prospectus

Item 13. Other Expenses of Issuance and Distribution.

The following table sets forth the fees and expenses, other than underwriting discounts and commissions, payable by us in connection with the registration of our common stock hereunder. All amounts are estimates except the SEC registration fee, FINRA filing fee and Nasdaq Global Market initial listing fee.

	Amount
SEC registration fee	$ *
FINRA filing fee	*
Nasdaq Global Market initial listing fee	*
Printing and engraving expenses	*
Legal fees and expenses	*
Accountants' fees and expenses	*
Transfer agent and registrar fees and expenses	*
Blue Sky fees and expenses	*
Miscellaneous	*
Total	$ *

* To be filed by amendment.

Item 14. Indemnification of Directors and Officers.

Section 145 of the Delaware General Corporation Law (DGCL) authorizes a corporation to indemnify its directors and officers against liabilities arising out of actions, suits and proceedings to which they are made or threatened to be made a party by reason of the fact that they have served or are currently serving as a director or officer to a corporation. The indemnity may cover expenses (including attorneys' fees) judgments, fines, and amounts paid in settlement actually and reasonably incurred by the director or officer in connection with any such action, suit or proceeding. Section 145 permits corporations to pay expenses (including attorneys' fees) incurred by directors and officers in advance of the final disposition of such action, suit or proceeding. In addition, Section 145 provides that a corporation has the power to purchase and maintain insurance on behalf of its directors and officers against any liability asserted against them and incurred by them in their capacity as a director or officer, or arising out of their status as such, whether or not the corporation would have the power to indemnify the director or officer against such liability under Section 145.

Section 102 of the DGCL permits a corporation to eliminate the personal liability of directors of a corporation to the corporation or its stockholders for monetary damages for a breach of fiduciary duty as a director. We have adopted provisions in our amended and restated certificate of incorporation and amended and restated bylaws to be in effect upon the closing of this offering that limit or eliminate the personal liability of our directors to the fullest extent permitted by the DGCL, as it now exists or may in the future be amended. Consequently, a director will not be personally liable to us or our stockholders for monetary damages or breach of fiduciary duty as a director, except for 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;

- any unlawful payments related to dividends or unlawful stock purchases, redemptions or other distributions; or

- any transaction from which the director derived an improper personal benefit.

These limitations of liability do not alter director liability under the federal securities laws and do not affect the availability of equitable remedies, such as an injunction or rescission.

In addition, our amended and restated bylaws will provide that:

- we will indemnify our directors, officers and, in the discretion of our board of directors, certain employees to the fullest extent permitted by the DGCL, as it now exists or may in the future be amended; and

- we will advance reasonable expenses, including attorneys' fees, to our directors and, in the discretion of our board of directors, to our officers and certain employees, in connection with legal proceedings relating to their service for or on behalf of us, subject to limited exceptions.

We have entered into indemnification agreements with each of our directors and intend to enter into such agreements with certain of our executive officers. These agreements provide that we will indemnify each of our directors, certain of our executive officers and, at times, their affiliates to the fullest extent permitted by Delaware law. We will advance expenses, including attorneys' fees (but excluding judgments, fines and settlement amounts), to each indemnified director, executive officer or affiliate in connection with any proceeding in which indemnification is available and we will indemnify our directors and officers for any action or proceeding arising out of that person's services as a director or officer brought on behalf of us or in furtherance of our rights. Additionally, certain of our directors or officers may have certain rights to indemnification, advancement of expenses or insurance provided by their affiliates or other third parties, which indemnification relates to and might apply to the same proceedings arising out of such director's or officer's services as a director referenced herein. Nonetheless, we have agreed in the indemnification agreements that our obligations to those same directors or officers are primary and any obligation of such affiliates or other third parties to advance expenses or to provide indemnification for the expenses or liabilities incurred by those directors are secondary.

We also maintain general liability insurance which covers certain liabilities of our directors and officers arising out of claims based on acts or omissions in their capacities as directors or officers, including liabilities under the Securities Act of 1933, as amended, or the Securities Act.

In the underwriting agreement that we enter into in connection with the sale of shares of our common stock in this offering, a form of which will be filed as Exhibit 1.1 to this registration statement, there will be provisions for indemnification of us and our directors and officers by the underwriters against certain liabilities under the Securities Act, and the Securities Exchange Act of 1934, as amended.

Item 15. Recent Sales of Unregistered Securities.

In the three years preceding the filing of this registration statement, we and our predecessor, Hookipa Biotech AG, have issued the following securities that were not registered under the Securities Act.

1. Hookipa Biotech AG granted stock options to purchase an aggregate of 133,850 shares of its common shares, with an exercise price of $1.16 per share, to its employees, directors and consultants pursuant to its 2016 Stock Option Plan.

2. We have granted stock options to purchase an aggregate of 133,850 shares of our common stock, with an exercise price of $1.16 per share, to our employees, directors and consultants pursuant to our 2018 Stock Option and Grant Plan, all of which replaced the options that were previously granted and revoked by Hookipa Biotech AG under the 2016 Stock Option Plan.

3. Between November 2013 and June 2015, Hookipa Biotech AG issued and sold 328,128 shares of its Series B Preferred Shares for aggregate consideration of approximately $25.6 million.

4. In December 2016, Hookipa Biotech AG issued and sold 82,032 shares of its Series B Preferred Shares for aggregate consideration of approximately $5.2 million.

5. In March 2017, Hookipa Biotech AG issued and sold 82,032 shares of its Series B Preferred Shares for aggregate consideration of approximately $5.3 million.

6. In December 2017, Hookipa Biotech AG issued and sold 693,500 shares of its Series C Preferred Shares for aggregate consideration of approximately $59.4 million.

7. On June 29, 2018, we issued 78,311 shares of common stock and 1,323,506 shares of preferred stock to the shareholders of Hookipa Biotech AG in exchange for all of the outstanding capital stock of Hookipa Biotech AG held by such holders.

We deemed the options to purchase common stock and common shares in paragraphs (1) and (2) to be exempt from registration under the Securities Act either in reliance on Rule 701 of the Securities Act as offers and sales of securities under compensatory benefit plans and contracts relating to compensation in compliance with Rule 701, or in reliance on Section 4(a)(2), as transactions by an issuer not involving a public offering. We deemed the offers, sales and issuances of the securities described in paragraphs (3) through (7) above to be exempt from registration under the Securities Act, in reliance on Section 4(a)(2) of the Securities Act, regarding transactions by an issuer not involving a public offering.

There were no underwritten offerings employed in connection with any of the transactions set forth above.

Item 16. Exhibits and Financial Statement Schedules.

(a) Exhibits

The exhibits to the registration statement are listed in the Exhibit Index to this registration statement and are incorporated herein by reference.

(b) Financial Statement Schedules

All schedules have been omitted because they are not required or because the required information is given in the financial statements or notes to those statements.

Item 17. Undertakings.

Insofar as indemnification for liabilities arising under the Securities Act 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.

The undersigned Registrant hereby undertakes:

(1) That the undersigned registrant will provide to the underwriters at the closing specified in the underwriting agreement certificates in such denominations and registered in such names as required by the underwriters to permit prompt delivery to each purchaser.

(2) That for purposes of determining any liability under the Securities Act, 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.

(3) That for the purpose of determining any liability under the Securities Act, 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.

EXHIBIT INDEX

1.1*	Form of Underwriting Agreement
3.1	Amended and Restated Certificate of Incorporation of the Registrant, as amended, as currently in effect
3.2*	Form of Amended and Restated Certificate of Incorporation of the Registrant (to be effective upon closing of this offering)
3.3	Bylaws of the Registrant, as currently in effect
3.4*	Form of Amended and Restated Bylaws (to be effective upon closing of this offering)
4.1*	Specimen Common Stock Certificate
5.1*	Opinion of Goodwin Procter LLP
10.1#	HOOKIPA Pharma Inc. 2018 Stock Option and Grant Plan and forms of awards thereunder
10.2#*	Form of 2019 Stock Option and Incentive Plan
10.3#*	Form of Incentive Stock Option Agreement under the Registrant's 2019 Stock Option and Incentive Plan
10.4#*	Form of Non-Qualified Stock Option Agreement for Company Employees under the Registrant's 2019 Stock Option and Incentive Plan
10.5#*	Form of Non-Qualified Stock Option Agreement for Non-Employee Directors under the Registrant's 2019 Stock Option and Incentive Plan
10.6#*	Form of Restricted Stock Award Agreement under the Registrant's 2019 Stock Option and Incentive Plan
10.7#*	Form of Restricted Stock Award Agreement for Company Employees under the Registrant's 2019 Stock Option and Incentive Plan
10.8#*	Form of Restricted Stock Award Agreement for Non-Employee Directors under the Registrant's 2019 Stock Option and Incentive Plan
10.9#*	2019 Employee Stock Purchase Plan

10.10#*	Form of Director Indemnification Agreement
10.11#*	Form of Officer Indemnification Agreement
10.12#*	Employment Agreement between Jörn Aldag and the Registrant (to be entered into in connection with this offering)
10.13#*	Employment Agreement between Reinhard Kandera and the Registrant (to be entered into in connection with this offering)
10.14#*	Employment Agreement between Igor Matushansky and the Registrant (to be entered into in connection with this offering)
10.15#*	Employment Agreement between Daniel Pinschewer and the Registrant (to be entered into in connection with this offering)
10.16*	Lease by and between the Registrant and Marxbox Bauprojekt GmbH & Co OG, dated February 3, 2012, as supplemented by the Lease Agreement, dated April 2, 2014.
10.17*	Lease by and between the Registrant and Wüstenrot Marxbox GmbH & Co KG, dated May 15, 2018.
10.18†*	Collaboration and License Agreement, by and between Hookipa Biotech AG and Gilead Sciences, Inc., dated as of June 4, 2018
10.19†*	Patent License Agreement, by and between Hookipa Biotech GmbH and the University of Zurich, dated as of October 6, 2011
10.20†*	Patent License Agreement, by and between Hookipa Biotech AG and the University of Basel, dated as of January 16, 2017
10.21†*	Patent License Agreement, by and between Hookipa Biotech AG and the University of Geneva, dated as of February 8, 2017
10.22†*	The National Institutes of Health Biological Materials License Agreement, by and between the National Institutes of Health within the Department of Health and Human Services through the Office of Technology Transfer and Hookipa Biotech AG, dated as of September 25, 2013
10.23†*	First Amendment to the National Institutes of Health Biological Materials License Agreement, by and between the National Institutes of Health within the Department of Health and Human Services through the Office of Technology Transfer and Hookipa Biotech AG, dated as of April 12, 2017
10.24†*	Second Amendment to the National Institutes of Health Biological Materials License Agreement, by and between the National Institutes of Health within the Department of Health and Human Services through the Office of Technology Transfer and Hookipa Biotech AG, dated as of July 11, 2018.
21.1*	Subsidiaries of the Registrant
23.1*	Consent of PwC Wirtschaftsprüfung GmbH, Independent Registered Public Accounting Firm
23.2*	Consent of Goodwin Procter LLP (included in Exhibit 5.1)
24.1	Power of Attorney (included in page II-6)]

* To be included by amendment.

† Confidential treatment to be requested as to certain portions, which portions will be omitted and filed separately with the Securities and Exchange Commission.

\# Indicates a management contract or any compensatory plan, contract or arrangement.

SIGNATURES

Pursuant to the requirements of the Securities Act of 1933, the registrant has duly caused this Registration Statement on Form S-1 to be signed on its behalf by the undersigned, thereunto duly authorized, in the City of New York, State of New York, on the day of , 2019.

HOOKIPA PHARMA INC.

By: ____________________________

Jörn Aldag
Chief Executive Officer

POWER OF ATTORNEY AND SIGNATURES

KNOW ALL BY THESE PRESENTS, each individual whose signature appears below hereby constitutes and appoints each of Jörn Aldag, Reinhard Kandera and Daniel Courtney and as such person's true and lawful attorney-in-fact and agent with full power of substitution and resubstitution, for such person in such person's name, place and stead, in any and all capacities, to sign any and all amendments (including post-effective amendments) to this Registration Statement (or any Registration Statement for the same offering that is to be effective upon filing pursuant to Rule 462(b) under the Securities Act of 1933 and all post-effective amendments thereto), and to file the same, with all exhibits thereto, and all documents in connection therewith, with the Securities and Exchange Commission granting unto each said attorney-in-fact and agent full power and authority to do and perform each and every act and thing requisite and necessary to be done in and about the premises, as fully to all intents and purposes as such person might or could do in person, hereby ratifying and confirming all that any said attorney-in-fact and agent, or any substitute or substitutes of any of them, may lawfully do or cause to be done by virtue hereof.

Pursuant to the requirements of the Securities Act of 1933, as amended, this Registration Statement and Power of Attorney has been signed by the following person in the capacities and on the date indicated.

Name	Title	Date
Jörn Aldag	Chief Executive Officer and Director (Principal Executive Officer)	, 2019
Reinhard Kandera	Chief Financial Officer (Principal Financial and Accounting Officer)	, 2019
Jan van de Winkel, Ph.D.	Chairman of the Board	, 2019
Paul-Henri Lambert, M.D.	Director	, 2019

Name	Title	Date
______________________ Christoph Lengauer, Ph.D.	Director	, 2019
______________________ Julie O'Neill	Director	, 2019
______________________ Graziano Seghezzi	Director	, 2019
______________________ Sander van Deventer, M.D., Ph.D.	Director	, 2019

Exhibit 3.1

Delaware

The First State

I, JEFFREY W. BULLOCK, SECRETARY OF STATE OF THE STATE OF DELAWARE, DO HEREBY CERTIFY THE ATTACHED IS A TRUE AND CORRECT COPY OF THE RESTATED CERTIFICATE OF "HOOKIPA PHARMA INC.", FILED IN THIS OFFICE ON THE EIGHTEENTH DAY OF JUNE, A.D. 2018, AT 10:22 O'CLOCK A.M.

A FILED COPY OF THIS CERTIFICATE HAS BEEN FORWARDED TO THE NEW CASTLE COUNTY RECORDER OF DEEDS.

Jeffrey W. Bullock, Secretary of State

6317212 8100
SR# 20185203340

Authentication: 202905617
Date: 06-18-18

You may verify this certificate online at corp.delaware.gov/authver.shtml

State of Delaware
Secretary of State
Division of Corporations
Delivered 10:22 AM 06/18/2018
FILED 10:22 AM 06/18/2018
SR 20185203340 - File Number 6317212

Execution

AMENDED AND RESTATED
CERTIFICATE OF INCORPORATION
OF
HOOKIPA PHARMA INC.

(Pursuant to Sections 242 and 245 of the
General Corporation Law of the State of Delaware)

HOOKIPA Pharma Inc., a corporation organized and existing under and by virtue of the provisions of the General Corporation Law of the State of Delaware (the "**General Corporation Law**"),

DOES HEREBY CERTIFY:

1. That the name of this corporation is HOOKIPA Pharma Inc., and that this corporation was originally incorporated pursuant to the General Corporation Law on February 15, 2017 under the name Hookipa Biotech, Inc.

2. That the Board of Directors duly adopted resolutions proposing to amend and restate the Certificate of Incorporation of this corporation, declaring said amendment and restatement to be advisable and in the best interests of this corporation and its stockholders, and authorizing the appropriate officers of this corporation to solicit the consent of the stockholders therefor, which resolution setting forth the proposed amendment and restatement is as follows:

RESOLVED, that the Certificate of Incorporation of this corporation be amended and restated in its entirety to read as follows:

FIRST: The name of this corporation is HOOKIPA Pharma Inc. (the "**Corporation**").

SECOND: The address of the registered office of the Corporation in the State of Delaware is 251 Little Falls Drive, Wilmington DE, 19808, in New Castle County. The name of its registered agent at such address is Corporation Service Company.

THIRD: The nature of the business or purposes to be conducted or promoted is to engage in any lawful act or activity for which corporations may be organized under the General Corporation Law.

FOURTH: The total number of shares of all classes of stock which the Corporation shall have authority to issue is (i) 1,585,054 shares of Common Stock, $0.0001 par value per share ("**Common Stock**") and (ii) 1,323,506 shares of Preferred Stock, $0.0001 par value per share ("**Preferred Stock**").

The following is a statement of the designations and the powers, privileges and rights, and the qualifications, limitations or restrictions thereof in respect of each class of capital stock of the Corporation.

A. COMMON STOCK

1. General. The voting, dividend and liquidation rights of the holders of the Common Stock are subject to and qualified by the rights, powers and preferences of the holders of the Preferred Stock set forth herein.

2. Voting. The holders of the Common Stock are entitled to one vote for each share of Common Stock held at all meetings of stockholders (and written actions in lieu of meetings); 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 the Certificate of Incorporation that relates solely to the terms of one or more outstanding series of Preferred Stock if the holders of such affected series are entitled, either separately or together with the holders of one or more other such series, to vote thereon pursuant to the Certificate of Incorporation or pursuant to the General Corporation Law. There shall be no cumulative voting. The number of authorized shares of Common Stock may be increased or decreased (but not below the number of shares thereof then outstanding) by (in addition to any vote of the holders of one or more series of Preferred Stock that may be required by the terms of the Certificate of Incorporation) the affirmative vote of the holders of shares of capital stock of the Corporation representing a majority of the votes represented by all outstanding shares of capital stock of the Corporation entitled to vote, irrespective of the provisions of Section 242(b)(2) of the General Corporation Law.

B. PREFERRED STOCK

137,814 shares of the authorized and unissued Preferred Stock of the Corporation are hereby designated "**Series A Preferred Stock**" with the following rights, preferences, powers, privileges and restrictions, qualifications and limitations. 492,192 shares of the authorized and unissued Preferred Stock of the Corporation are hereby designated "**Series B Preferred Stock**" with the following rights, preferences, powers, privileges and restrictions, qualifications and limitations. 693,500 shares of the authorized and unissued Preferred Stock of the Corporation are hereby designated "**Series C Preferred Stock**" with the following rights, preferences, powers, privileges and restrictions, qualifications and limitations. Unless otherwise indicated, references to "sections" or "subsections" in this Part B of this Article Fourth refer to sections and subsections of Part B of this Article Fourth.

1. Dividends.

The Corporation may pay dividends when, as, and if declared by the Board of Directors; provided that, the Corporation shall not declare, pay or set aside any dividends on shares of any other class or series of capital stock of the Corporation (other than dividends on shares of Common Stock payable in shares of Common Stock) unless (in addition to the obtaining of any consents required elsewhere in the Certificate of Incorporation) the holders of the Preferred Stock then outstanding shall first receive, or simultaneously receive, a dividend on each outstanding share of each class or series of Preferred Stock equal to six percent (6%) of the Applicable Original Issue Price (as defined below) of each such share plus an amount at least equal to (i) in the case of a dividend on Common Stock or any class or series that is convertible into Common Stock, that dividend per share of such class or series of Preferred Stock as would equal the product of (A) the dividend payable on each share of such class or series determined, if applicable, as if all shares of such class or series had been converted into Common Stock and (B) the number of shares of Common Stock issuable upon conversion of a share of such class or series of Preferred Stock, in each case calculated on the record date for determination of holders entitled to receive such dividend or (ii) in the case of a dividend on any class or series that is not convertible into Common Stock, at a rate per share of such class or series of Preferred Stock determined by (A) dividing the amount of the dividend payable on each share of such class or series of capital stock by the original issuance price of such class or series of capital stock (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to such class or series) and (B) multiplying such fraction by an amount equal to the Applicable Original Issue Price (as defined below); provided that, if the Corporation declares, pays or sets aside, on the same date, a dividend on shares of more than one class or series of capital stock of the Corporation, the dividend payable to the holders of each class or series of Preferred Stock pursuant to this Section 1 shall be calculated based upon the dividend on the class or series of capital stock that would result in the highest dividend to such class or series of Preferred Stock. The "**Series A Original Issue Price**" shall mean €50.80 per share, subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series A Preferred Stock. The "**Series B Original Issue Price**" shall mean €60.95 per share, subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series B Preferred Stock. The "**Series C Original Issue Price**" shall mean €72.10 per share, subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series C Preferred Stock. The "**Applicable Original Issue Price**" shall mean with respect to shares of Series A Preferred Stock, the Series A Original Issue Price, with respect to shares of Series B Preferred Stock, the Series B Original Issue Price and with respect to shares of Series C Preferred Stock, the Series C Original Issue Price.

2. Liquidation, Dissolution or Winding Up; Certain Mergers, Consolidations and Asset Sales.

2.1 Preferential Payments to Holders of Preferred Stock. In the event of any voluntary or involuntary liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event, the holders of shares of Preferred Stock then outstanding shall be entitled to be paid out of the assets of the Corporation available for distribution to its stockholders before any payment shall be made to the holders of Common Stock by reason of their ownership thereof, an amount per share equal to the greater of (i) the Applicable Original Issue Price, plus any dividends declared but unpaid thereon, plus the Preferred Participation Amount (as defined below) or (ii) such amount per share as would have been payable had all shares of such series of Preferred Stock been converted into Common Stock (and thereby do not receive the applicable Preferred Participation Amount) pursuant to Section 4 immediately prior to such liquidation, dissolution, winding up or Deemed Liquidation Event. If upon any such liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event, the assets of the Corporation available for distribution to its stockholders shall be insufficient to pay the holders of shares of Preferred Stock the full amount to which they shall be entitled under this Subsection 2.1, the holders of shares of Preferred Stock shall share ratably in any distribution of the assets available for distribution in proportion to the respective amounts which would otherwise be payable in respect of the shares held by them upon such distribution if all amounts payable on or with respect to such shares were paid in full. The aggregate amount which a holder of a share of Series A Preferred Stock is entitled to receive per such share under Subsections 2.1 and 2.2.1 is hereinafter referred to as the "**Series A Liquidation Amount**." The aggregate amount which a holder of a share of Series B Preferred Stock is entitled to receive per such share under Subsections 2.1 and 2.2.1 is hereinafter referred to as the "**Series B Liquidation Amount**." The aggregate amount which a holder of a share of Series C Preferred Stock is entitled to receive per such share under Subsections 2.1 and 2.2.1 is hereinafter referred to as the "**Series C Liquidation Amount**."

2.2 Distribution of Remaining Assets. In the event of any voluntary or involuntary liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event, after the payment of all preferential amounts required to be paid to the holders of shares of Preferred Stock the remaining assets of the Corporation available for distribution to its stockholders shall be distributed:

2.2.1 until the holders of Preferred Stock receive pursuant to Section 1, Subsections 2.1 and 2.2.1 an amount per share equal to the product of two (2) times the Applicable Original Issue Price (the "**Preferred Participation Cap**"), among the holders of the shares of Preferred Stock and Common Stock, pro rata based on the number of shares held by each such holder, treating for this purpose all such securities as if they had been converted to Common Stock pursuant to the terms of the Certificate of Incorporation immediately prior to such dissolution, liquidation or winding up of the Corporation (the aggregate amount which a holder of a share of Preferred Stock is entitled to receive under this Subsection 2.2.1 is hereinafter referred to as the "**Preferred Participation Amount**"); and

2.2.2 second, after the holders of Preferred Stock have received the Preferred Participation Cap, among the holders of the shares of Common Stock, pro rata based on the number of shares of Common Stock held by each such holder.

2.3 Deemed Liquidation Events.

2.3.1 Definition. Each of the following events shall be considered a "**Deemed Liquidation Event**" unless (i) the holders of a majority of the outstanding shares of Preferred Stock, voting as a single class, on as as-converted basis, (collectively, the "**Requisite Preferred**") and (ii) the Requisite Series C Preferred (as defined below) elect otherwise by written notice sent to the Corporation at least 7 days prior to the effective date of any such event:

(a) a merger or consolidation in which

(i) the Corporation is a constituent party or

(ii) a subsidiary of the Corporation is a constituent party and the Corporation issues shares of its capital stock pursuant to such merger or consolidation,

except any such merger or consolidation involving the Corporation or a subsidiary in which the shares of capital stock of the Corporation outstanding immediately prior to such merger or consolidation continue to represent, or are converted into or exchanged for shares of capital stock that represent, immediately following such merger or consolidation, at least a majority, by voting power, of the capital stock of (1) the surviving or resulting corporation; or (2) if the surviving or resulting corporation is a wholly owned subsidiary of another corporation immediately following such merger or consolidation, the parent corporation of such surviving or resulting corporation;

(b) the sale of all of the issued and outstanding equity securities of the Corporation in a single transaction or series of related transactions; or

(c) the sale, lease, transfer, exclusive license or other disposition, in a single transaction or series of related transactions, by the Corporation or any subsidiary of the Corporation of all or substantially all the assets of the Corporation and its subsidiaries taken as a whole, or the sale or disposition (whether by merger, consolidation or otherwise) of one or more subsidiaries of the Corporation if substantially all of the assets of the Corporation and its subsidiaries taken as a whole are held by such subsidiary or subsidiaries, except where such sale, lease, transfer, exclusive license or other disposition is to a wholly owned subsidiary of the Corporation.

2.3.2 Amount Deemed Paid or Distributed. The amount deemed paid or distributed to the holders of capital stock of the Corporation upon any such merger, consolidation, sale, transfer, exclusive license, other disposition or redemption shall be the cash or the value of the property, rights or securities paid or distributed to such holders by the Corporation or the acquiring person, firm or other entity. The value of such property, rights or securities shall be determined in good faith by the Board of Directors of the Corporation.

2.3.3 Allocation of Escrow and Contingent Consideration. In the event of a Deemed Liquidation Event pursuant to Subsection 2.3.1(a)(i), if any portion of the consideration payable to the stockholders of the Corporation is payable only upon satisfaction of contingencies (the "**Additional Consideration**"), the Merger Agreement shall provide that (a) the portion of such consideration that is not Additional Consideration (such portion, the "**Initial Consideration**") shall be allocated among the holders of capital stock of the Corporation in accordance with Subsections 2.1 and 2.2 as if the Initial Consideration were the only consideration payable in connection with such Deemed Liquidation Event; and (b) any Additional Consideration which becomes payable to the stockholders of the Corporation upon satisfaction of such contingencies shall be allocated among the holders of capital stock of the Corporation in accordance with Subsections 2.1 and 2.2 after taking into account the previous payment of the Initial Consideration as part of the same transaction. For the purposes of this Subsection 2.3.4, consideration placed into escrow or retained as holdback to be available for satisfaction of indemnification or similar obligations in connection with such Deemed Liquidation Event shall be deemed to be Additional Consideration.

3. Voting.

3.1 General. On any matter presented to the stockholders of the Corporation for their action or consideration at any meeting of stockholders of the Corporation (or by written consent of stockholders in lieu of meeting), each holder of outstanding shares of Preferred Stock shall be entitled to cast the number of votes equal to the number of whole shares of Common Stock into which the shares of Preferred Stock held by such holder are convertible as of the record date for determining stockholders entitled to vote on such matter. Except as provided by law or by the other provisions of the Certificate of Incorporation, holders of Preferred Stock shall vote together with the holders of Common Stock as a single class.

3.2 Election of Directors. The holders of record of the shares of Preferred Stock, exclusively and as a separate class, shall be entitled to elect 3 directors of the Corporation pursuant to the terms of and in the manner set forth in the Shareholders Agreement (as defined below) (the "**Preferred Directors**"). Any director elected as provided in the preceding sentence 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 or directors, 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 shares of Preferred Stock fail to elect a sufficient number of directors to fill all directorships for which they are entitled to elect directors, voting exclusively and as a separate class, pursuant to the first sentence of this Subsection 3.2, then any directorship not so filled shall remain vacant until such time as the holders of the Preferred Stock 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 exclusively and as a separate class. The holders of record of the shares of Common Stock and of any other class or series of voting stock (including the Preferred Stock), exclusively and voting together as a single class, shall be entitled to elect the balance of the total number of directors of the Corporation. 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 Subsection 3.2, 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 Subsection 3.2.

3.3 Preferred Stock Protective Provisions. At any time when shares of Preferred Stock are outstanding, the Corporation shall not, either directly or indirectly by amendment, merger, consolidation or otherwise, do any of the following without (in addition to any other vote required by law or the Certificate of Incorporation) the written consent or affirmative vote of the Requisite Preferred, given in writing or by vote at a meeting, consenting or voting (as the case may be), and any such act or transaction entered into without such consent or vote shall be null and void *ab initio*, and of no force or effect.

3.3.1 liquidate, dissolve or wind-up the business and affairs of the Corporation, effect any merger or consolidation or any other Deemed Liquidation Event, or consent to any of the foregoing;

3.3.2 amend, alter or repeal any provision of the Certificate of Incorporation or Bylaws of the Corporation;

3.3.3 create, or authorize the creation of, or issue or obligate itself to issue shares of, any additional class or series of capital stock other than Exempted Securities (as defined below), or increase the authorized number of shares of any series of

Preferred Stock or increase the authorized number of shares of any additional class or series of capital stock;

3.3.4 (i) reclassify, alter or amend any existing security of the Corporation that is pari passu with the Preferred Stock in respect of the distribution of assets on the liquidation, dissolution or winding up of the Corporation, the payment of dividends or rights of redemption, if such reclassification, alteration or amendment would render such other security senior to the Preferred Stock in respect of any such right, preference, or privilege or (ii) reclassify, alter or amend any existing security of the Corporation that is junior to the Preferred Stock in respect of the distribution of assets on the liquidation, dissolution or winding up of the Corporation, the payment of dividends or rights of redemption, if such reclassification, alteration or amendment would render such other security senior to or pari passu with the Preferred Stock in respect of any such right, preference or privilege;

3.3.5 purchase or redeem (or permit any subsidiary to purchase or redeem) or pay or declare any dividend or make any distribution on, any shares of capital stock of the Corporation other than (i) redemptions of or dividends or distributions on the Preferred Stock as expressly authorized herein, (ii) dividends or other distributions payable on the Common Stock solely in the form of additional shares of Common Stock and (iii) repurchases of stock from former employees, officers, directors, consultants or other persons who performed services for the Corporation or any subsidiary in connection with the cessation of such employment or service at the lower of the original purchase price or the then-current fair market value thereof;

3.3.6 a public offering pursuant to an effective registration statement under the Securities Act of 1933, as amended, of any class or series of capital stock of the Corporation; or

3.3.7 adopt, or amend the terms of, any stock option plan (or other equity-based incentive plan) or grant any Options (as defined below) to directors of the Corporation.

3.4 Additional Preferred Stock Protective Provisions. At any time when shares of Preferred Stock are outstanding, the Corporation shall not, either directly or indirectly by amendment, merger, consolidation or otherwise, do any of the following without (in addition to any other vote required by law or the Certificate of Incorporation) the written consent or affirmative vote of the holders of: (i) a majority of the outstanding shares of Series A Preferred Stock, voting as a separate class, (ii) a majority of the outstanding shares of Series B Preferred Stock, voting as a separate class, (iii) a majority of the outstanding shares of Series C Preferred Stock, voting as a separate class and (iv) seventy-five percent (75%) the outstanding shares of Preferred Stock, voting as a single class, on an as-converted basis, given in writing or by vote at a meeting, consenting or voting (as the case may be), and any such act or transaction entered into without such consent or vote shall be null and void *ab initio*, and of no force or effect.

3.4.1 amend, alter or repeal any provision of the Certificate of Incorporation or Bylaws of the Corporation in a manner that affects the powers, preferences or rights of the Preferred Stock, or any class or series of Preferred Stock.

3.5 Series C Preferred Stock Protective Provisions. At any time when shares of Series C Preferred Stock are outstanding, the Corporation shall not, either directly or indirectly by amendment, merger, consolidation or otherwise, do any of the following without (in addition to any other vote required by law or the Certificate of Incorporation) the written consent or affirmative vote of the Requisite Series C Preferred, given in writing or by vote at a meeting, consenting or voting (as the case may be), and any such act or transaction entered into without such consent or vote shall be null and void *ab initio*, and of no force or effect.

3.5.1 liquidate, dissolve or wind-up the business and affairs of the Corporation, effect any merger or consolidation or any other Deemed Liquidation Event, or consent to any of the foregoing;

3.5.2 sell, transfer, license, pledge or encumber material technology or material intellectual property of the Corporation, or any subsidiary of the Corporation;

3.5.3 create, or authorize the creation of, or issue, or authorize the issuance of any debt security, loans, credits or any similar financing arrangement or lease arrangement, or permit any subsidiary to take any such action with respect to any such transaction in excess of €2,000,000 individually, or if the aggregate value of such transactions in a single fiscal year would exceed €3,000,000;

3.5.4 the sale, lease, transfer, exclusive license or other disposition of any assets of the Corporation, or any subsidiary of the Corporation, or (ii) the acquisition, lease, transfer, license or other acquisition of any assets by the Corporation, or any subsidiary of the Corporation, for consideration in excess of for consideration €2,000,000 in any individual instance or €3,000,000 in the aggregate in any fiscal year;

3.5.5 purchase or redeem (or permit any subsidiary to purchase or redeem) or pay or declare any dividend or make any distribution on, any shares of capital stock of the Corporation other than (i) redemptions of or dividends or distributions on the Preferred Stock as expressly authorized herein, (ii) dividends or other distributions payable on the Common Stock solely in the form of additional shares of Common Stock and (iii) repurchases of stock from former employees, officers, directors, consultants or other persons who performed services for the Corporation or any subsidiary in connection with the cessation of such employment or service at the lower of the original purchase price or the then-current fair market value thereof; or

3.5.6 create, or authorize the creation of, or issue or obligate itself to issue shares of, any additional class or series of capital stock other than Exempted Securities (as defined below), or increase the authorized number of shares of any series of Preferred Stock or increase the authorized number of shares of any additional class or series of capital stock.

The “**Requite Series C Preferred**” shall mean: (a) for so long as no holder, nor group of Affiliated Shareholders, of Series C Preferred Stock holds more than 50% of the outstanding shares of Series C Preferred stock, (i) the holders of at least 60% of the Series C Preferred Stock, or (ii) if a holder, or group of Affiliated Shareholders, of Series C Preferred Stock holds more than 40%, but less than 50%, of the outstanding shares of Series C Preferred Stock, then all other holders of Series C Preferred Stock; and (b) for so long as a holder, or group of Affiliated Shareholders, of Series C Preferred Stock holds more than 50% of the outstanding shares of Series C Preferred Stock, the holders of a majority of the outstanding shares of Series C Preferred Stock.

The “**Affiliated Shareholders**” shall mean any two or more holders of capital stock who are Affiliates.

An “**Affiliate**” shall mean, with respect to any holder of shares of capital stock, any person, entity or firm which, directly or indirectly, controls, is controlled by or is under common control with such holder, including, without limitation, any entity of which the holder is a partner or member, any partner, officer, director, member or employee of such holder and any venture capital fund now or hereafter existing of which the holder is a partner or member which is controlled by or under common control with one or more general partners (or member thereof) of such holder, or managing members (or members thereof) of, or shares the same management company (or member thereof) with, such holder.

4. Optional Conversion.

The holders of the Preferred Stock shall have conversion rights as follows (the “**Conversion Rights**”):

4.1 Right to Convert.

4.1.1 Conversion Ratio. Each share of Preferred Stock shall be convertible, at the option of the holder thereof, at any time and from time to time, and without the payment of additional consideration by the holder thereof, into such number of fully paid and non-assessable shares of Common Stock as is determined by dividing the Applicable Original Issue Price by the Applicable Conversion Price (as defined below) in effect at the time of conversion. The “**Series A Conversion Price**” shall initially be equal to €50.80 per share. The “**Series B Conversion Price**” shall initially be equal to €60.95 per share. The “**Series C Conversion Price**” shall initially be equal to €72.10 per share. The “**Applicable Conversion Price**” shall mean with respect to shares of Series A Preferred Stock, the Series A Conversion Price, with respect to shares of Series B Preferred Stock, the Series B Conversion Price and with respect to shares of Series C Preferred Stock, the Series C Conversion Price. Such Applicable Conversion Price, and the rate at which shares of Preferred Stock may be converted into shares of Common Stock, shall be subject to adjustment as provided below.

4.1.2 Termination of Conversion Rights. In the event of a notice of redemption of any shares of Preferred Stock pursuant to Section 6, the Conversion Rights of the shares designated for redemption shall terminate at the close of business on the last full day preceding the date fixed for redemption, unless the redemption price is not fully paid on such redemption date, in which case the Conversion Rights for such shares shall continue until such price is paid in full. In the event of a liquidation, dissolution or winding up of the Corporation or a Deemed Liquidation Event, the Conversion Rights shall terminate at the close of business on the last full day preceding the date fixed for the payment of any such amounts distributable on such event to the holders of Preferred Stock.

4.2 Fractional Shares. No fractional shares of Common Stock shall be issued upon conversion of the 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 fair market value of a share of Common Stock as determined in good faith by the Board of Directors of the Corporation. Whether or not fractional shares would be issuable upon such conversion shall be determined on the basis of the total number of shares of Preferred Stock the holder is at the time converting into Common Stock and the aggregate number of shares of Common Stock issuable upon such conversion.

4.3 Mechanics of Conversion.

4.3.1 Notice of Conversion. In order for a holder of Preferred Stock to voluntarily convert shares of Preferred Stock into shares of Common Stock, such holder shall surrender the certificate or certificates for such shares of Preferred Stock (or, if such registered holder alleges that such certificate has been lost, stolen or destroyed, a lost certificate affidavit and agreement reasonably acceptable to the Corporation to indemnify the Corporation against any claim that may be made against the Corporation on account of the alleged loss, theft or destruction of such certificate), at the office of the transfer agent for the Preferred Stock (or at the principal office of the Corporation if the Corporation serves as its own transfer agent), together with written notice that such holder elects to convert all or any number of the shares of the Preferred Stock represented by such certificate or certificates and, if applicable, any event on which such conversion is contingent. Such notice shall state such holder’s name or the names of the nominees in which such holder wishes the certificate or certificates for shares of Common Stock to be issued. If required by the Corporation, certificates surrendered for conversion shall be endorsed or accompanied by a written instrument or instruments of transfer, in form satisfactory to the Corporation, duly executed by the registered holder or his, her or its attorney duly authorized in writing. The close of business on the date of receipt by the transfer agent (or by the Corporation if the Corporation serves as its own transfer agent) of such certificates (or lost certificate affidavit and agreement) and notice shall be the time of conversion (the “**Conversion Time**”), and the shares of Common Stock issuable upon conversion of the shares represented by such certificate shall be deemed to be outstanding of record as of such date. The Corporation shall, as soon as practicable after the Conversion Time, (i) issue and deliver to such holder of Preferred Stock, or to his, her or its nominees, a certificate or certificates for the number of full shares of Common Stock issuable upon such conversion in accordance with the provisions hereof and a certificate for the number (if any) of the shares of Preferred Stock represented by the surrendered certificate that were not converted into Common Stock, (ii) pay in cash such amount as provided in Subsection 4.2 in lieu of any fraction of a share of Common Stock otherwise issuable upon such conversion and (iii) pay all declared but unpaid dividends on the shares of Preferred Stock converted.

4.3.2 Reservation of Shares. The Corporation shall at all times when shares of Preferred Stock shall be outstanding, reserve and keep available out of its authorized but unissued capital stock, for the purpose of effecting the conversion of the Preferred Stock, such number of its duly authorized shares of Common Stock as shall from time to time be sufficient to effect the conversion of all outstanding 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 shall take such corporate action as may be necessary to increase its authorized but unissued shares of Common Stock to such number of shares as shall be sufficient for such purposes, including, without limitation, engaging in best efforts to obtain the requisite stockholder approval of any necessary amendment to the Certificate of Incorporation. Before taking any action which would cause an adjustment reducing any Applicable Conversion Price below the then par value of the shares of Common Stock issuable upon conversion of such shares of Preferred Stock, the Corporation will take any corporate action which may, in the opinion of its counsel, be necessary in order that the Corporation may validly and legally issue fully paid and non-assessable shares of Common Stock at such adjusted Applicable Conversion Price.

4.3.3 Effect of Conversion. All shares of Preferred Stock which shall have been surrendered for conversion as herein provided shall no longer be deemed to be outstanding and all rights with respect to such shares shall immediately cease and terminate at the Conversion Time, except only the right of the holders thereof to receive shares of Common Stock in exchange therefor, to receive payment in lieu of any fraction of a share otherwise issuable upon such conversion as provided in Subsection 4.2 and to receive payment of any dividends declared but unpaid thereon. Any shares of Preferred Stock so converted shall be retired and cancelled and may not be reissued as shares of such series, and the Corporation may thereafter take such appropriate action (without the need for stockholder action) as may be necessary to reduce the authorized number of shares of Preferred Stock accordingly.

4.3.4 No Further Adjustment. Upon any such conversion, no adjustment to the Applicable Conversion Price shall be made for any declared but unpaid dividends on the shares of Preferred Stock surrendered for conversion or on the Common Stock delivered upon conversion.

4.3.5 Taxes. The Corporation shall pay any and all issue and other similar taxes that may be payable in respect of any issuance or delivery of shares of Common Stock upon conversion of shares of Preferred Stock pursuant to this Section 4. The Corporation shall not, however, be required to pay any tax which may be payable in respect of any transfer involved in the issuance and delivery of shares of Common Stock in a name other than that in which the shares of Preferred Stock so converted were registered, and no such issuance or delivery shall be made unless and until the person or entity requesting such issuance has paid to the Corporation the amount of any such tax or has established, to the satisfaction of the Corporation, that such tax has been paid.

4.4 Adjustments to Applicable Conversion Price for Diluting Issues.

4.4.1 Special Definitions. For purposes of this Article Fourth, the following definitions shall apply:

(a) "**Option**" shall mean rights, options or warrants to subscribe for, purchase or otherwise acquire Common Stock or Convertible Securities.

(b) "**Preferred Stock Original Issue Date**" shall mean the date on which the first share of Preferred Stock was issued.

(c) "**Convertible Securities**" shall mean any evidences of indebtedness, shares or other securities directly or indirectly convertible into or exchangeable for Common Stock, but excluding Options.

(d) "**Additional Shares of Common Stock**" shall mean all shares of Common Stock issued (or, pursuant to Subsection 4.4.3 below, deemed to be issued) by the Corporation after the Preferred Stock Original Issue Date, other than (1) the following shares of Common Stock and (2) shares of Common Stock deemed issued pursuant to the following Options and Convertible Securities (clauses (1) and (2), collectively, "**Exempted Securities**"):

(i) shares of Common Stock, Options or Convertible Securities issued as a dividend or distribution on Preferred Stock;

(ii) shares of Common Stock, Options or Convertible Securities issued by reason of a dividend, stock split, split-up or other distribution on shares of Common Stock that is covered by Subsection 4.5, 4.6, 4.7 or 4.8**;**

(iii) shares of Common Stock or Options issued to employees or directors of, or consultants or advisors to, the Corporation or any of its subsidiaries pursuant to a plan, agreement or arrangement approved by the Board of Directors of the Corporation, including at least one Preferred Director;

(iv) shares of Common Stock or Convertible Securities actually issued upon the exercise of Options or shares of Common Stock actually issued upon the conversion or exchange of Convertible Securities, in each case provided such issuance is pursuant to the terms of such Option or Convertible Security; or

(v) shares of Common Stock, Options or Convertible Securities issued to banks, equipment lessors or other financial institutions, or to real property lessors, pursuant to a debt financing, equipment leasing or real property leasing transaction approved by the Requisite Preferred.

4.4.2 No Adjustment of Applicable Conversion Price. No adjustment to an Applicable Conversion Price shall be made as the result of the issuance or

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deemed issuance of Additional Shares of Common Stock if the Corporation receives written notice from the holders of a majority of the outstanding shares of such series of Preferred Stock agreeing that no such adjustment shall be made to such Applicable Conversion Price as the result of the issuance or deemed issuance of such Additional Shares of Common Stock.

4.4.3 Deemed Issue of Additional Shares of Common Stock.

(a) If the Corporation at any time or from time to time after the Preferred Stock Original Issue Date shall issue any Options or Convertible Securities (excluding Options or Convertible Securities which are themselves Exempted 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 of Common Stock (as set forth in the instrument relating thereto, assuming the satisfaction of any conditions to exercisability, convertibility or exchangeability but without regard to any provision contained therein for a subsequent adjustment of such number) issuable upon the exercise of such Options or, in the case of Convertible Securities and Options therefor, the conversion or exchange of such Convertible Securities, shall be deemed to be Additional Shares of Common Stock 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.

(b) If the terms of any Option or Convertible Security, the issuance of which resulted in an adjustment to the Applicable Conversion Price pursuant to the terms of Subsection 4.4.4, are revised as a result of an amendment to such terms or any other adjustment pursuant to the provisions of such Option or Convertible Security (but excluding automatic adjustments to such terms pursuant to anti-dilution or similar provisions of such Option or Convertible Security) to provide for either (1) any increase or decrease in the number of shares of Common Stock issuable upon the exercise, conversion and/or exchange of any such Option or Convertible Security or (2) any increase or decrease in the consideration payable to the Corporation upon such exercise, conversion and/or exchange, then, effective upon such increase or decrease becoming effective, the Applicable Conversion Price computed upon the original issue of such Option or Convertible Security (or upon the occurrence of a record date with respect thereto) shall be readjusted to such Applicable Conversion Price as would have obtained had such revised terms been in effect upon the original date of issuance of such Option or Convertible Security. Notwithstanding the foregoing, no readjustment pursuant to this clause (b) shall have the effect of increasing the Applicable Conversion Price to an amount which exceeds the lower of (i) the Applicable Conversion Price in effect immediately prior to the original adjustment made as a result of the issuance of such Option or Convertible Security, or (ii) the Applicable Conversion Price that would have resulted from any issuances of Additional Shares of Common Stock (other than deemed issuances of Additional Shares of Common Stock as a result of the issuance of such Option or Convertible Security) between the original adjustment date and such readjustment date.

(c) If the terms of any Option or Convertible Security (excluding Options or Convertible Securities which are themselves Exempted Securities), the issuance of which did not result in an adjustment to the Applicable Conversion Price pursuant to the terms of Subsection 4.4.4 (either because the consideration per share (determined pursuant to Subsection 4.4.5) of the Additional Shares of Common Stock subject thereto was equal to or greater than the Applicable Conversion Price then in effect, or because such Option or

Convertible Security was issued before the Preferred Stock Original Issue Date), are revised after the Preferred Stock Original Issue Date as a result of an amendment to such terms or any other adjustment pursuant to the provisions of such Option or Convertible Security (but excluding automatic adjustments to such terms pursuant to anti-dilution or similar provisions of such Option or Convertible Security) to provide for either (1) any increase in the number of shares of Common Stock issuable upon the exercise, conversion or exchange of any such Option or Convertible Security or (2) any decrease in the consideration payable to the Corporation upon such exercise, conversion or exchange, then such Option or Convertible Security, as so amended or adjusted, and the Additional Shares of Common Stock subject thereto (determined in the manner provided in Subsection 4.4.3(a)) shall be deemed to have been issued effective upon such increase or decrease becoming effective.

(d) Upon the expiration or termination of any unexercised Option or unconverted or unexchanged Convertible Security (or portion thereof) which resulted (either upon its original issuance or upon a revision of its terms) in an adjustment to the Applicable Conversion Price pursuant to the terms of Subsection 4.4.4, the Applicable Conversion Price shall be readjusted to such Applicable Conversion Price as would have obtained had such Option or Convertible Security (or portion thereof) never been issued.

(e) If the number of shares of Common Stock issuable upon the exercise, conversion and/or exchange of any Option or Convertible Security, or the consideration payable to the Corporation upon such exercise, conversion and/or exchange, is calculable at the time such Option or Convertible Security is issued or amended but is subject to adjustment based upon subsequent events, any adjustment to the Applicable Conversion Price provided for in this Subsection 4.4.3 shall be effected at the time of such issuance or amendment based on such number of shares or amount of consideration without regard to any provisions for subsequent adjustments (and any subsequent adjustments shall be treated as provided in clauses (b) and (c) of this Subsection 4.4.3). If the number of shares of Common Stock issuable upon the exercise, conversion and/or exchange of any Option or Convertible Security, or the consideration payable to the Corporation upon such exercise, conversion and/or exchange, cannot be calculated at all at the time such Option or Convertible Security is issued or amended, any adjustment to the Applicable Conversion Price that would result under the terms of this Subsection 4.4.3 at the time of such issuance or amendment shall instead be effected at the time such number of shares and/or amount of consideration is first calculable (even if subject to subsequent adjustments), assuming for purposes of calculating such adjustment to the Applicable Conversion Price that such issuance or amendment took place at the time such calculation can first be made.

4.4.4 Adjustment of Applicable Conversion Price Upon Issuance of Additional Shares of Common Stock. In the event the Corporation shall at any time after the Preferred Stock Original Issue Date issue Additional Shares of Common Stock (including Additional Shares of Common Stock deemed to be issued pursuant to Subsection 4.4.3), without consideration or for a consideration per share less than the Applicable Conversion Price in effect immediately prior to such issue, then the Applicable Conversion Price shall be reduced, concurrently with such issue, to a price (calculated to the nearest one-hundredth of a Euro) determined in accordance with the following formula:

$$CP_2 = CP_1 * (A + B) \div (A + C).$$

For purposes of the foregoing formula, the following definitions shall apply:

(a) "CP_2" shall mean the Applicable Conversion Price in effect immediately after such issue of Additional Shares of Common Stock

(b) "CP_1" shall mean the Applicable Conversion Price in effect immediately prior to such issue of Additional Shares of Common Stock;

(c) "A" shall mean the number of shares of Common Stock outstanding immediately prior to such issue of Additional Shares of Common Stock (treating for this purpose as outstanding all shares of Common Stock issuable upon exercise of Options outstanding immediately prior to such issue or upon conversion or exchange of Convertible Securities (including the Preferred Stock) outstanding (assuming exercise of any outstanding Options therefor) immediately prior to such issue);

(d) "B" shall mean the number of shares of Common Stock that would have been issued if such Additional Shares of Common Stock had been issued at a price per share equal to CP_1 (determined by dividing the aggregate consideration received by the Corporation in respect of such issue by CP_1); and

(e) "C" shall mean the number of such Additional Shares of Common Stock issued in such transaction.

Such formula shall not be applied reiteratively.

4.4.5 Determination of Consideration. For purposes of this Subsection 4.4, the consideration received by the Corporation for the issue of any Additional Shares of Common Stock shall be computed as follows:

(a) Cash and Property: Such consideration shall:

(i) insofar as it consists of cash, be computed at the aggregate amount of cash received by the Corporation, excluding amounts paid or payable for accrued interest;

(ii) 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 of the Corporation; and

(iii) in the event Additional Shares of Common Stock 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 (i) and (ii) above, as determined in good faith by the Board of Directors of the Corporation.

(b) Options and Convertible Securities. The consideration per share received by the Corporation for Additional Shares of Common Stock deemed to have been issued pursuant to Subsection 4.4.3, relating to Options and Convertible Securities, shall be determined by dividing:

(i) 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

(ii) 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, 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.

4.4.6 Multiple Closing Dates. In the event the Corporation shall issue on more than one date Additional Shares of Common Stock that are a part of one transaction or a series of related transactions and that would result in an adjustment to the Applicable Conversion Price pursuant to the terms of Subsection 4.4., and such issuance dates occur within a period of no more than ninety (90) days from the first such issuance to the final such issuance, then, upon the final such issuance, the Applicable Conversion Price shall be readjusted to give effect to all such issuances as if they occurred on the date of the first such issuance (and without giving effect to any additional adjustments as a result of any such subsequent issuances within such period).

4.5 Adjustment for Stock Splits and Combinations. If the Corporation shall at any time or from time to time after the Preferred Stock Original Issue Date effect a subdivision of the outstanding Common Stock, the Applicable Conversion Price in effect immediately before that subdivision shall be proportionately decreased so that the number of shares of Common Stock issuable on conversion of each share of such series shall be increased in proportion to such increase in the aggregate number of shares of Common Stock outstanding. If the Corporation shall at any time or from time to time after the Preferred Stock Original Issue Date combine the outstanding shares of Common Stock, the Applicable Conversion Price in effect immediately before the combination shall be proportionately increased so that the number of shares of Common Stock issuable on conversion of each share of such series shall be decreased in proportion to such decrease in the aggregate number of shares of Common Stock outstanding. Any adjustment under this subsection shall become effective at the close of business on the date the subdivision or combination becomes effective.

4.6 Adjustment for Certain Dividends and Distributions. In the event the Corporation at any time or from time to time after the Preferred Stock Original Issue Date shall make or issue, or fix a record date for the determination of holders of Common Stock entitled to receive, a dividend or other distribution payable on the Common Stock in additional shares of Common Stock, then and in each such event the Applicable Conversion Price in effect immediately before such event shall be decreased as of the time of such issuance or, in the event such a record date shall have been fixed, as of the close of business on such record date, by multiplying the Applicable Conversion Price then in effect by a fraction:

(1) the numerator of which shall be the total number of shares of Common Stock issued and outstanding immediately prior to the time of such issuance or the close of business on such record date, and

(2) the denominator of which shall be the total number of shares of Common Stock issued and outstanding immediately prior to the time of such issuance or the close of business on such record date plus the number of shares of Common Stock issuable in payment of such dividend or distribution.

Notwithstanding the foregoing (a) if such record date shall have been fixed and such dividend is not fully paid or if such distribution is not fully made on the date fixed therefor, the Applicable Conversion Price shall be recomputed accordingly as of the close of business on such record date and thereafter the Applicable Conversion Price shall be adjusted pursuant to this subsection as of the time of actual payment of such dividends or distributions; and (b) that no such adjustment shall be made if the holders of such series of Preferred Stock simultaneously receive a dividend or other distribution of shares of Common Stock in a number equal to the number of shares of Common Stock as they would have received if all outstanding shares of such series of Preferred Stock had been converted into Common Stock on the date of such event.

4.7 Adjustments for Other Dividends and Distributions. In the event the Corporation at any time or from time to time after the Preferred Stock Original Issue Date shall make or issue, or fix a record date for the determination of holders of Common Stock entitled to receive, a dividend or other distribution payable in securities of the Corporation (other than a distribution of shares of Common Stock in respect of outstanding shares of Common Stock) or in other property and the provisions of Section 1 do not apply to such dividend or distribution, then and in each such event the holders of each series of Preferred Stock shall receive, simultaneously with the distribution to the holders of Common Stock, a dividend or other distribution of such securities or other property in an amount equal to the amount of such securities or other property as they would have received if all outstanding shares of such series of Preferred Stock had been converted into Common Stock on the date of such event.

4.8 Adjustment for Merger or Reorganization, etc. Subject to the provisions of Subsection 2.3, if there shall occur any reorganization, recapitalization, reclassification, consolidation or merger involving the Corporation in which the Common Stock (but not the Preferred Stock) is converted into or exchanged for securities, cash or other property (other than a transaction covered by Subsections 4.4, 4.6 or 4.7), then, following any such reorganization, recapitalization, reclassification, consolidation or merger, each share of Preferred Stock shall thereafter be convertible in lieu of the Common Stock into which it was convertible prior to such event into the kind and amount of securities, cash or other property which a holder of the number of shares of Common Stock of the Corporation issuable upon conversion of one share of such series of Preferred Stock immediately prior to such reorganization, recapitalization, reclassification, consolidation or merger would have been entitled to receive pursuant to such transaction; and, in such case, appropriate adjustment (as determined in good faith by the Board of Directors of the Corporation) shall be made in the application of the provisions in this Section 4 with respect to the rights and interests thereafter of the holders of such series of Preferred Stock, to the end that the provisions set forth in this Section 4 (including provisions with respect to changes in and other adjustments of the Applicable Conversion Price) shall thereafter be applicable, as nearly as reasonably may be, in relation to any securities or other property thereafter deliverable upon the conversion of such series of Preferred Stock. For the avoidance of doubt, nothing in this Subsection 4.8 shall be construed as preventing the holders of Preferred Stock from seeking any appraisal rights to which they are otherwise entitled under the DGCL in connection with a merger triggering an adjustment hereunder, nor shall this Subsection 4.8 be deemed conclusive evidence of the fair value of the shares of Preferred Stock in any such appraisal proceeding.

4.9 Certificate as to Adjustments. Upon the occurrence of each adjustment or readjustment of the Applicable Conversion Price pursuant to this Section 4, the Corporation at its expense shall, as promptly as reasonably practicable but in any event not later than ten (10) days thereafter, 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 (including the kind and amount of securities, cash or other property into which the such series of Preferred Stock is convertible) and showing in detail the facts upon which such adjustment or readjustment is based. The Corporation shall, as promptly as reasonably practicable after the written request at any time of any holder of Preferred Stock (but in any event not later than ten (10) days thereafter), furnish or cause to be furnished to such holder a certificate setting forth (i) the Applicable Conversion Price then in effect, and (ii) the number of shares of Common Stock and the amount, if any, of other securities, cash or property which then would be received upon the conversion of such series of Preferred Stock.

4.10 Notice of Record Date. In the event:

(a) the Corporation shall take a record of the holders of its Common Stock (or other capital stock or securities at the time issuable upon conversion of the

Preferred Stock) for the purpose of entitling or enabling them to receive any dividend or other distribution, or to receive any right to subscribe for or purchase any shares of capital stock of any class or any other securities, or to receive any other security; or

(b) of any capital reorganization of the Corporation, any reclassification of the Common Stock of the Corporation, or any Deemed Liquidation Event; or

(c) of the voluntary or involuntary dissolution, liquidation or winding-up of the Corporation,

then, and in each such case, the Corporation will send or cause to be sent to the holders of the Preferred Stock a notice specifying, as the case may be, (i) the record date for such dividend, distribution or right, and the amount and character of such dividend, distribution or right, or (ii) the effective date on which such reorganization, reclassification, consolidation, merger, transfer, dissolution, liquidation or winding-up is proposed to take place, and the time, if any is to be fixed, as of which the holders of record of Common Stock (or such other capital stock or securities at the time issuable upon the conversion of such series of Preferred Stock) shall be entitled to exchange their shares of Common Stock (or such other capital stock or securities) for securities or other property deliverable upon such reorganization, reclassification, consolidation, merger, transfer, dissolution, liquidation or winding-up, and the amount per share and character of such exchange applicable to such series of Preferred Stock and the Common Stock. Such notice shall be sent at least ten (10) days prior to the record date or effective date for the event specified in such notice.

5. Mandatory Conversion.

5.1 Trigger Events. Upon either (a) the closing of the sale of shares of Common Stock to the public at a price of at least €72.10 per share (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Common Stock), in an underwritten public offering pursuant to an effective registration statement under the Securities Act of 1933, as amended, resulting in at least $60,000,000 of gross proceeds to the Corporation or (b) the date and time, or the occurrence of an event, specified by vote or written consent of the holders of (i) at least sixty percent (60%) of the then outstanding shares of Preferred Stock and (ii) except in the case of a conversion in connection with a liquidation, dissolution or winding up of the Corporation or a Deemed Liquidation Event pursuant to Section 1 herein where the holders of Series C Preferred Stock receive an amount at least equal to two times the Original Purchase Price for the Series C Preferred Stock, Requisite Series C Preferred (the time of such closing or the date and time specified or the time of the event specified in such vote or written consent is referred to herein as the "**Mandatory Conversion Time**"), then (i) all outstanding shares of Preferred Stock shall automatically be converted into shares of Common Stock, at the then effective conversion rate as calculated pursuant to Subsection 4.1.1. and (ii) such shares may not be reissued by the Corporation.

5.2 Procedural Requirements. All holders of record of shares of Preferred Stock shall be sent written notice of the Mandatory Conversion Time and the place designated for mandatory conversion of all such shares of Preferred Stock pursuant to this

Section 5. Such notice need not be sent in advance of the occurrence of the Mandatory Conversion Time. Upon receipt of such notice, each holder of shares of Preferred Stock in certificated form shall surrender his, her or its certificate or certificates for all such shares (or, if such holder alleges that such certificate has been lost, stolen or destroyed, a lost certificate affidavit and agreement reasonably acceptable to the Corporation to indemnify the Corporation against any claim that may be made against the Corporation on account of the alleged loss, theft or destruction of such certificate) to the Corporation at the place designated in such notice. If so required by the Corporation, any certificates surrendered for conversion shall be endorsed or accompanied by written instrument or instruments of transfer, in form satisfactory to the Corporation, duly executed by the registered holder or by his, her or its attorney duly authorized in writing. All rights with respect to the Preferred Stock converted pursuant to Subsection 5.1, including the rights, if any, to receive notices and vote (other than as a holder of Common Stock), will terminate at the Mandatory Conversion Time (notwithstanding the failure of the holder or holders thereof to surrender any certificates at or prior to such time), except only the rights of the holders thereof, upon surrender of any certificate or certificates of such holders (or lost certificate affidavit and agreement) therefor, to receive the items provided for in the next sentence of this Subsection 5.2. As soon as practicable after the Mandatory Conversion Time and, if applicable, the surrender of any certificate or certificates (or lost certificate affidavit and agreement) for such Preferred Stock, the Corporation shall (a) issue and deliver to such holder, or to his, her or its nominees, a certificate or certificates for the number of full shares of Common Stock issuable on such conversion in accordance with the provisions hereof and (b) pay cash as provided in Subsection 4.2 in lieu of any fraction of a share of Common Stock otherwise issuable upon such conversion and the payment of any declared but unpaid dividends on the shares of Preferred Stock converted. Such converted Preferred Stock shall be retired and cancelled and may not be reissued as shares of such series, and the Corporation may thereafter take such appropriate action (without the need for stockholder action) as may be necessary to reduce the authorized number of shares of Preferred Stock accordingly.

6. Redemption. The shares of Preferred Stock shall not be mandatorily redeemable. Any shares of Preferred Stock that are redeemed or otherwise acquired by the Corporation or any of its subsidiaries shall be automatically and immediately cancelled and retired and shall not be reissued, sold or transferred. Neither the Corporation nor any of its subsidiaries may exercise any voting or other rights granted to the holders of Preferred Stock following redemption.

7. Waiver. Except as otherwise set forth herein, any of the rights, powers, preferences and other terms of the Preferred Stock set forth herein may be waived on behalf of all holders of Preferred Stock by the affirmative written consent or vote of the holders of at least a majority of the shares of Preferred Stock then outstanding; provided that any waiver shall require the consent of each holder of Preferred Stock negatively and unequally affected if such waiver does not apply to all holders of Preferred Stock in the fashion.

8. Notices. Any notice required or permitted by the provisions of this Article Fourth to be given to a holder of shares of Preferred Stock shall be mailed, postage prepaid, to the post office address last shown on the records of the Corporation, or given by electronic communication in compliance with the provisions of the General Corporation Law, and shall be deemed sent upon such mailing or electronic transmission.

FIFTH: Subject to any additional vote required by the Certificate of Incorporation or Bylaws, in furtherance and not in limitation of the powers conferred by statute, the Board of Directors is expressly authorized to make, repeal, alter, amend and rescind any or all of the Bylaws of the Corporation.

SIXTH: Subject to any additional vote required by the Certificate of Incorporation, the number of directors of the Corporation shall be determined in the manner set forth in the Bylaws of the Corporation.

SEVENTH: Elections of directors need not be by written ballot unless the Bylaws of the Corporation shall so provide.

EIGHTH: Meetings of stockholders may be held within or without the State of Delaware, as the Bylaws of the Corporation may provide. The books of the Corporation may be kept outside the State of Delaware at such place or places as may be designated from time to time by the Board of Directors or in the Bylaws of the Corporation.

NINTH: To the fullest extent permitted by law, 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. If the General Corporation Law or any other law of the State of Delaware is amended after approval by the stockholders of this Article Ninth to authorize corporate action further eliminating or limiting the personal liability of directors, then the liability of a director of the Corporation shall be eliminated or limited to the fullest extent permitted by the General Corporation Law as so amended.

Any repeal or modification of the foregoing provisions of this Article Ninth by the stockholders of the Corporation shall not adversely affect any right or protection of a director of the Corporation existing at the time of, or increase the liability of any director of the Corporation with respect to any acts or omissions of such director occurring prior to, such repeal or modification.

TENTH: To the fullest extent permitted by applicable law, the Corporation is authorized to provide indemnification of (and advancement of expenses to) directors, officers and agents of the Corporation (and any other persons to which General Corporation Law permits the Corporation to provide indemnification) through Bylaw provisions, agreements with such agents or other persons, vote of stockholders or disinterested directors or otherwise, in excess of the indemnification and advancement otherwise permitted by Section 145 of the General Corporation Law.

Any amendment, repeal or modification of the foregoing provisions of this Article Tenth shall not adversely affect any right or protection of any director, officer or other agent of the Corporation existing at the time of such amendment, repeal or modification.

ELEVENTH: The Corporation renounces, to the fullest extent permitted by law, any interest or expectancy of the Corporation in, or in being offered an opportunity to participate in, any Excluded Opportunity. An “**Excluded Opportunity**” is any matter, transaction or interest that is presented to, or acquired, created or developed by, or which otherwise comes into the possession of (i) any director of the Corporation who is not an employee of the Corporation or any of its subsidiaries, or (ii) any holder of Preferred Stock or any partner, member, director, stockholder, employee or agent of any such holder, other than someone who is an employee of the Corporation or any of its subsidiaries (collectively, "**Covered Persons**"), unless such matter, transaction or interest is presented to, or acquired, created or developed by, or otherwise comes into the possession of, a Covered Person expressly and solely in such Covered Person's capacity as a director of the Corporation.

TWELFTH: Unless the Corporation consents in writing to the selection of an alternative forum, the Court of Chancery in the State of Delaware shall be the sole and exclusive forum for any stockholder (including a beneficial owner) to bring (i) any derivative action or proceeding brought on behalf of the Corporation, (ii) any action asserting a claim of breach of 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 against the Corporation, its directors, officers or employees arising pursuant to any provision of the Delaware General Corporation Law or the Corporation's certificate of incorporation or bylaws or (iv) any action asserting a claim against the Corporation, its directors, officers or employees governed by the internal affairs doctrine, except for, as to each of (i) through (iv) above, any claim as to which the Court of Chancery determines that there is an indispensable party not subject to the jurisdiction of the Court of Chancery (and the indispensable party does not consent to the personal jurisdiction of the Court of Chancery within ten days following such determination), which is vested in the exclusive jurisdiction of a court or forum other than the Court of Chancery, or for which the Court of Chancery does not have subject matter jurisdiction. If any provision or provisions of this Article Twelfth shall be held to be invalid, illegal or unenforceable as applied to any person or entity or circumstance for any reason whatsoever, then, to the fullest extent permitted by law, the validity, legality and enforceability of such provisions in any other circumstance and of the remaining provisions of this Article Twelfth (including, without limitation, each portion of any sentence of this Article Twelfth containing any such provision held to be invalid, illegal or unenforceable that is not itself held to be invalid, illegal or unenforceable) and the application of such provision to other persons or entities and circumstances shall not in any way be affected or impaired thereby.

* * *

3. That the foregoing amendment and restatement was approved by the holders of the requisite number of shares of this corporation in accordance with Section 228 of the General Corporation Law.

4. That this Amended and Restated Certificate of Incorporation, which restates and integrates and further amends the provisions of this Corporation's Certificate of Incorporation, has been duly adopted in accordance with Sections 242 and 245 of the General Corporation Law.

[Remainder of Page Intentionally Blank]

IN WITNESS WHEREOF, this Amended and Restated Certificate of Incorporation has been executed by a duly authorized officer of this corporation on this 23rd day of May, 2018.

By: ______________________________

Reinhard Kandera, Assistant Secretary

Signature Page - Amended and Restated Certificate of Incorporation of HOOKIPA Pharma Inc.

Exhibit 3.3

AMENDED AND RESTATED

BY-LAWS

of

HOOKIPA Pharma Inc.

(the "Corporation")

1. Stockholders

(a) Annual Meeting. The annual meeting of stockholders shall be held for the election of directors each year at such place, date and time as shall be designated by the Board of Directors. Any other proper business may be transacted at the annual meeting. If no date for the annual meeting is established or said meeting is not held on the date established as provided above, a special meeting in lieu thereof may be held or there may be action by written consent of the stockholders on matters to be voted on at the annual meeting, and such special meeting or written consent shall have for the purposes of these By-laws or otherwise all the force and effect of an annual meeting.

(b) Special Meetings. Special meetings of stockholders may be called by the Chief Executive Officer, if one is elected, or, if there is no Chief Executive Officer, a President, or by the Board of Directors, but such special meetings may not be called by any other person or persons. The call for the meeting shall state the place, date, hour and purposes of the meeting. Only the purposes specified in the notice of special meeting shall be considered or dealt with at such special meeting.

(c) Notice of Meetings. Whenever stockholders are required or permitted to take any action at a meeting, a notice stating the place, if any, date and hour of the meeting, the means of remote communications, if any, by which stockholders and proxyholders may be deemed to be present and vote at such meeting, and, in the case of a special meeting, the purpose or purposes of the meeting, shall be given by the Secretary (or other person authorized by these By-laws or by law) not less than ten (10) nor more than sixty (60) days before the meeting to each stockholder entitled to vote thereat and to each stockholder who, under the Certificate of Incorporation or under these By-laws is entitled to such notice. If mailed, notice is given when deposited in the mail, postage prepaid, directed to such stockholder at such stockholder's address as it appears in the records of the Corporation. Without limiting the manner by which notice otherwise may be effectively given to stockholders, any notice to stockholders may be given by electronic transmission in the manner provided in Section 232 of the Delaware General Corporation Law (the "DGCL").

If a meeting is adjourned to another time or place, notice need not be given of the adjourned meeting if the time and place, if any, and the means of remote communications, if any, by which stockholders and proxyholders may be deemed to be present in person and vote at such adjourned meeting are announced at the meeting at which the adjournment is taken, except that if the adjournment is for more than thirty (30) days, or if after the adjournment a new record date is fixed for the adjourned meeting, notice of the adjourned meeting shall be given to each stockholder of record entitled to vote at the meeting.

(d) Quorum. The holders of a majority in interest of all stock issued, outstanding and entitled to vote at a meeting, present in person or represented by proxy, shall constitute a quorum. Any meeting may be adjourned from time to time by a majority of the votes properly cast upon the question, whether or not a quorum is present. The stockholders present at a duly constituted meeting may continue to transact business until adjournment notwithstanding the withdrawal of enough stockholders to reduce the voting shares below a quorum.

(e) Voting and Proxies. Except as otherwise provided by the Certificate of Incorporation or by law, each stockholder entitled to vote at any meeting of stockholders shall be entitled to one vote for each share of stock held by such stockholder which has voting power upon the matter in question. Each stockholder entitled to vote at a meeting of stockholders or to express consent or dissent to corporate action in writing without a meeting may authorize another person or persons to act for such stockholder by either written proxy or by a transmission permitted by Section 212(c) of the DGCL, but no proxy shall be voted or acted upon after three years from its date, unless the proxy provides for a longer period or is irrevocable and coupled with an interest. Proxies shall be filed with the Secretary of the meeting, or of any adjournment thereof. Except as otherwise limited therein, proxies shall entitle the persons authorized thereby to vote at any adjournment of such meeting.

(f) Action at Meeting. When a quorum is present, any matter before the meeting shall be decided by vote of the holders of a majority of the shares of stock voting on such matter except where a larger vote is required by law, by the Certificate of Incorporation or by these By-laws. Any election of directors by stockholders shall be determined by a plurality of the votes cast, except where a larger vote is required by law, by the Certificate of Incorporation or by these By-laws. The Corporation shall not directly or indirectly vote any share of its own stock; provided, however, that the Corporation may vote shares which it holds in a fiduciary capacity to the extent permitted by law.

(g) Presiding Officer. Meetings of stockholders shall be presided over by the Chairman of the Board, if one is elected, or in his or her absence, the Vice Chairman of the Board, if one is elected, or if neither is elected or in their absence, a President. The Board of Directors shall have the authority to appoint a temporary presiding officer to serve at any meeting of the stockholders if the Chairman of the Board, the Vice Chairman of the Board or a President is unable to do so for any reason.

(h) Conduct of Meetings. The Board of Directors may adopt by resolution such rules and regulations for the conduct of the meeting of stockholders as it shall deem appropriate. Except to the extent inconsistent with such rules and regulations as adopted by the Board of Directors, the presiding officer of any meeting of stockholders shall have the right and authority to prescribe such rules, regulations and procedures and to do all such acts as, in the judgment of such chairman, are appropriate for the proper conduct of the meeting. Such rules, regulations or procedures, whether adopted by the Board of Directors or prescribed by the presiding officer of the meeting, may include, without limitation, the following: (i) the establishment of an agenda or order of business for the meeting; (ii) rules and procedures for maintaining order at the meeting and the safety of those present; (iii) limitations on attendance at or participation in the meeting to stockholders of record of the Corporation, their duly authorized and constituted proxies or such other persons as the chairman of the meeting shall determine; (iv) restrictions on entry to the meeting after the time fixed for the commencement thereof; and (v) limitations on the time allotted to questions or comments by participants. Unless and to the extent determined by the Board of Directors or the presiding officer of the meeting, meetings of stockholders shall not be required to be held in accordance with the rules of parliamentary procedure.

(i) Action without a Meeting. Unless otherwise provided in the Certificate of Incorporation, any action required or permitted by law to be taken at any annual or special meeting of stockholders, may be taken without a meeting, without prior notice and without a vote, if a consent or consents in writing, setting forth the action so taken, shall be signed by the holders of outstanding stock having not less than the minimum number of votes that would be necessary to authorize or take such action at a meeting at which all shares entitled to vote thereon were present and voted and shall be delivered to the Corporation by delivery to its registered office, by hand or by certified mail, return receipt requested, or to the Corporation's principal place of business or to the officer of the Corporation having custody of the minute book. Every written consent shall bear the date of signature and no written consent shall be effective unless, within sixty (60) days of the earliest dated consent delivered pursuant to these By-laws, written consents signed by a sufficient number of stockholders entitled to take action are delivered to the Corporation in the manner set forth in these By-laws. Prompt notice of the taking of the corporate action without a meeting by less than unanimous written consent shall be given to those stockholders who have not consented in writing.

(j) Stockholder Lists. The officer who has charge of the stock ledger of the Corporation shall prepare and make, at least ten (10) days before every meeting of stockholders, a complete list of the stockholders entitled to vote at the meeting, arranged in alphabetical order, and showing the address of each stockholder and the number of shares registered in the name of each stockholder. Nothing contained in this Section 1(j) shall require the Corporation to include electronic mail addresses or other electronic contact information on such list. Such list shall be open to the examination of any stockholder, for any purpose germane to the meeting, for a period of at least ten (10) days prior to the meeting in the manner provided by law. The list shall also be open to the examination of any stockholder during the whole time of the meeting as provided by law.

2. Directors

(a) Powers. The business of the Corporation shall be managed by or under the direction of a Board of Directors who may exercise all the powers of the Corporation except as otherwise provided by law, by the Certificate of Incorporation or by these By-laws. In the event of a vacancy in the Board of Directors, the remaining directors, except as otherwise provided by law, may exercise the powers of the full Board until the vacancy is filled.

(b) Number and Qualification. Unless otherwise provided in the Certificate of Incorporation or in these By-laws, the number of directors which shall constitute the whole board shall be determined from time to time by resolution of the Board of Directors. Directors need not be stockholders.

(c) Vacancies; Reduction of Board. A majority of the directors then in office, although less than a quorum, or a sole remaining Director, may fill vacancies in the Board of Directors occurring for any reason and newly created directorships resulting from any increase in the authorized number of directors. In lieu of filling any vacancy, the Board of Directors may reduce the number of directors.

(d) Tenure. Except as otherwise provided by law, by the Certificate of Incorporation or by these By-laws, directors shall hold office until their successors are elected and qualified or until their earlier resignation or removal. Any director may resign at any time upon notice given in writing or by electronic transmission to the Corporation. Such resignation shall be effective upon receipt unless it is specified to be effective at some other time or upon the happening of some other event.

(e) Removal. To the extent permitted by law, a director may be removed from office with or without cause by vote of the holders of a majority of the shares of stock entitled to vote in the election of directors.

(f) Meetings. Regular meetings of the Board of Directors may be held without notice at such time, date and place as the Board of Directors may from time to time determine. Special meetings of the Board of Directors may be called, orally or in writing, by the Chief Executive Officer, if one is elected, or, if there is no Chief Executive Officer, the President, or by two or more Directors, designating the time, date and place thereof. Directors may participate in meetings of the Board of Directors by means of conference telephone or other communications equipment by means of which all directors participating in the meeting can hear each other, and participation in a meeting in accordance herewith shall constitute presence in person at such meeting.

(g) Notice of Meetings. Notice of the time, date and place of all special meetings of the Board of Directors shall be given to each director by the Secretary, or Assistant Secretary, or in case of the death, absence, incapacity or refusal of such persons, by the officer or one of the directors calling the meeting. Notice shall be given to each director in person, by telephone, or by facsimile, electronic mail or other form of electronic communications, sent to such director’s business or home address at least twenty-four (24) hours in advance of the meeting, or by written notice mailed to such director’s business or home address at least forty-eight (48) hours in advance of the meeting.

(h) Quorum. At any meeting of the Board of Directors, a majority of the total number of directors shall constitute a quorum for the transaction of business. Less than a quorum may adjourn any meeting from time to time and the meeting may be held as adjourned without further notice.

(i) Action at Meeting. At any meeting of the Board of Directors at which a quorum is present, unless otherwise provided in the following sentence, a majority of the directors present may take any action on behalf of the Board of Directors, unless a larger number is required by law, by the Certificate of Incorporation or by these By-laws. So long as there are two (2) or fewer Directors, any action to be taken by the Board of Directors shall require the approval of all Directors.

(j) Action by Consent. Any action required or permitted to be taken at any meeting of the Board of Directors may be taken without a meeting if all members of the Board of Directors consent thereto in writing or by electronic transmission, and the writing or writings or electronic transmission or transmissions are filed with the records of the meetings of the Board of Directors. 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.

(k) Committees. The Board of Directors may, by resolution passed by a majority of the whole Board of Directors, establish one or more committees, each committee to consist of one or more directors. 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 thereof 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 permitted by law and 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: (i) approving or adopting, or recommending to the stockholders, any action or matter expressly required by the DGCL to be submitted to stockholders for approval or (ii) adopting, amending or repealing any provision of these By-laws.

Except as the Board of Directors may otherwise determine, any such committee may make rules for the conduct of its business, but in the absence of such rules its business shall be conducted so far as possible in the same manner as is provided in these By-laws for the Board of Directors. All members of such committees shall hold their committee offices at the pleasure of the Board of Directors, and the Board may abolish any committee at any time.

3. Officers

(a) Enumeration. The officers of the Corporation shall consist of one or more Presidents (who, if there is more than one, shall be referred to as Co-Presidents), a Treasurer, a Secretary, and such other officers, including, without limitation, a Chief Executive Officer and one or more Vice Presidents (including Executive Vice Presidents or Senior Vice Presidents), Assistant Vice Presidents, Assistant Treasurers and Assistant Secretaries, as the Board of

Directors may determine. The Board of Directors may elect from among its members a Chairman of the Board and a Vice Chairman of the Board.

(b) Election. The Presidents, Treasurer and Secretary shall be elected annually by the Board of Directors at their first meeting following the annual meeting of stockholders. Other officers may be chosen by the Board of Directors at such meeting or at any other meeting.

(c) Qualification. No officer need be a stockholder or Director. Any two or more offices may be held by the same person. Any officer may be required by the Board of Directors to give bond for the faithful performance of such officer's duties in such amount and with such sureties as the Board of Directors may determine.

(d) Tenure. Except as otherwise provided by the Certificate of Incorporation or by these By-laws, each of the officers of the Corporation shall hold office until the first meeting of the Board of Directors following the next annual meeting of stockholders and until such officer's successor is elected and qualified or until such officer's earlier resignation or removal. Any officer may resign by delivering his or her written resignation to the Corporation, and such resignation shall be effective upon receipt unless it is specified to be effective at some other time or upon the happening of some other event.

(e) Removal. The Board of Directors may remove any officer with or without cause by a vote of a majority of the directors then in office.

(f) Vacancies. Any vacancy in any office may be filled for the unexpired portion of the term by the Board of Directors.

(g) Chairman of the Board and Vice Chairman. Unless otherwise provided by the Board of Directors, the Chairman of the Board of Directors, if one is elected, shall preside, when present, at all meetings of the stockholders and the Board of Directors. The Chairman of the Board shall have such other powers and shall perform such duties as the Board of Directors may from time to time designate.

Unless otherwise provided by the Board of Directors, in the absence of the Chairman of the Board, the Vice Chairman of the Board, if one is elected, shall preside, when present, at all meetings of the stockholders and the Board of Directors. The Vice Chairman of the Board shall have such other powers and shall perform such duties as the Board of Directors may from time to time designate.

(h) Chief Executive Officer. The Chief Executive Officer, if one is elected, shall have such powers and shall perform such duties as the Board of Directors may from time to time designate.

(i) Presidents. The Presidents shall, subject to the direction of the Board of Directors, each have general supervision and control of the Corporation's business and any action that would typically be taken by a President may be taken by any Co-President. If there is no Chairman of the Board or Vice Chairman of the Board, a President shall preside, when present, at all meetings of stockholders and the Board of Directors. The Presidents shall have such other powers and shall perform such duties as the Board of Directors may from time to time designate.

(j) Vice Presidents and Assistant Vice Presidents. Any Vice President (including any Executive Vice President or Senior Vice President) and any Assistant Vice President shall have such powers and shall perform such duties as the Board of Directors may from time to time designate.

(k) Treasurer and Assistant Treasurers. The Treasurer shall, subject to the direction of the Board of Directors, have general charge of the financial affairs of the Corporation and shall cause to be kept accurate books of account. The Treasurer shall have custody of all funds, securities, and valuable documents of the Corporation, except as the Board of Directors may otherwise provide. The Treasurer shall have such other powers and shall perform such duties as the Board of Directors may from time to time designate.

Any Assistant Treasurer shall have such powers and perform such duties as the Board of Directors may from time to time designate.

(l) Secretary and Assistant Secretaries. The Secretary shall record the proceedings of all meetings of the stockholders and the Board of Directors (including committees of the Board) in books kept for that purpose. In the absence of the Secretary from any such meeting an Assistant Secretary, or if such person is absent, a temporary secretary chosen at the meeting, shall record the proceedings thereof. The Secretary shall have charge of the stock ledger (which may, however, be kept by any transfer or other agent of the Corporation) and shall have such other duties and powers as may be designated from time to time by the Board of Directors.

Any Assistant Secretary shall have such powers and perform such duties as the Board of Directors may from time to time designate.

(m) Other Powers and Duties. Subject to these By-laws, each officer of the Corporation shall have in addition to the duties and powers specifically set forth in these By-laws, such duties and powers as are customarily incident to such officer's office, and such duties and powers as may be designated from time to time by the Board of Directors.

4. Capital Stock

(a) Certificates of Stock. Each stockholder shall be entitled to a certificate of the capital stock of the Corporation in such form as may from time to time be prescribed by the Board of Directors. Such certificate shall be signed by a President or a Vice President, and by the Treasurer or an Assistant Treasurer, or the Secretary or an Assistant Secretary. Such signatures may be a facsimile. In case any officer, transfer agent or registrar who has signed or whose facsimile signature has been placed on such 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 time of its issue. Every certificate for shares of stock which are subject to any restriction on transfer and every certificate issued when the Corporation is authorized to issue more than one

class or series of stock shall contain such legend with respect thereto as is required by law. The Corporation shall be permitted to issue fractional shares.

(b) Transfers. Subject to any restrictions on transfer, shares of stock may be transferred on the books of the Corporation by the surrender to the Corporation or its transfer agent of the certificate therefor properly endorsed or accompanied by a written assignment or power of attorney properly executed, with transfer stamps (if necessary) affixed, and with such proof of the authenticity of signature as the Corporation or its transfer agent may reasonably require.

(c) Record Holders. Except as may otherwise be required by law, by the Certificate of Incorporation or by these By-laws, the Corporation shall be entitled to treat the record holder of stock as shown on its books as the owner of such stock for all purposes, including the payment of dividends and the right to vote with respect thereto, regardless of any transfer, pledge or other disposition of such stock, until the shares have been transferred on the books of the Corporation in accordance with the requirements of these By-laws.

It shall be the duty of each stockholder to notify the Corporation of such stockholder's post office address.

(d) Record Date. In order that the Corporation may determine the stockholders entitled to notice of or to vote at any meeting of stockholders or any adjournment thereof, or to consent to corporate action in writing without a meeting, or entitled to receive payment of any dividend or other distribution or allotment of any rights, or 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, in advance, a record date, which shall not precede the date on which it is established, and which shall not be more than sixty (60) nor less than ten (10) days before the date of such meeting, more than ten (10) days after the date on which the record date for stockholder consent without a meeting is established, nor more than sixty (60) days prior to any other action. In such case only stockholders of record on such record date shall be so entitled notwithstanding any transfer of stock on the books of the Corporation after the record date.

If no record date is fixed, (i) 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, (ii) the record date for determining stockholders entitled to consent to corporate action in writing without a meeting, when no prior action by the Board of Directors is necessary, shall be the first date on which a signed written consent setting forth the action taken or proposed to be taken is delivered to the Corporation by delivery to its registered office in this state, to its principal place of business, or to an officer or agent of the Corporation having custody of the book in which proceedings of meetings of stockholders are recorded, and (iii) the record date for determining stockholders for any other purpose shall be at the close of business on the day on which the Board of Directors adopts the resolution relating thereto.

(e) Lost Certificates. The Corporation may issue a new certificate of stock in the place of any certificate theretofore issued by it, alleged to have been lost, stolen or destroyed, and the Corporation may require the owner of the lost, stolen or destroyed certificate, or his legal representative, to give the Corporation a bond sufficient to indemnify it against any claim that may be made against it on account of the alleged loss, theft or destruction of any such certificate or the issuance of such new certificate.

5. Indemnification

(a) Definitions. For purposes of this Section 5:

(i) "Corporate Status" describes the status of a person who is serving or has served (A) as a Director of the Corporation, (B) as an Officer of the Corporation, (C) as a Non-Officer Employee of the Corporation, or (D) as a director, partner, trustee, officer, employee or agent of any other corporation, partnership, limited liability company, joint venture, trust, employee benefit plan, foundation, association, organization or other legal entity for which such person is or was serving at the request of the Corporation. For purposes of this Section 5(a)(i), a Director, Officer or Non-Officer Employee of the Corporation who is serving or has served as a director, partner, trustee, officer, employee or agent of a Subsidiary shall be deemed to be serving at the request of the Corporation. Notwithstanding the foregoing, "Corporate Status" shall not include the status of a person who is serving or has served as a director, officer, employee or agent of a constituent corporation absorbed in a merger or consolidation transaction with the Corporation with respect to such person's activities prior to said transaction, unless specifically authorized by the Board of Directors or the stockholders of the Corporation;

(ii) "Director" means any person who serves or has served the Corporation as a director on the Board of Directors of the Corporation;

(iii) "Disinterested Director" means, with respect to each Proceeding in respect of which indemnification is sought hereunder, a Director of the Corporation who is not and was not a party to such Proceeding;

(iv) "Expenses" means all reasonable attorneys fees, retainers, court costs, transcript costs, fees of expert witnesses, private investigators and professional advisors (including, without limitation, accountants and investment bankers), travel expenses, duplicating costs, printing and binding costs, costs of preparation of demonstrative evidence and other courtroom presentation aids and devices, costs incurred in connection with document review, organization, imaging and computerization, telephone charges, postage, delivery service fees, and all other disbursements, costs or expenses of the type customarily incurred in connection with prosecuting, defending, preparing to prosecute or defend, investigating, being or preparing to be a witness in, settling or otherwise participating in, a Proceeding;

(v) "Liabilities" means judgments, damages, liabilities, losses, penalties, excise taxes, fines and amounts paid in settlement;

(vi) "Non-Officer Employee" means any person who serves or has served as an employee or agent of the Corporation, but who is not or was not a Director or Officer;

(vii) "Officer" means any person who serves or has served the Corporation as an officer of the Corporation appointed by the Board of Directors of the Corporation;

(viii) "Proceeding" means any threatened, pending or completed action, suit, arbitration, alternate dispute resolution mechanism, inquiry, investigation, administrative hearing or other proceeding, whether civil, criminal, administrative, arbitrative or investigative; and

(ix) "Subsidiary" shall mean any corporation, partnership, limited liability company, joint venture, trust or other entity of which the Corporation owns (either directly or through or together with another Subsidiary of the Corporation) either (i) a general partner, managing member or other similar interest or (ii) (A) 50% or more of the voting power of the voting capital equity interests of such corporation, partnership, limited liability company, joint venture or other entity, or (B) 50% or more of the outstanding voting capital stock or other voting equity interests of such corporation, partnership, limited liability company, joint venture or other entity.

(b) Indemnification of Directors and Officers. Subject to the operation of Section 5(d) of these By-laws, each Director and Officer shall be indemnified and held harmless by the Corporation to the fullest extent authorized by the DGCL, as the same exists or may hereafter be amended (but, in the case of any such amendment, only to the extent that such amendment permits the Corporation to provide broader indemnification rights than such law permitted the Corporation to provide prior to such amendment), and to the extent authorized in subsections (i) through (iv) of this Section 5(b).

(i) Actions, Suits and Proceedings Other than By or In the Right of the Corporation. Each Director and Officer shall be indemnified and held harmless by the Corporation against any and all Expenses and Liabilities that are incurred or paid by such Director or Officer or on such Director's or Officer's behalf in connection with any Proceeding or any claim, issue or matter therein (other than an action by or in the right of the Corporation), which such Director or Officer is, or is threatened to be made, a party to or participant in by reason of such Director's or Officer's Corporate Status, if such Director or Officer acted in good faith and in a manner such Director or Officer reasonably believed to be in or not opposed to the best interests of the Corporation and, with respect to any criminal proceeding, had no reasonable cause to believe his or her conduct was unlawful.

(ii) Actions, Suits and Proceedings By or In the Right of the Corporation. Each Director and Officer shall be indemnified and held harmless by the Corporation against any and all Expenses that are incurred by such Director or Officer or on such Director's or Officer's behalf in connection with any Proceeding or any claim, issue or matter therein by or in the right of the Corporation, which such Director or

Officer is, or is threatened to be made, a party to or participant in by reason of such Director's or Officer's Corporate Status, if such Director or Officer acted in good faith and in a manner such Director or Officer reasonably believed to be in or not opposed to the best interests of the Corporation; provided, however, that no indemnification shall be made under this Section 5(b)(ii) in respect of any claim, issue or matter as to which such Director or Officer shall have been finally adjudged by a court of competent jurisdiction to be liable to the Corporation, unless, and only to the extent that, the Court of Chancery or another court in which such Proceeding was brought shall determine upon application that, despite adjudication of liability, but in view of all the circumstances of the case, such Director or Officer is fairly and reasonably entitled to indemnification for such Expenses that such court deems proper.

(iii) Survival of Rights. The rights of indemnification provided by this Section 5(b) shall continue as to a Director or Officer after he or she has ceased to be a Director or Officer and shall inure to the benefit of his or her heirs, executors, administrators and personal representatives.

(iv) Actions by Directors or Officers. Notwithstanding the foregoing, the Corporation shall indemnify any Director or Officer seeking indemnification in connection with a Proceeding initiated by such Director or Officer only if such Proceeding (including any parts of such Proceeding not initiated by such Director or Officer) was authorized in advance by the Board of Directors of the Corporation, unless such Proceeding was brought to enforce such Officer's or Director's rights to indemnification or, in the case of Directors, advancement of Expenses under these By-laws in accordance with the provisions set forth herein.

(c) Indemnification of Non-Officer Employees. Subject to the operation of Section 5(d) of these By-laws, each Non-Officer Employee may, in the discretion of the Board of Directors of the Corporation, be indemnified by the Corporation to the fullest extent authorized by the DGCL, as the same exists or may hereafter be amended, against any or all Expenses and Liabilities that are incurred by such Non-Officer Employee or on such Non-Officer Employee's behalf in connection with any threatened, pending or completed Proceeding, or any claim, issue or matter therein, which such Non-Officer Employee is, or is threatened to be made, a party to or participant in by reason of such Non-Officer Employee's Corporate Status, if such Non-Officer Employee acted in good faith and in a manner such Non-Officer Employee reasonably believed to be in or not opposed to the best interests of the Corporation and, with respect to any criminal proceeding, had no reasonable cause to believe his or her conduct was unlawful. The rights of indemnification provided by this Section 5(c) shall exist as to a Non-Officer Employee after he or she has ceased to be a Non-Officer Employee and shall inure to the benefit of his or her heirs, personal representatives, executors and administrators. Notwithstanding the foregoing, the Corporation may indemnify any Non-Officer Employee seeking indemnification in connection with a Proceeding initiated by such Non-Officer Employee only if such Proceeding was authorized in advance by the Board of Directors of the Corporation.

(d) Determination. Unless ordered by a court, no indemnification shall be provided pursuant to this Section 5 to a Director, to an Officer or to a Non-Officer Employee unless a determination shall have been made that such person acted in good faith and in a manner such person reasonably believed to be in or not opposed to the best interests of the Corporation and, with respect to any criminal Proceeding, such person had no reasonable cause to believe his or her conduct was unlawful. Such determination shall be made by (i) a majority vote of the Disinterested Directors, even though less than a quorum of the Board of Directors, (ii) a committee comprised of Disinterested Directors, such committee having been designated by a majority vote of the Disinterested Directors (even though less than a quorum), (iii) if there are no such Disinterested Directors, or if a majority of Disinterested Directors so directs, by independent legal counsel in a written opinion, or (iv) by the stockholders of the Corporation.

(e) Advancement of Expenses to Directors Prior to Final Disposition.

(i) The Corporation shall advance all Expenses incurred by or on behalf of any Director in connection with any Proceeding in which such Director is involved by reason of such Director's Corporate Status within thirty (30) days after the receipt by the Corporation of a written statement from such Director requesting such advance or advances from time to time, whether prior to or after final disposition of such Proceeding. Such statement or statements shall reasonably evidence the Expenses incurred by such Director and shall be preceded or accompanied by an undertaking by or on behalf of such Director to repay any Expenses so advanced if it shall ultimately be determined that such Director is not entitled to be indemnified against such Expenses. Notwithstanding the foregoing, the Corporation shall advance all Expenses incurred by or on behalf of any Director seeking advancement of expenses hereunder in connection with a Proceeding initiated by such Director only if such Proceeding (including any parts of such Proceeding not initiated by such Director) was (A) authorized by the Board of Directors of the Corporation, or (B) brought to enforce such Director's rights to indemnification or advancement of Expenses under these By-laws.

(ii) If a claim for advancement of Expenses hereunder by a Director is not paid in full by the Corporation within thirty (30) days after receipt by the Corporation of documentation of Expenses and the required undertaking, such Director may at any time thereafter bring suit against the Corporation to recover the unpaid amount of the claim and if successful in whole or in part, such Director shall also be entitled to be paid the expenses of prosecuting such claim. The failure of the Corporation (including its Board of Directors or any committee thereof, independent legal counsel, or stockholders) to make a determination concerning the permissibility of such advancement of Expenses under this Section 5 shall not be a defense to an action brought by a Director for recovery of the unpaid amount of an advancement claim and shall not create a presumption that such advancement is not permissible. The burden of proving that a Director is not entitled to an advancement of expenses shall be on the Corporation.

(iii) In any suit brought by the Corporation to recover an advancement of expenses pursuant to the terms of an undertaking, the Corporation shall be entitled to recover such expenses upon a final adjudication that the Director has not met any applicable standard for indemnification set forth in the DGCL.

(f) Advancement of Expenses to Officers and Non-Officer Employees Prior to Final Disposition.

(i) The Corporation may, at the discretion of the Board of Directors of the Corporation, advance any or all Expenses incurred by or on behalf of any Officer or any Non-Officer Employee in connection with any Proceeding in which such person is involved by reason of his or her Corporate Status as an Officer or Non-Officer Employee upon the receipt by the Corporation of a statement or statements from such Officer or Non-Officer Employee requesting such advance or advances from time to time, whether prior to or after final disposition of such Proceeding. Such statement or statements shall reasonably evidence the Expenses incurred by such Officer or Non-Officer Employee and shall be preceded or accompanied by an undertaking by or on behalf of such person to repay any Expenses so advanced if it shall ultimately be determined that such Officer or Non-Officer Employee is not entitled to be indemnified against such Expenses.

(ii) In any suit brought by the Corporation to recover an advancement of expenses pursuant to the terms of an undertaking, the Corporation shall be entitled to recover such expenses upon a final adjudication that the Officer or Non-Officer Employee has not met any applicable standard for indemnification set forth in the DGCL.

(g) Contractual Nature of Rights.

(i) The provisions of this Section 5 shall be deemed to be a contract between the Corporation and each Director and Officer entitled to the benefits hereof at any time while this Section 5 is in effect, in consideration of such person's past or current and any future performance of services for the Corporation. Neither amendment, repeal or modification of any provision of this Section 5 nor the adoption of any provision of the Certificate of Incorporation inconsistent with this Section 5 shall eliminate or reduce any right conferred by this Section 5 in respect of any act or omission occurring, or any cause of action or claim that accrues or arises or any state of facts existing, at the time of or before such amendment, repeal, modification or adoption of an inconsistent provision (even in the case of a proceeding based on such a state of facts that is commenced after such time), and all rights to indemnification and advancement of Expenses granted herein or arising out of any act or omission shall vest at the time of the act or omission in question, regardless of when or if any proceeding with respect to such act or omission is commenced. The rights to indemnification and to advancement of expenses provided by, or granted pursuant to, this Section 5 shall continue notwithstanding that the person has ceased to be a director or officer of the Corporation and shall inure to the benefit of the estate, heirs, executors, administrators, legatees and distributees of such person.

(ii) If a claim for indemnification hereunder by a Director or Officer is not paid in full by the Corporation within sixty (60) days after receipt by the Corporation of a written claim for indemnification, such Director or Officer may at any time thereafter bring suit against the Corporation to recover the unpaid amount of the claim, and if successful in whole or in part, such Director or Officer shall also be entitled to be paid the expenses of prosecuting such claim. The failure of the Corporation (including its Board of Directors or any committee thereof, independent legal counsel, or stockholders) to make a determination concerning the permissibility of such indemnification under this Section 5 shall not be a defense to an action brought by a Director or Officer for recovery of the unpaid amount of an indemnification claim and shall not create a presumption that such indemnification is not permissible. The burden of proving that a Director or Officer is not entitled to indemnification shall be on the Corporation.

(iii) In any suit brought by a Director or Officer to enforce a right to indemnification hereunder, it shall be a defense that such Director or Officer has not met any applicable standard for indemnification set forth in the DGCL.

(h) Non-Exclusivity of Rights. The rights to indemnification and advancement of Expenses set forth in this Section 5 shall not be exclusive of any other right which any Director, Officer, or Non-Officer Employee may have or hereafter acquire under any statute, provision of the Certificate or these By-laws, agreement, vote of stockholders or Disinterested Directors or otherwise.

(i) Insurance. The Corporation may maintain insurance, at its expense, to protect itself and any Director, Officer or Non-Officer Employee against any liability of any character asserted against or incurred by the Corporation or any such Director, Officer or Non-Officer Employee, or arising out of any such person's Corporate Status, whether or not the Corporation would have the power to indemnify such person against such liability under the DGCL or the provisions of this Section 5.

(j) Other Indemnification. The Corporation's obligation, if any, to indemnify or provide advancement of Expenses to any person under this Section 5 as a result of such person serving, at the request of the Corporation, as a director, partner, trustee, officer, employee or agent of another corporation, partnership, joint venture, trust, employee benefit plan or other enterprise shall be reduced by any amount such person may collect as indemnification or advancement of Expenses from such other corporation, partnership, joint venture, trust, employee benefit plan or enterprise (the "Primary Indemnitor"). Any indemnification or advancement of Expenses under this Section 5 owed by the Corporation as a result of a person serving, at the request of the Corporation, as a director, partner, trustee, officer, employee or agent of another corporation, partnership, joint venture, trust, employee benefit plan or other enterprise shall only be in excess of, and shall be secondary to, the indemnification or advancement of Expenses available from the applicable Primary Indemnitor(s) and any applicable insurance policies.

6. Miscellaneous Provisions

(a) Fiscal Year. Except as otherwise determined by the Board of Directors, the fiscal year of the Corporation shall end on December 31 of each year.

(b) Seal. The Board of Directors shall have power to adopt and alter the seal of the Corporation.

(c) Execution of Instruments. Subject to any limitations which may be set forth in a resolution of the Board of Directors, all deeds, leases, transfers, contracts, bonds, notes and other obligations to be entered into by the Corporation in the ordinary course of its business without director action may be executed on behalf of the Corporation by, a President, or by any other officer, employee or agent of the Corporation as the Board of Directors may authorize.

(d) Voting of Securities. Unless the Board of Directors otherwise provides, a President, any Vice President or the Treasurer may waive notice of and act on behalf of this Corporation, or appoint another person or persons to act as proxy or attorney in fact for this Corporation with or without discretionary power and/or power of substitution, at any meeting of stockholders or shareholders of any other corporation or organization, any of whose securities are held by this Corporation.

(e) Resident Agent. The Board of Directors may appoint a resident agent upon whom legal process may be served in any action or proceeding against the Corporation.

(f) Corporate Records. The original or attested copies of the Certificate of Incorporation, By-laws and records of all meetings of the incorporators, stockholders and the Board of Directors and the stock and transfer records, which shall contain the names of all stockholders, their record addresses and the amount of stock held by each, shall be kept at the principal office of the Corporation, at the office of its counsel, or at an office of its transfer agent.

(g) Certificate of Incorporation. All references in these By-laws to the Certificate of Incorporation shall be deemed to refer to the Certificate of Incorporation of the Corporation, as amended and in effect from time to time.

(h) Amendments. These By-laws may be altered, amended or repealed, and new By-laws may be adopted, by the stockholders or by the Board of Directors; provided, that (a) the Board of Directors may not alter, amend or repeal any provision of these By-laws which by law, by the Certificate of Incorporation or by these By-laws requires action by the stockholders and (b) any alteration, amendment or repeal of these By-laws by the Board of Directors and any new By-law adopted by the Board of Directors may be altered, amended or repealed by the stockholders.

(i) Waiver of Notice. Whenever notice is required to be given under any provision of these By-laws, a written waiver, signed by the person entitled to notice, or a waiver by electronic transmission by the person entitled to notice, whether before or after the time of the event for which notice is to be given, 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 a 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. Neither the business to be transacted at, nor the purpose of, any meeting needs to be specified in any written waiver or any waiver by electronic transmission.

Adopted May 23, 2018

Exhibit 10.1

HOOKIPA PHARMA INC.

2018 STOCK OPTION AND GRANT PLAN

SECTION 1. GENERAL PURPOSE OF THE PLAN; DEFINITIONS

The name of the plan is the HOOKIPA Pharma Inc. 2018 Stock Option and Grant Plan (the "Plan"). The purpose of the Plan is to encourage and enable the officers, employees, directors, Consultants and other key persons of HOOKIPA Pharma Inc., a Delaware corporation (including any successor entity, the "Company") and its Subsidiaries, upon whose judgment, initiative and efforts the Company largely depends for the successful conduct of its business, to acquire a proprietary interest in the Company. In connection with the legal restructuring resolved and approved by the Hookipa Biotech AG shareholders meeting on 23 May, 2018, options under this 2018 Stock Option and Grant Plan shall replace the options granted by Hookipa Biotech AG and outstanding at the time of the effectiveness of the restructuring transaction at essentially the same commercial terms.

The following terms shall be defined as set forth below:

"*Affiliate*" of any Person means a Person that directly or indirectly, through one or more intermediaries, controls, is controlled by or is under common control with the first mentioned Person. A Person shall be deemed to control another Person if such first Person possesses directly or indirectly the power to direct, or cause the direction of, the management and policies of the second Person, whether through the ownership of voting securities, by contract or otherwise.

"*Award*" or "*Awards,*" except where referring to a particular category of grant under the Plan, shall include Incentive Stock Options, Non-Qualified Stock Options, Restricted Stock Awards, Unrestricted Stock Awards, Restricted Stock Units or any combination of the foregoing.

"Award Agreement" means a written or electronic agreement setting forth the terms and provisions applicable to an Award granted under the Plan. Each Award Agreement may contain terms and conditions in addition to those set forth in the Plan; *provided, however,* in the event of any conflict in the terms of the Plan and the Award Agreement, the terms of the Plan shall govern**.**

"*Board*" means the Board of Directors of the Company.

"*Cause*" shall have the meaning as set forth in the Award Agreement(s). In the case that any Award Agreement does not contain a definition of "Cause," it shall mean (i) the grantee's dishonest statements or acts with respect to the Company or any Affiliate of the Company, or any current or prospective customers, suppliers vendors or other third parties with which such entity does business; (ii) the grantee's commission of (A) a felony or (B) any misdemeanor involving moral turpitude, deceit, dishonesty or fraud; (iii) the grantee's failure to perform his assigned duties and responsibilities to the reasonable satisfaction of the Company which failure continues, in the reasonable judgment of the Company, after written notice given to the grantee by the Company; (iv) the grantee's gross negligence, willful misconduct or insubordination with respect to the Company or any Affiliate of the Company; or (v) the grantee's material violation of any provision of any agreement(s) between the grantee and the Company relating to noncompetition, nonsolicitation, nondisclosure and/or assignment of inventions.

"Chief Executive Officer" means the Chief Executive Officer of the Company or, if there is no Chief Executive Officer, then the President of the Company.

"*Code*" means the Internal Revenue Code of 1986, as amended, and any successor Code, and related rules, regulations and interpretations.

"*Committee*" means the Committee of the Board referred to in Section 2.

"Consultant" means any natural person that provides bona fide services to the Company (including a Subsidiary), and such services are not in connection with the offer or sale of securities in a capital-raising transaction and do not directly or indirectly promote or maintain a market for the Company's securities.

"*Disability*" means "disability" as defined in Section 422(c) of the Code.

"*Effective Date*" means the date on which the Plan is adopted as set forth on the final page of the Plan.

"*Exchange Act*" means the Securities Exchange Act of 1934, as amended, and the rules and regulations thereunder.

"*Fair Market Value*" of the Stock on any given date means the fair market value of the Stock determined in good faith by the Committee based on the reasonable application of a reasonable valuation method not inconsistent with Section 409A of the Code. If the Stock is admitted to trade on a national securities exchange, the determination shall be made by reference to the closing price reported on such exchange. If there is no closing price for such date, the determination shall be made by reference to the last date preceding such date for which there is a closing price. If the date for which Fair Market Value is determined is the first day when trading prices for the Stock are reported on a national securities exchange, the Fair Market Value shall be the "Price to the Public" (or equivalent) set forth on the cover page for the final prospectus relating to the Company's Initial Public Offering.

"Good Reason" shall have the meaning as set forth in the Award Agreement(s). In the case that any Award Agreement does not contain a definition of "Good Reason," it shall mean (i) a material diminution in the grantee's base salary except for across-the-board salary reductions similarly affecting all or substantially all similarly situated employees of the Company or (ii) a change of more than 50 miles in the geographic location at which the grantee provides services to the Company, so long as the grantee provides at least 90 days notice to the Company following the initial occurrence of any such event and the Company fails to cure such event within 30 days thereafter.

"*Grant Date"* means the date that the Committee designates in its approval of an Award in accordance with applicable law as the date on which the Award is granted, which date may not precede the date of such Committee approval.

"Holder" means, with respect to an Award or any Shares, the Person holding such Award or Shares, including the initial recipient of the Award or any Permitted Transferee.

"*Incentive Stock Option*" means any Stock Option designated and qualified as an "incentive stock option" as defined in Section 422 of the Code.

"*Initial Public Offering*" means the consummation of the first firm commitment underwritten public offering pursuant to an effective registration statement under the Securities Act covering the offer and sale by the Company of its equity securities, as a result of or following which the Stock shall be publicly held.

"*Non-Qualified Stock Option*" means any Stock Option that is not an Incentive Stock Option.

"*Option*" or "*Stock Option*" means any option to purchase shares of Stock granted pursuant to Section 5.

"*Permitted Transferees*" shall mean any of the following to whom a Holder may transfer Shares hereunder (as set forth in Section 9(a)(ii)(A)): the Holder's 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, any person sharing the Holder's household (other than a tenant or employee), a trust in which these persons have more than fifty percent of the beneficial interest, a foundation in which these persons control the management of assets, and any other entity in which these persons own more than fifty percent of the voting interests*; provided, however,* that any such trust does not require or permit distribution of any Shares during the term of the Award Agreement unless subject to its terms. Upon the death of the Holder, the term Permitted Transferees shall also include such deceased Holder's estate, executors, administrators, personal representatives, heirs, legatees and distributees, as the case may be.

"*Person*" shall mean any individual, corporation, partnership (limited or general), limited liability company, limited liability partnership, association, trust, joint venture, unincorporated organization or any similar entity.

"Restricted Stock Award" means Awards granted pursuant to Section 6 and *"Restricted Stock"* means Shares issued pursuant to such Awards.

"*Restricted Stock Unit"* means an Award of phantom stock units to a grantee, which may be settled in cash or Shares as determined by the Committee, pursuant to Section 8.

"*Sale Event"* means the consummation of (i) the dissolution or liquidation of the Company, (ii) the sale of all or substantially all of the assets of the Company on a consolidated basis to an unrelated person or entity, (iii) a merger, reorganization or consolidation pursuant to which the holders of the Company's outstanding voting power immediately prior to such transaction do not own a majority of the outstanding voting power of the surviving or resulting entity (or its ultimate parent, if applicable), (iv) the acquisition of all or a majority of the outstanding voting stock of the Company in a single transaction or a series of related transactions by a Person or group of Persons, or (v) any other acquisition of the business of the Company, as determined by the Board; *provided*, *however,* that the Company's Initial Public Offering, any subsequent public offering or another capital raising event, or a merger effected solely to change the Company's domicile shall not constitute a "Sale Event."

"Section 409A" means Section 409A of the Code and the regulations and other guidance promulgated thereunder.

"*Securities Act*" means the Securities Act of 1933, as amended, and the rules and regulations thereunder.

"Service Relationship" means any relationship as a full-time employee, part-time employee, director or other key person (including Consultants) of the Company or any Subsidiary or any successor entity (e.g., a Service Relationship shall be deemed to continue without interruption in the event an individual's status changes from full-time employee to part-time employee or Consultant).

"Shares" means shares of Stock.

"*Stock*" means the Common Stock, par value $0.0001 per share, of the Company.

"*Subsidiary*" means any corporation or other entity (other than the Company) in which the Company has more than a 50 percent interest, either directly or indirectly.

"Ten Percent Owner" means an employee who owns or is deemed to own (by reason of the attribution rules of Section 424(d) of the Code) more than 10 percent of the combined voting power of all classes of stock of the Company or any parent of the Company or any Subsidiary.

"Termination Event" means the termination of the Award recipient's Service Relationship with the Company and its Subsidiaries for any reason whatsoever, regardless of the circumstances thereof, and including, without limitation, upon death, disability, retirement, discharge or resignation for any reason, whether voluntarily or involuntarily. The following shall not constitute a Termination Event: (i) a transfer to the service of the Company from a Subsidiary or from the Company to a Subsidiary, or from one Subsidiary to another Subsidiary or (ii) an approved leave of absence for military service or sickness, or for any other purpose approved by the Committee, if the individual's right to re-employment is guaranteed either by a statute or by contract or under the policy pursuant to which the leave of absence was granted or if the Committee otherwise so provides in writing.

"*Unrestricted Stock Award"* means any Award granted pursuant to Section 7 and *"Unrestricted Stock"* means Shares issued pursuant to such Awards.

SECTION 2. ADMINISTRATION OF PLAN; COMMITTEE AUTHORITY TO SELECT GRANTEES AND DETERMINE AWARDS

(a) Administration of Plan. The Plan shall be administered by the Board, or at the discretion of the Board, by a committee of the Board, comprised of not less than two directors. All references herein to the "Committee" shall be deemed to refer to the group then responsible for administration of the Plan at the relevant time (i.e., either the Board of Directors or a committee or committees of the Board, as applicable).

(b) Powers of Committee. The Committee shall have the power and authority to grant Awards consistent with the terms of the Plan, including the power and authority:

(i) to select the individuals to whom Awards may from time to time be granted;

(ii) to determine the time or times of grant, and the amount, if any, of Incentive Stock Options, Non-Qualified Stock Options, Restricted Stock Awards, Unrestricted Stock Awards, Restricted Stock Units, or any combination of the foregoing, granted to any one or more grantees;

(iii) to determine the number of Shares to be covered by any Award and, subject to the provisions of the Plan, the price, exercise price, conversion ratio or other price relating thereto;

(iv) to determine and, subject to Section 12, to modify from time to time the terms and conditions, including restrictions, not inconsistent with the terms of the Plan, of any Award, which terms and conditions may differ among individual Awards and grantees, and to approve the form of Award Agreements;

(v) to accelerate at any time the exercisability or vesting of all or any portion of any Award;

(vi) to impose any limitations on Awards, including limitations on transfers, repurchase provisions and the like, and to exercise repurchase rights or obligations;

(vii) subject to Section 5(a)(ii) and any restrictions imposed by Section 409A, to extend at any time the period in which Stock Options may be exercised; and

(viii) at any time to adopt, alter and repeal such rules, guidelines and practices for administration of the Plan and for its own acts and proceedings as it shall deem advisable; to interpret the terms and provisions of the Plan and any Award (including Award Agreements); to make all determinations it deems advisable for the administration of the Plan; to decide all disputes arising in connection with the Plan; and to otherwise supervise the administration of the Plan.

All decisions and interpretations of the Committee shall be binding on all persons, including the Company and all Holders.

(c) Award Agreement. Awards under the Plan shall be evidenced by Award Agreements that set forth the terms, conditions and limitations for each Award.

(d) Indemnification. Neither the Board nor the Committee, nor any member of either or any delegate thereof, shall be liable for any act, omission, interpretation, construction or determination made in good faith in connection with the Plan, and the members of the Board and the Committee (and any delegate thereof) shall be entitled in all cases to indemnification and reimbursement by the Company in respect of any claim, loss, damage or expense (including, without limitation, reasonable attorneys' fees) arising or resulting therefrom to the fullest extent permitted by law and/or under the Company's governing documents, including its certificate of incorporation or bylaws, or any directors' and officers' liability insurance coverage which may be in effect from time to time and/or any indemnification agreement between such individual and the Company.

(e) Foreign Award Recipients. Notwithstanding any provision of the Plan to the contrary, in order to comply with the laws in other countries in which the Company and any Subsidiary operate or have employees or other individuals eligible for Awards, the Committee, in its sole discretion, shall have the power and authority to: (i) determine which additional Subsidiaries, if any, shall be covered by the Plan; (ii) determine which individuals, if any, outside the United States or Austria are eligible to participate in the Plan; (iii) modify the terms and conditions of any Award granted to individuals outside the United States to comply with applicable foreign laws; (iv) establish subplans and modify exercise procedures and other terms and procedures, to the extent the Committee determines such actions to be necessary or advisable (and such subplans and/or modifications shall be attached to the Plan as appendices); provided, however, that no such subplans and/or modifications shall increase the share limitation contained in Section 3(a) hereof; and (v) take any action, before or after an Award is made, that the Committee determines to be necessary or advisable to obtain approval or comply with any local governmental regulatory exemptions or approvals.

SECTION 3. STOCK ISSUABLE UNDER THE PLAN; MERGERS AND OTHER TRANSACTIONS; SUBSTITUTION

(a) Stock Issuable. The maximum number of Shares reserved and available for issuance under the Plan shall be 183,237 Shares, subject to adjustment as provided in Section 3(b). For purposes of this limitation, the Shares underlying any Awards that are forfeited, canceled, reacquired by the Company prior to vesting, satisfied without the issuance of Stock or otherwise terminated (other than by exercise) and Shares that are withheld upon exercise of an Option or settlement of an Award to cover the exercise price or tax withholding shall be added back to the Shares available for issuance under the Plan. Subject to such overall limitations, Shares may be issued up to such maximum number pursuant to any type or types of Award, and no more than 183,237 Shares may be issued pursuant to Incentive Stock Options. The Shares available for issuance under the Plan may be authorized but unissued Shares or Shares reacquired by the Company. Beginning on the date that the Company becomes subject to Section 162(m) of the Code, Options with respect to no more than 183,237 Shares shall be granted to any one individual in any calendar year period.

(b) Changes in Stock. Subject to Section 3(c) hereof, if, as a result of any reorganization, recapitalization, reclassification, stock dividend, stock split, reverse stock split or other similar change in the Company's capital stock, the outstanding Shares are increased or decreased or are exchanged for a different number or kind of shares or other securities of the Company, or additional Shares or new or different shares or other securities of the Company or other non-cash assets are distributed with respect to such Shares or other securities, in each case, without the receipt of consideration by the Company, or, if, as a result of any merger or consolidation, or sale of all or substantially all of the assets of the Company, the outstanding Shares are converted into or exchanged for other securities of the Company or any successor entity (or a parent or subsidiary thereof), the Committee shall make an appropriate and proportionate adjustment in (i) the maximum number of Shares reserved for issuance under the Plan, (ii) the number and kind of Shares or other securities subject to any then outstanding Awards under the Plan, (iii) the repurchase price, if any, per Share subject to each outstanding Award, and (iv) the exercise price for each Share subject to any then outstanding Stock Options under the Plan, without changing the aggregate exercise price (i.e., the exercise price multiplied by the number of Stock Options) as to which such Stock Options remain exercisable. The Committee shall in any event make such adjustments as may be required by Section 25102(o) of the California Corporation Code and the rules and regulations promulgated thereunder. The adjustment by the Committee shall be final, binding and conclusive. No fractional Shares shall be issued under the Plan resulting from any such adjustment, but the Committee in its discretion may make a cash payment in lieu of fractional shares.

(c) Sale Events.

(i) Options.

(A) In the case of and subject to the consummation of a Sale Event, the Plan and all outstanding Options issued hereunder shall terminate upon the effective time of any such Sale Event unless assumed or continued by the successor entity, or new stock options or other awards of the successor entity or parent thereof are substituted therefor, with an equitable or proportionate adjustment as to the number and kind of shares and, if appropriate, the per share exercise prices, as such parties shall agree (after taking into account any acceleration hereunder and/or pursuant to the terms of any Award Agreement).

(B) In the event of the termination of the Plan and all outstanding Options issued hereunder pursuant to Section 3(c), each Holder of Options shall be permitted, within a period of time prior to the consummation of the Sale Event as specified by the Committee, to exercise all such Options which are then exercisable or will become exercisable as of the effective time of the Sale Event; *provided, however*, that the exercise of Options not exercisable prior to the Sale Event shall be subject to the consummation of the Sale Event.

(C) Notwithstanding anything to the contrary in Section 3(c)(i)(A), in the event of a Sale Event, the Company shall have the right, but not the obligation, to make or provide for a cash payment to the Holders of Options, without any consent of the Holders, in exchange for the cancellation thereof, in an amount equal to the difference between (A) the value as determined by the Committee of the consideration payable per share of Stock pursuant to the Sale Event (the "Sale Price") times the number of Shares subject to outstanding Options being cancelled (to the extent then vested and exercisable, including by reason of acceleration in connection with such Sale Event, at prices not in excess of the Sale Price) and (B) the aggregate exercise price of all such outstanding vested and exercisable Options.

(ii) Restricted Stock and Restricted Stock Unit Awards.

(A) In the case of and subject to the consummation of a Sale Event, all unvested Restricted Stock and unvested Restricted Stock Unit Awards (other than those becoming vested as a result of the Sale Event) issued hereunder shall be forfeited immediately prior to the effective time of any such Sale Event unless assumed or continued by the successor entity, or awards of the successor entity or parent thereof are substituted therefor, with an equitable or proportionate adjustment as to the number and kind of shares subject to such awards as such parties shall agree (after taking into account any acceleration hereunder and/or pursuant to the terms of any Award Agreement).

(B) In the event of the forfeiture of Restricted Stock pursuant to Section 3(c)(ii)(A), such Restricted Stock shall be repurchased from the Holder thereof at a price per share equal to the original per share purchase price paid by the Holder (subject to adjustment as provided in Section 3(b)) for such Shares.

(C) Notwithstanding anything to the contrary in Section 3(c)(ii)(A), in the event of a Sale Event, the Company shall have the right, but not the obligation, to make or provide for a cash payment to the Holders of Restricted Stock or Restricted Stock Unit Awards, without consent of the Holders, in exchange for the cancellation thereof, in an amount equal to the Sale Price times the number of Shares subject to such Awards, to be paid at the time of such Sale Event or upon the later vesting of such Awards.

SECTION 4. ELIGIBILITY

Grantees under the Plan will be such full or part-time officers and other employees, directors, Consultants and key persons of the Company and any Subsidiary who are selected from time to time by the Committee in its sole discretion; provided, however, that Awards shall be granted only to those individuals described in Rule 701(c) of the Securities Act.

SECTION 5. STOCK OPTIONS

Upon the grant of a Stock Option, the Company and the grantee shall enter into an Award Agreement. The terms and conditions of each such Award Agreement shall be determined by the Committee, and such terms and conditions may differ among individual Awards and grantees.

Stock Options granted under the Plan may be either Incentive Stock Options or Non-Qualified Stock Options. Incentive Stock Options may be granted only to employees of the Company or any Subsidiary that is a "subsidiary corporation" within the meaning of

Section 424(f) of the Code. To the extent that any Option does not qualify as an Incentive Stock Option, it shall be deemed a Non-Qualified Stock Option.

(a) Terms of Stock Options. The Committee in its discretion may grant Stock Options to those individuals who meet the eligibility requirements of Section 4. Stock Options shall be subject to the following terms and conditions and shall contain such additional terms and conditions, not inconsistent with the terms of the Plan, as the Committee shall deem desirable.

(i) Exercise Price. The exercise price per share for the Shares covered by a Stock Option shall be the U.S. dollar equivalent of 1 (one) euro for options that replace options granted by Hookipa Biotech AG and for new options granted prior to an Initial Public Offering of the Company. For any option grant after an Initial Public Offering of the Company, the Exercise Price shall be determined by the Committee at the time of grant but shall not be less than 100 percent of the Fair Market Value on the Grant Date. In the case of an Incentive Stock Option that is granted to a Ten Percent Owner, the exercise price per share for the Shares covered by such Incentive Stock Option shall not be less than 110 percent of the Fair Market Value on the Grant Date.

(ii) Option Term. The term of each Stock Option shall be fixed by the Committee, but no Stock Option shall be exercisable more than ten years from the Grant Date. In the case of an Incentive Stock Option that is granted to a Ten Percent Owner, the term of such Stock Option shall be no more than five years from the Grant Date.

(iii) Exercisability; Rights of a Stockholder. Stock Options shall become exercisable and/or vested at such time or times, whether or not in installments, as shall be determined by the Committee at or after the Grant Date. The Award Agreement may permit a grantee to exercise all or a portion of a Stock Option immediately at grant; provided that the Shares issued upon such exercise shall be subject to restrictions and a vesting schedule identical to the vesting schedule of the related Stock Option, such Shares shall be deemed to be Restricted Stock for purposes of the Plan, and the optionee may be required to enter into an additional or new Award Agreement as a condition to exercise of such Stock Option. An optionee shall have the rights of a stockholder only as to Shares acquired upon the exercise of a Stock Option and not as to unexercised Stock Options. An optionee shall not be deemed to have acquired any Shares unless and until a Stock Option shall have been exercised pursuant to the terms of the Award Agreement and this Plan and the optionee’s name has been entered on the books of the Company as a stockholder.

(iv) Method of Exercise. Stock Options may be exercised by an optionee in whole or in part, by the optionee giving written or electronic notice of exercise to the Company, specifying the number of Shares to be purchased. Payment of the purchase price may be made by one or more of the following methods (or any combination thereof) to the extent provided in the Award Agreement:

(A) In cash, by certified or bank check, by wire transfer of immediately available funds, or other instrument acceptable to the Committee;

(B) If permitted by the Committee, by the optionee delivering to the Company a promissory note, if the Board has expressly authorized the loan of funds to the optionee for the purpose of enabling or assisting the optionee to effect the exercise of his or her Stock Option; provided, that at least so much of the exercise price as represents the par value of the Stock shall be paid in cash if required by state law;

(C) If permitted by the Committee and the Initial Public Offering has occurred (or the Stock otherwise becomes publicly-traded), through the delivery (or attestation to the ownership) of Shares that have been purchased by the optionee on the open market or that are beneficially owned by the optionee and are not then subject to restrictions under any Company plan. To the extent required to avoid variable accounting treatment under ASC 718 or other applicable accounting rules, such surrendered Shares if originally purchased from the Company shall have been owned by the optionee for at least six months. Such surrendered Shares shall be valued at Fair Market Value on the exercise date;

(D) If permitted by the Committee and the Initial Public Offering has occurred (or the Stock otherwise becomes publicly-traded), by the optionee delivering to the Company a properly executed exercise notice together with irrevocable instructions to a broker to promptly deliver to the Company cash or a check payable and acceptable to the Company for the purchase price; provided that in the event the optionee chooses to pay the purchase price as so provided, the optionee and the broker shall comply with such procedures and enter into such agreements of indemnity and other agreements as the Committee shall prescribe as a condition of such payment procedure; or

(E) If permitted by the Committee, and only with respect to Stock Options that are not Incentive Stock Options, by a "net exercise" arrangement pursuant to which the Company will reduce the number of Shares issuable upon exercise by the largest whole number of Shares with a Fair Market Value that does not exceed the aggregate exercise price.

Payment instruments will be received subject to collection. No certificates for Shares so purchased will be issued to the optionee or, with respect to uncertificated Stock, no transfer to the optionee on the records of the Company will take place, until the Company has completed all steps it has deemed necessary to satisfy legal requirements relating to the issuance and sale of the Shares, which steps may include, without limitation, (i) receipt of a representation from the optionee at the time of exercise of the Option that the optionee is purchasing the Shares for the optionee's own account and not with a view to any sale or distribution of the Shares or other representations relating to compliance with applicable law governing the issuance of securities, (ii) the legending of the certificate (or notation on any book entry) representing the Shares to evidence the foregoing restrictions, and (iii) obtaining from optionee payment or provision for all withholding taxes due as a result of the exercise of the Option. The delivery of certificates representing the shares of Stock (or the transfer to the optionee on the records of the Company with respect to uncertificated Stock) to be purchased pursuant to the exercise of a Stock Option will be contingent upon (A) receipt from the optionee (or a purchaser acting in his or her stead in accordance with the provisions of the Stock Option) by the Company of the full purchase price for such Shares and the fulfillment of any other requirements contained in the Award Agreement

or applicable provisions of laws and (B) if required by the Company, the optionee shall have entered into any stockholders agreements or other agreements with the Company and/or certain other of the Company's stockholders relating to the Stock. In the event an optionee chooses to pay the purchase price by previously-owned Shares through the attestation method, the number of Shares transferred to the optionee upon the exercise of the Stock Option shall be net of the number of Shares attested to.

(b) Annual Limit on Incentive Stock Options. To the extent required for "incentive stock option" treatment under Section 422 of the Code, the aggregate Fair Market Value (determined as of the Grant Date) of the Shares with respect to which Incentive Stock Options granted under the Plan and any other plan of the Company or its parent and any Subsidiary that become exercisable for the first time by an optionee during any calendar year shall not exceed $100,000 or such other limit as may be in effect from time to time under Section 422 of the Code. To the extent that any Stock Option exceeds this limit, it shall constitute a Non-Qualified Stock Option.

(c) Termination. Any portion of a Stock Option that is not vested and exercisable on the date of termination of an optionee's Service Relationship shall immediately expire and be null and void. Once any portion of the Stock Option becomes vested and exercisable, the optionee's right to exercise such portion of the Stock Option (or the optionee's representatives and legatees as applicable) in the event of a termination of the optionee's Service Relationship shall continue until the earliest of: (i) the date which is: (A) 12 months following the date on which the optionee's Service Relationship terminates due to death or Disability (or such longer period of time as determined by the Committee and set forth in the applicable Award Agreement), or (B) three months following the date on which the optionee's Service Relationship terminates if the termination is due to any reason other than death or Disability (or such longer period of time as determined by the Committee and set forth in the applicable Award Agreement), or (ii) the Expiration Date set forth in the Award Agreement; provided that notwithstanding the foregoing, an Award Agreement may provide that if the optionee's Service Relationship is terminated for Cause, the Stock Option shall terminate immediately and be null and void upon the date of the optionee's termination and shall not thereafter be exercisable.

SECTION 6. RESTRICTED STOCK AWARDS

(a) Nature of Restricted Stock Awards. The Committee may, in its sole discretion, grant (or sell at par value or such other purchase price determined by the Committee) to an eligible individual under Section 4 hereof a Restricted Stock Award under the Plan. The Committee shall determine the restrictions and conditions applicable to each Restricted Stock Award at the time of grant. Conditions may be based on continuing employment (or other Service Relationship), achievement of pre-established performance goals and objectives and/or such other criteria as the Committee may determine. Upon the grant of a Restricted Stock Award, the Company and the grantee shall enter into an Award Agreement. The terms and conditions of each such Award Agreement shall be determined by the Committee, and such terms and conditions may differ among individual Awards and grantees.

(b) Rights as a Stockholder. Upon the grant of the Restricted Stock Award and payment of any applicable purchase price, a grantee of Restricted Stock shall be considered the record owner of and shall be entitled to vote the Restricted Stock if, and to the extent, such Shares are entitled to voting rights, subject to such conditions contained in the Award Agreement. The grantee shall be entitled to receive all dividends and any other distributions declared on the Shares; provided, however, that the Company is under no duty to declare any such dividends or to make any such distribution. Unless the Committee shall otherwise determine, certificates evidencing the Restricted Stock shall remain in the possession of the Company until such Restricted Stock is vested as provided in subsection (d) below of this Section, and the grantee shall be required, as a condition of the grant, to deliver to the Company a stock power endorsed in blank and such other instruments of transfer as the Committee may prescribe.

(c) Restrictions. Restricted Stock may not be sold, assigned, transferred, pledged or otherwise encumbered or disposed of except as specifically provided herein or in the Award Agreement. Except as may otherwise be provided by the Committee either in the Award Agreement or, subject to Section 12 below, in writing after the Award Agreement is issued, if a grantee's Service Relationship with the Company and any Subsidiary terminates, the Company or its assigns shall have the right, as may be specified in the relevant instrument, to repurchase some or all of the Shares subject to the Award at such purchase price as is set forth in the Award Agreement.

(d) Vesting of Restricted Stock. The Committee at the time of grant shall specify in the Award Agreement the date or dates and/or the attainment of pre-established performance goals, objectives and other conditions on which the substantial risk of forfeiture imposed shall lapse and the Restricted Stock shall become vested, subject to such further rights of the Company or its assigns as may be specified in the Award Agreement.

SECTION 7. UNRESTRICTED STOCK AWARDS

The Committee may, in its sole discretion, grant (or sell at par value or such other purchase price determined by the Committee) to an eligible person under Section 4 hereof an Unrestricted Stock Award under the Plan. Unrestricted Stock Awards may be granted in respect of past services or other valid consideration, or in lieu of cash compensation due to such grantee.

SECTION 8. RESTRICTED STOCK UNITS

(a) Nature of Restricted Stock Units. The Committee may, in its sole discretion, grant to an eligible person under Section 4 hereof Restricted Stock Units under the Plan. The Committee shall determine the restrictions and conditions applicable to each Restricted Stock Unit at the time of grant. Vesting conditions may be based on continuing employment (or other Service Relationship), achievement of pre-established performance goals and objectives and/or other such criteria as the Committee may determine. Upon the grant of Restricted Stock Units, the grantee and the Company shall enter into an Award Agreement. The terms and conditions of each such Award Agreement shall be determined by the Committee and may differ among individual Awards and grantees. On or promptly following the vesting date or dates applicable to any Restricted Stock Unit, but in no event later than March 15 of the year following the year in which such vesting occurs, such Restricted Stock Unit(s) shall be settled in the form of cash or shares of Stock, as specified in the Award Agreement. Restricted Stock Units may not be sold, assigned, transferred, pledged, or otherwise encumbered or disposed of.

(b) Rights as a Stockholder. A grantee shall have the rights of a stockholder only as to Shares, if any, acquired upon settlement of Restricted Stock Units. A grantee shall not be deemed to have acquired any such Shares unless and until the Restricted Stock Units shall have been settled in Shares pursuant to the terms of the Plan and the Award Agreement, the Company shall have issued and delivered a certificate representing the Shares to the grantee (or transferred on the records of the Company with respect to uncertificated stock), and the grantee's name has been entered in the books of the Company as a stockholder.

(c) Termination. Except as may otherwise be provided by the Committee either in the Award Agreement or in writing after the Award Agreement is issued, a grantee's right in all Restricted Stock Units that have not vested shall automatically terminate upon the grantee's cessation of Service Relationship with the Company and any Subsidiary for any reason.

SECTION 9. TRANSFER RESTRICTIONS; COMPANY RIGHT OF FIRST REFUSAL; COMPANY REPURCHASE RIGHTS

(a) Restrictions on Transfer.

(i) Non-Transferability of Stock Options. Stock Options and, prior to exercise, the Shares issuable upon exercise of such Stock Option, shall not be transferable by the optionee otherwise than by will, or by the laws of descent and distribution, and all Stock Options shall be exercisable, during the optionee's lifetime, only by the optionee, or by the optionee's legal representative or guardian in the event of the optionee's incapacity. Notwithstanding the foregoing, the Committee, in its sole discretion, may provide in the Award Agreement regarding a given Stock Option that the optionee may transfer by gift, without consideration for the transfer, his or her Non-Qualified Stock Options to his or her family members (as defined in Rule 701 of the Securities Act), to trusts for the benefit of such family members, or to partnerships in which such family members are the only partners (to the extent such trusts or partnerships are considered "family members" for purposes of Rule 701 of the Securities Act), provided that the transferee agrees in writing with the Company to be bound by all of the terms and conditions of this Plan and the applicable Award Agreement, including the execution of a stock power upon the issuance of Shares. Stock Options, and the Shares issuable upon exercise of such Stock Options, shall be restricted as to any pledge, hypothecation, or other transfer, including any short position, any "put equivalent position" (as defined in the Exchange Act) or any "call equivalent position" (as defined in the Exchange Act) prior to exercise.

(ii) Shares. No Shares shall be sold, assigned, transferred, pledged, hypothecated, given away or in any other manner disposed of or encumbered, whether voluntarily or by operation of law, unless (i) the transfer is in compliance with the terms of the applicable Award Agreement, all applicable securities laws (including, without limitation, the Securities Act), and with the terms and conditions of this Section 9, (ii) the transfer does not cause the Company to become subject to the reporting requirements of the Exchange Act, and (iii) the transferee consents in writing to be bound by the provisions of the Plan and the Award Agreement, including this Section 9. In connection with any proposed transfer, the Committee may require the transferor to provide at the transferor's own expense an opinion of counsel to the transferor, satisfactory to the Committee, that such transfer is in compliance with all foreign, federal and state securities laws (including, without limitation, the Securities Act). Any attempted transfer of Shares not in accordance with the terms and conditions of this Section 9 shall be null and void, and the Company shall not reflect on its records any change in record ownership of any Shares as a result of any such transfer, shall otherwise refuse to recognize any such transfer and shall not in any way give effect to any such transfer of Shares. The Company shall be entitled to seek protective orders, injunctive relief and other remedies available at law or in equity including, without limitation, seeking specific performance or the rescission of any transfer not made in strict compliance with the provisions of this Section 9. Subject to the foregoing general provisions, and unless otherwise provided in the applicable Award Agreement, Shares may be transferred pursuant to the following specific terms and conditions (provided that with respect to any transfer of Restricted Stock, all vesting and forfeiture provisions shall continue to apply with respect to the original recipient):

(A) Transfers to Permitted Transferees. The Holder may transfer any or all of the Shares to one or more Permitted Transferees; *provided, however*, that following such transfer, such Shares shall continue to be subject to the terms of this Plan (including this Section 9) and such Permitted Transferee(s) shall, as a condition to any such transfer, deliver a written acknowledgment to that effect to the Company and shall deliver a stock power to the Company with respect to the Shares. Notwithstanding the foregoing, the Holder may not transfer any of the Shares to a Person whom the Company reasonably determines is a direct competitor or a potential competitor of the Company or any of its Subsidiaries.

(B) Transfers Upon Death. Upon the death of the Holder, any Shares then held by the Holder at the time of such death and any Shares acquired after the Holder's death by the Holder's legal representative shall be subject to the provisions of this Plan, and the Holder's estate, executors, administrators, personal representatives, heirs, legatees and distributees shall be obligated to convey such Shares to the Company or its assigns under the terms contemplated by the Plan and the Award Agreement.

(b) Right of First Refusal. In the event that a Holder desires at any time to sell or otherwise transfer all or any part of his or her Shares (other than shares of Restricted Stock which by their terms are not transferrable), the Holder first shall give written notice to the Company of the Holder's intention to make such transfer. Such notice shall state the number of Shares that the Holder proposes to sell (the "Offered Shares"), the price and the terms at which the proposed sale is to be made and the name and address of the proposed transferee. At any time within 30 days after the receipt of such notice by the Company, the Company or its assigns may elect to purchase all or any portion of the Offered Shares at the price and on the terms offered by the proposed transferee and specified in the notice. The Company or its assigns shall exercise this right by mailing or delivering written notice to the Holder within the foregoing 30-day period. If the Company or its assigns elect to exercise its purchase rights under this Section 9(b), the closing for such purchase shall, in any event, take place within 45 days after the receipt by the Company of the initial notice from the Holder. In the event that the Company or its assigns do not elect to exercise such purchase right, or in the event that the Company or its assigns do not pay the full purchase price within such 45-day period, the Holder shall be required to pay a transaction processing fee of $10,000 to the Company (unless waived by the Committee) and then may, within 60 days thereafter, sell the Offered Shares to the proposed transferee and at the same price and on the same terms as specified in the Holder's notice. Any Shares not sold to the proposed transferee shall remain subject to the Plan. If the Holder is a party to any stockholders agreements or other agreements with the Company and/or certain other of the Company's stockholders relating to the Shares, (i) the transferring Holder shall comply with the requirements of such stockholders agreements or other agreements relating to any proposed transfer of the Offered Shares, and (ii) any proposed transferee that purchases Offered Shares shall enter into such stockholders agreements or other agreements with the Company and/or certain of the Company's stockholders relating to the Offered Shares on the same terms and in the same capacity as the transferring Holder.

(c) Company's Right of Repurchase.

(i) Right of Repurchase for Unvested Shares Issued Upon the Exercise of an Option. Upon a Termination Event, the Company or its assigns shall have the right and option to repurchase from a Holder of Shares acquired upon exercise of a Stock Option which are still subject to a risk of forfeiture as of the Termination Event. Such repurchase rights may be exercised by the Company within the later of (A) six months following the date of such Termination Event or (B) seven months after the acquisition of Shares upon exercise of a Stock Option. The repurchase price shall be equal to the lower of the original per share price paid by the Holder, subject to adjustment as provided in Section 3(b) of the Plan, or the current Fair Market Value of such Shares as of the date the Company elects to exercise its repurchase rights.

(ii) Right of Repurchase With Respect to Restricted Stock. Upon a Termination Event, the Company or its assigns shall have the right and option to repurchase from a Holder of Shares received pursuant to a Restricted Stock Award any Shares that are still subject to a risk of forfeiture as of the Termination Event. Such repurchase right may be exercised by the Company within six months following the date of such Termination Event. The repurchase price shall be the lower of the original per share purchase price paid by the Holder, subject to adjustment as provided in Section 3(b) of the Plan, or the current Fair Market Value of such Shares as of the date the Company elects to exercise its repurchase rights.

(iii) Procedure. Any repurchase right of the Company shall be exercised by the Company or its assigns by giving the Holder written notice on or before the last day of the repurchase period of its intention to exercise such repurchase right. Upon such notification, the Holder shall promptly surrender to the Company, free and clear of any liens or encumbrances, any certificates representing the Shares being purchased, together with a duly executed stock power for the transfer of such Shares to the Company or the Company's assignee or assignees. Upon the Company's or its assignee's receipt of the certificates from the Holder, the Company or its assignee or assignees shall deliver to him, her or them a check for the applicable repurchase price; *provided, however*, that the Company may pay the repurchase price by offsetting and canceling any indebtedness then owed by the Holder to the Company.

(d) Reserved.

(e) Escrow Arrangement.

(i) Escrow. In order to carry out the provisions of this Section 9 of this Plan more effectively, the Company shall hold any Shares issued pursuant to Awards granted under the Plan in escrow together with separate stock powers executed by the Holder in blank for transfer. The Company shall not dispose of the Shares except as otherwise provided in this Plan. In the event of any repurchase by the Company (or any of its assigns), the Company is hereby authorized by the Holder, as the Holder's attorney-in-fact, to date and complete the stock powers necessary for the transfer of the Shares being purchased and to transfer such Shares in accordance with the terms hereof. At such time as any Shares are no longer subject to the Company's repurchase and first refusal rights, the Company shall, at the written request of the Holder, deliver to the Holder a certificate representing such Shares with the balance of the Shares to be held in escrow pursuant to this Section.

(ii) Remedy. Without limitation of any other provision of this Plan or other rights, in the event that a Holder or any other Person is required to sell a Holder's Shares pursuant to the provisions of Sections 9(b) or (c) hereof and in the further event that he or she refuses or for any reason fails to deliver to the Company or its designated purchaser of such Shares the certificate or certificates evidencing such Shares together with a related stock power, the Company or such designated purchaser may deposit the applicable purchase price for such Shares with a bank designated by the Company, or with the Company's independent public accounting firm, as agent or trustee, or in escrow, for such Holder or other Person, to be held by such bank or accounting firm for the benefit of and for delivery to him, her, them or it, and/or, in its discretion, pay such purchase price by offsetting any indebtedness then owed by such Holder as provided above. Upon any such deposit and/or offset by the Company or its designated purchaser of such amount and upon notice to the Person who was required to sell the Shares to be sold pursuant to the provisions of Sections 9(b) or (c), such Shares shall at such time be deemed to have been sold, assigned, transferred and conveyed to such purchaser, such Holder shall have no further rights thereto (other than the right to withdraw the payment thereof held in escrow, if applicable), and the Company shall record such transfer in its stock transfer book or in any appropriate manner.

(f) Lockup Provision. If requested by the Company, a Holder shall not sell or otherwise transfer or dispose of any Shares (including, without limitation, pursuant to Rule 144 under the Securities Act) held by him or her for such period following the effective date of a public offering by the Company of Shares as the Company shall specify reasonably and in good faith. If requested by the underwriter engaged by the Company, each Holder shall execute a separate letter confirming his or her agreement to comply with this Section.

(g) Adjustments for Changes in Capital Structure. If, as a result of any reorganization, recapitalization, reclassification, stock dividend, stock split, reverse stock split or other similar change in the Common Stock, the outstanding Shares are increased or decreased or are exchanged for a different number or kind of securities of the Company, the restrictions contained in this Section 9 shall apply with equal force to additional and/or substitute securities, if any, received by Holder in exchange for, or by virtue of his or her ownership of, Shares.

(h) Termination. The terms and provisions of Section 9(b) and Section 9(c) (except for the Company's right to repurchase Shares still subject to a risk of forfeiture upon a Termination Event) shall terminate upon the closing of the Company's Initial Public Offering or upon consummation of any Sale Event, in either case as a result of which Shares are registered under Section 12 of the Exchange Act and publicly-traded on any national security exchange.

SECTION 10. TAX WITHHOLDING

(a) Payment by Grantee. Each grantee shall, no later than the date as of which the value of an Award or of any Shares or other amounts received thereunder first becomes includable in the gross income of the grantee for income tax purposes, pay to the Company, or make arrangements satisfactory to the Committee regarding payment of, any Federal, state, or local taxesof any kind required by law to be withheld by the Company with respect to such income, in the United States or elsewhere. The Company and any Subsidiary shall, to the extent permitted by law, have the right to deduct any such taxes from any payment of any kind otherwise due to the grantee. The Company's obligation to deliver stock certificates (or evidence of book entry) to any grantee is subject to and conditioned on any such tax withholding obligations being satisfied by the grantee.

(b) Payment in Stock. The Company's minimum required tax withholding obligation may be satisfied, in whole or in part, by the Company withholding from Shares to be issued pursuant to an Award a number of Shares having an aggregate Fair Market Value (as of the date the withholding is effected) that would satisfy the minimum withholding amount due.

SECTION 11. SECTION 409A AWARDS.

To the extent that any Award is determined to constitute "nonqualified deferred compensation" within the meaning of Section 409A (a "409A Award"), the Award shall be subject to such additional rules and requirements as may be specified by the Committee from time to time. In this regard, if any amount under a 409A Award is payable upon a "separation from service" (within the meaning of Section 409A) to a grantee who is considered a "specified employee" (within the meaning of Section 409A), then no such payment shall be made prior to the date that is the earlier of (i) six months and one day after the grantee's separation from service, or (ii) the grantee's death, but only to the extent such delay is necessary to prevent such payment from being subject to interest, penalties and/or additional tax imposed pursuant to Section 409A. The Company makes no representation or warranty and shall have no liability to any grantee under the Plan or any other Person with respect to any penalties or taxes under Section 409A that are, or may be, imposed with respect to any Award.

SECTION 12. AMENDMENTS AND TERMINATION

The Board may, at any time, amend or discontinue the Plan and the Committee may, at any time, amend or cancel any outstanding Award for the purpose of satisfying changes in law or for any other lawful purpose, but no such action shall adversely affect rights under any outstanding Award without the consent of the holder of the Award. The Committee may exercise its discretion to reduce the exercise price of outstanding Stock Options or effect repricing through cancellation of outstanding Stock Options and by granting such holders new

Awards in replacement of the cancelled Stock Options. To the extent determined by the Committee to be required either by the Code to ensure that Incentive Stock Options granted under the Plan are qualified under Section 422 of the Code or otherwise, Plan amendments shall be subject to approval by the Company stockholders entitled to vote at a meeting of stockholders. Nothing in this Section 12 shall limit the Board's or Committee's authority to take any action permitted pursuant to Section 3(c). The Board reserves the right to amend the Plan and/or the terms of any outstanding Stock Options to the extent reasonably necessary to comply with the requirements of the exemption pursuant to paragraph (f)(4) of Rule 12h-1 of the Exchange Act.

SECTION 13. STATUS OF PLAN

With respect to the portion of any Award that has not been exercised and any payments in cash, Stock or other consideration not received by a grantee, a grantee shall have no rights greater than those of a general creditor of the Company unless the Committee shall otherwise expressly so determine in connection with any Award.

SECTION 14. GENERAL PROVISIONS

(a) No Distribution; Compliance with Legal Requirements. The Committee may require each person acquiring Shares pursuant to an Award to represent to and agree with the Company in writing that such person is acquiring the Shares without a view to distribution thereof. No Shares shall be issued pursuant to an Award until all applicable securities law and other legal and stock exchange or similar requirements have been satisfied. The Committee may require the placing of such stop-orders and restrictive legends on certificates for Stock and Awards as it deems appropriate.

(b) Delivery of Stock Certificates. Stock certificates to grantees under the Plan shall be deemed delivered for all purposes when the Company or a stock transfer agent of the Company shall have mailed such certificates in the United States mail, addressed to the grantee, at the grantee's last known address on file with the Company; provided that stock certificates to be held in escrow pursuant to Section 9 of the Plan shall be deemed delivered when the Company shall have recorded the issuance in its records. Uncertificated Stock shall be deemed delivered for all purposes when the Company or a stock transfer agent of the Company shall have given to the grantee by electronic mail (with proof of receipt) or by United States mail, addressed to the grantee, at the grantee's last known address on file with the Company, notice of issuance and recorded the issuance in its records (which may include electronic "book entry" records).

(c) No Employment Rights. The adoption of the Plan and the grant of Awards do not confer upon any Person any right to continued employment or Service Relationship with the Company or any Subsidiary.

(d) Trading Policy Restrictions. Option exercises and other Awards under the Plan shall be subject to the Company's insider trading policy-related restrictions, terms and conditions as may be established by the Committee, or in accordance with policies set by the Committee, from time to time.

(e) Designation of Beneficiary. Each grantee to whom an Award has been made under the Plan may designate a beneficiary or beneficiaries to exercise any Award on or after the grantee's death or receive any payment under any Award payable on or after the grantee's death. Any such designation shall be on a form provided for that purpose by the Committee and shall not be effective until received by the Committee. If no beneficiary has been designated by a deceased grantee, or if the designated beneficiaries have predeceased the grantee, the beneficiary shall be the grantee's estate.

(f) Legend. Any certificate(s) representing the Shares shall carry substantially the following legend (and with respect to uncertificated Stock, the book entries evidencing such shares shall contain the following notation):

> The transferability of this certificate and the shares of stock represented hereby are subject to the restrictions, terms and conditions (including repurchase and restrictions against transfers) contained in the HOOKIPA Pharma Inc. 2018 Stock Option and Grant Plan and any agreements entered into thereunder by and between the company and the holder of this certificate (a copy of which is available at the offices of the company for examination).

(g) Information to Holders of Options. In the event the Company is relying on the exemption from the registration requirements of Section 12(g) of the Exchange Act contained in paragraph (f)(1) of Rule 12h-1 of the Exchange Act, the Company shall provide the information described in Rule 701(e)(3), (4) and (5) of the Securities Act to all holders of Options in accordance with the requirements thereunder. The foregoing notwithstanding, the Company shall not be required to provide such information unless the optionholder has agreed in writing, on a form prescribed by the Company, to keep such information confidential.

SECTION 15. EFFECTIVE DATE OF PLAN

The Plan shall become effective upon adoption by the Board and shall be approved by stockholders in accordance with applicable state law and the Company's articles of incorporation and bylaws within 12 months thereafter. If the stockholders fail to approve the Plan within 12 months after its adoption by the Board of Directors, then any Awards granted or sold under the Plan shall be rescinded and no additional grants or sales shall thereafter be made under the Plan. Subject to such approval by stockholders and to the requirement that no Shares may be issued hereunder prior to such approval, Stock Options and other Awards may be granted hereunder on and after adoption of the Plan by the Board. No grants of Stock Options and other Awards may be made hereunder after the tenth anniversary of the date the Plan is adopted by the Board or the date the Plan is approved by the Company's stockholders, whichever is earlier.

SECTION 16. GOVERNING LAW

This Plan, all Awards and any controversy arising out of or relating to this Plan and all Awards shall be governed by and construed in accordance with the General Corporation Law of the State of Delaware as to matters within the scope thereof, and as to all other matters shall be governed by and construed in accordance with the internal laws of Delaware, without regard to conflict of law principles that would result in the application of any law other than the law of the State of Delaware.

DATE ADOPTED BY THE BOARD OF DIRECTORS: May 23, 2018

DATE APPROVED BY THE STOCKHOLDERS: May 23, 2018

Final Form

INCENTIVE STOCK OPTION GRANT NOTICE
UNDER THE HOOKIPA PHARMA INC.
2018 STOCK OPTION AND GRANT PLAN

Pursuant to the HOOKIPA Pharma Inc. 2018 Stock Option and Grant Plan (the "Plan"), HOOKIPA Pharma Inc., a Delaware corporation (together with any successor, the "Company"), has granted to the individual named below, an option (the "Stock Option") to purchase on or prior to the Expiration Date, or such earlier date as is specified herein, all or any part of the number of shares of Common Stock, par value $0.0001 per share ("Common Stock"), of the Company indicated below (the "Shares"), at the Option Exercise Price per share, subject to the terms and conditions set forth in this Incentive Stock Option Grant Notice (the "Grant Notice"), the attached Incentive Stock Option Agreement (the "Agreement") and the Plan. This Stock Option is intended to qualify as an "incentive stock option" as defined in Section 422(b) of the Internal Revenue Code of 1986, as amended from time to time (the "Code"). To the extent that any portion of the Stock Option does not so qualify, it shall be deemed a non-qualified stock option.

Name of Optionee:	(the "Optionee")
No. of Shares:	Shares of Common Stock
Grant Date:	
Vesting Commencement Date:	(the "Vesting Commencement Date")
Expiration Date:	(the "Expiration Date")
Option Exercise Price/Share:	$ (the "Option Exercise Price")
Vesting Schedule:	25 percent of the Shares shall vest and become exercisable on the first anniversary of the Vesting Commencement Date; provided that the Optionee continues to have a Service Relationship with the Company at such time. Thereafter, the remaining 75 percent of the Shares shall vest and become exercisable in12 equal quarterly installments following the first anniversary of the Vesting Commencement Date, provided the Optionee continues to have a Service Relationship with the Company on each vesting date. Notwithstanding anything in the Agreement to the contrary, in the case of a Sale Event, this Stock Option and the Shares shall be treated as provided in Section 3(c) of the Plan Provided, however, that notwithstanding anything herein to the contrary, in the event (and only in the event) that this Stock Option or the Shares are assumed or continued by the Company or its successor entity in the sole discretion of the parties to a Sale Event and thereafter remains in effect following such Sale Event, then 50% of the then-unvested

Shares shall be deemed vested in full upon the date on which the Optionee's Service Relationship with the Company and its Subsidiaries or successor entity terminates if (A) such termination occurs in connection with and effective as of the date of, or within 12 months following the date of, such Sale Event and (B) such termination is either by the Company without Cause or by the Optionee for Good Reason.

Attachments: Incentive Stock Option Agreement, 2018 Stock Option and Grant Plan

INCENTIVE STOCK OPTION AGREEMENT
UNDER THE HOOKIPA PHARMA INC.
2018 STOCK OPTION AND GRANT PLAN

All capitalized terms used herein and not otherwise defined shall have the respective meanings set forth in the Grant Notice and the Plan.

1. Vesting, Exercisability and Termination.

(a) No portion of this Stock Option may be exercised until such portion shall have vested and become exercisable.

(b) Except as set forth below, and subject to the determination of the Committee in its sole discretion to accelerate the vesting schedule hereunder, this Stock Option shall be vested and exercisable on the respective dates indicated below:

(i) This Stock Option shall initially be unvested and unexercisable.

(ii) This Stock Option shall vest and become exercisable in accordance with the Vesting Schedule set forth in the Grant Notice.

(c) Termination. Except as may otherwise be provided by the Committee, if the Optionee's Service Relationship is terminated, the period within which to exercise this Stock Option will be subject to earlier termination as set forth below (and if not exercised within such period, shall thereafter terminate subject, in each case, to Section 3(c) of the Plan):

(i) Termination Due to Death or Disability. If the Optionee's Service Relationship terminates by reason of such Optionee's death or Disability, this Stock Option may be exercised, to the extent exercisable on the date of such termination, by the Optionee, the Optionee's legal representative or legatee for a period of 12 months from the date of death or Disability or until the Expiration Date, if earlier.

(ii) Other Termination. If the Optionee's Service Relationship terminates for any reason other than death or Disability, and unless otherwise determined by the Committee, this Stock Option may be exercised, to the extent exercisable on the date of termination, for a period of 30 days from the date of termination or until the Expiration Date, if earlier; provided however, if the Optionee's Service Relationship is terminated for Cause, this Stock Option shall terminate immediately upon the date of such termination.

For purposes hereof, the Committee's determination of the reason for termination of the Optionee's Service Relationship shall be conclusive and binding on the Optionee and his or her representatives or legatees and any Permitted Transferee. Any portion of this Stock Option that is not vested and exercisable on the date of termination of the Service Relationship shall terminate immediately and be null and void.

(d) It is understood and intended that this Stock Option is intended to qualify as an "incentive stock option" as defined in Section 422 of the Code to the extent permitted under applicable law. Accordingly, the Optionee understands that in order to obtain the benefits of an incentive stock option under Section 422 of the Code, no sale or other disposition may be made of Shares for which incentive stock option treatment is desired within the one-year period beginning on the day after the day of the transfer of such Shares to him or her, nor within the two-year period beginning on the day after Grant Date of this Stock Option and further that this Stock Option must be exercised within three months after termination of employment as an employee (or 12 months in the case of death or disability) to qualify as an incentive stock option. If the Optionee disposes (whether by sale, gift, transfer or otherwise) of any such Shares within either of these periods, he or she will notify the Company within 30 days after such disposition. The Optionee also agrees to provide the Company with any information concerning any such dispositions required by the Company for tax purposes. Further, to the extent this Stock Option and any other incentive stock options of the Optionee having an aggregate Fair Market Value in excess of $100,000 (determined as of the Grant Date) first become exercisable in any year, such options will not qualify as incentive stock options.

2. Exercise of Stock Option.

(a) The Options may be exercised only within the relevant exercise periods set forth in (i) and (ii) below (each an "Exercise Period").

(i) After an IPO of the Company, any time that is not declared a restricted period by the Committee shall be considered an Exercise Period.

(ii) Prior to an IPO of the Company, an Exercise Period shall start upon receipt by the Optionee of an Option Window Notice and shall expire four weeks following receipt of the Option Winddow Notice which shall be deemed to be received by each Beneficiary on the seventh day from sending. An Option Window Notice shall be sent by the Company to the Optionee twice each business year and shall include the amount of vested Options.

(b) At any time during the Exercise Period, the Optionee may exercise this Stock Option only in the following manner: Prior to the Expiration Date, the Optionee may deliver a Stock Option exercise notice (an "Exercise Notice") in the form of Appendix A hereto indicating his or her election to purchase some or all of the Shares with respect to which this Stock Option is then exercisable together with an executed joinder to the page to the Shareholders Agreement, dated as of [ ], 2018, by and among the Company and the holders party, as the same may be amended from time to time, in the form of Appendix B. The Exercise Notice shall specify the number of Shares to be purchased. Payment of the purchase price may be made by one or more of the methods described in Section 5 of the Plan, subject to the limitations contained in such Section of the Plan, including the requirement that the Committee specifically approve in advance certain payment methods.

(c) Notwithstanding any other provision hereof or of the Plan, no portion of this Stock Option shall be exercisable after the Expiration Date.

(d) The Optionee agrees that the purchased Shares shall be delivered to and held by an escrow agent until the expiry of any lock-up period following the Initial Public Offering of the Company.

(e) In case the Company is required to pay or withhold any tax on behalf of the Optionee, the Optionee shall promptly reimburse the Company.

(f) Subject to applicable law, if the Optionee is a non-US Person, the Company shall use its commercially reasonable efforts to minimize, in accordance with applicable US law, any required tax withholdings from Optionee.

3. Incorporation of Plan. Notwithstanding anything herein to the contrary, this Stock Option shall be subject to and governed by all the terms and conditions of the Plan.

4. Transferability of Stock Option. This Stock Option is personal to the Optionee and is not transferable by the Optionee in any manner other than by will or by the laws of descent and distribution. The Stock Option may be exercised during the Optionee's lifetime only by the Optionee (or by the Optionee's guardian or personal representative in the event of the Optionee's incapacity). The Optionee may elect to designate a beneficiary by providing written notice of the name of such beneficiary to the Company, and may revoke or change such designation at any time by filing written notice of revocation or change with the Company; such beneficiary may exercise the Optionee's Stock Option in the event of the Optionee's death to the extent provided herein. If the Optionee does not designate a beneficiary, or if the designated beneficiary predeceases the Optionee, the legal representative of the Optionee may exercise this Stock Option to the extent provided herein in the event of the Optionee's death.

5. Restrictions on Transfer of Shares. The Shares acquired upon exercise of the Stock Option shall be subject to certain transfer restrictions and other limitations including, without limitation, the provisions contained in Section 9 of the Plan.

6. Miscellaneous Provisions.

(a) Equitable Relief. The parties hereto agree and declare that legal remedies may be inadequate to enforce the provisions of this Agreement and that equitable relief, including specific performance and injunctive relief, may be used to enforce the provisions of this Agreement.

(b) Adjustments for Changes in Capital Structure. If, as a result of any reorganization, recapitalization, reincorporation, reclassification, stock dividend, stock split, reverse stock split or other similar change in the Common Stock, the outstanding shares of Common Stock are increased or decreased or are exchanged for a different number or kind of securities of the Company, the restrictions contained in this Agreement shall apply with equal force to additional and/or substitute securities, if any, received by the Optionee in exchange for, or by virtue of his or her ownership of, this Stock Option or Shares acquired pursuant thereto.

(c) Change and Modifications. This Agreement may not be orally changed, modified or terminated, nor shall any oral waiver of any of its terms be effective. This

Agreement may be changed, modified or terminated only by an agreement in writing signed by the Company and the Optionee.

(d) Governing Law. This Agreement shall be governed by and construed in accordance with the General Corporation Law of the State of Delaware as to matters within the scope thereof, and as to all other matters shall be governed by and construed in accordance with the internal laws of Delaware, without regard to conflict of law principles that would result in the application of any law other than the law of the State of Delaware.

(e) Headings. The headings are intended only for convenience in finding the subject matter and do not constitute part of the text of this Agreement and shall not be considered in the interpretation of this Agreement.

(f) Saving Clause. If any provision(s) of this Agreement shall be determined to be illegal or unenforceable, such determination shall in no manner affect the legality or enforceability of any other provision hereof.

(g) Notices. All notices, requests, consents and other communications shall be in writing and be deemed given when delivered personally, by telex or facsimile transmission or when received if mailed by first class registered or certified mail, postage prepaid. Notices to the Company or the Optionee shall be addressed as set forth underneath their signatures below, or to such other address or addresses as may have been furnished by such party in writing to the other.

(h) Benefit and Binding Effect. This Agreement shall be binding upon and shall inure to the benefit of the parties hereto, their respective successors, assigns, and legal representatives. The Company has the right to assign this Agreement, and such assignee shall become entitled to all the rights of the Company hereunder to the extent of such assignment.

(i) Counterparts. For the convenience of the parties and to facilitate execution, this Agreement may be executed in two or more counterparts, each of which shall be deemed an original, but all of which shall constitute one and the same document.

(j) Integration. This Agreement constitutes the entire agreement between the parties with respect to this Stock Option and supersedes all prior agreements and discussions between the parties concerning such subject matter.

7. Dispute Resolution.

(a) Except as provided below, any dispute arising out of or relating to the Plan or this Stock Option, this Agreement, or the breach, termination or validity of the Plan, this Stock Option or this Agreement, shall be finally settled by binding arbitration conducted expeditiously in accordance with the J.A.M.S./Endispute Comprehensive Arbitration Rules and Procedures (the "J.A.M.S. Rules"). The arbitration shall be governed by the United States Arbitration Act, 9 U.S.C. Sections 1 16, and judgment upon the award rendered by the arbitrators may be entered by any court having jurisdiction thereof. The place of arbitration shall be [New York, New York].

(b) The arbitration shall commence within 60 days of the date on which a written demand for arbitration is filed by any party hereto. In connection with the arbitration proceeding, the arbitrator shall have the power to order the production of documents by each party and any third-party witnesses. In addition, each party may take up to three depositions as of right, and the arbitrator may in his or her discretion allow additional depositions upon good cause shown by the moving party. However, the arbitrator shall not have the power to order the answering of interrogatories or the response to requests for admission. In connection with any arbitration, each party to the arbitration shall provide to the other, no later than seven business days before the date of the arbitration, the identity of all persons that may testify at the arbitration and a copy of all documents that may be introduced at the arbitration or considered or used by a party's witness or expert. The arbitrator's decision and award shall be made and delivered within six months of the selection of the arbitrator. The arbitrator's decision shall set forth a reasoned basis for any award of damages or finding of liability. The arbitrator shall not have power to award damages in excess of actual compensatory damages and shall not multiply actual damages or award punitive damages, and each party hereby irrevocably waives any claim to such damages.

(c) The Company, the Optionee, each party to the Agreement and any other holder of Shares issued pursuant to this Agreement (each, a "Party") covenants and agrees that such party will participate in the arbitration in good faith. This Section 7 applies equally to requests for temporary, preliminary or permanent injunctive relief, except that in the case of temporary or preliminary injunctive relief any party may proceed in court without prior arbitration for the limited purpose of avoiding immediate and irreparable harm.

(d) Each Party (i) hereby irrevocably submits to the jurisdiction of any United States District Court of competent jurisdiction for the purpose of enforcing the award or decision in any such proceeding, (ii) hereby waives, and agrees not to assert, by way of motion, as a defense, or otherwise, in any such suit, action or proceeding, any claim that it is not subject personally to the jurisdiction of the above named courts, that its property is exempt or immune from attachment or execution (except as protected by applicable law), that the suit, action or proceeding is brought in an inconvenient forum, that the venue of the suit, action or proceeding is improper or that this Agreement or the subject matter hereof may not be enforced in or by such court, and (iii) hereby waives and agrees not to seek any review by any court of any other jurisdiction which may be called upon to grant an enforcement of the judgment of any such court. Each Party hereby consents to service of process by registered mail at the address to which notices are to be given. Each Party agrees that its, his or her submission to jurisdiction and its, his or her consent to service of process by mail is made for the express benefit of each other Party. Final judgment against any Party in any such action, suit or proceeding may be enforced in other jurisdictions by suit, action or proceeding on the judgment, or in any other manner provided by or pursuant to the laws of such other jurisdiction.

8. Waiver of Statutory Information Rights. The Optionee understands and agrees that, but for the waiver made herein, the Optionee would be entitled, upon written demand under oath stating the purpose thereof, to inspect for any proper purpose, and to make copies and extracts from, the Company's stock ledger, a list of its stockholders, and its other books and records, and the books and records of subsidiaries of the Company, if any, under the circumstances and in the manner provided in Section 220 of the General Corporation Law of

Delaware (any and all such rights, and any and all such other rights of the Optionee as may be provided for in Section 220, the "Inspection Rights"). In light of the foregoing, until the first sale of Stock of the Company to the general public pursuant to a registration statement filed with and declared effective by the Securities and Exchange Commission under the Securities Act, the Optionee hereby unconditionally and irrevocably waives the Inspection Rights, whether such Inspection Rights would be exercised or pursued directly or indirectly pursuant to Section 220 or otherwise, and covenants and agrees never to directly or indirectly commence, voluntarily aid in any way, prosecute, assign, transfer, or cause to be commenced any claim, action, cause of action, or other proceeding to pursue or exercise the Inspection Rights. The foregoing waiver shall not affect any rights of a director, in his or her capacity as such, under Section 220. The foregoing waiver shall not apply to any contractual inspection rights of the Optionee under any other written agreement between the Optionee and the Company.

9. Consent of the Optionee. The Optionee herby (i) agrees that the Plan and the Stock Option granted herein replace all former stock option plans of HOOKIPA Biotech AG and all stock options granted to the Optionee by HOOKIPA Biotech AG and (ii) waives any rights relating to the conditional capital of HOOKIPA Biotech AG pursuant to Section 3.6 of the articles of association of HOOKIPA Biotech AG.

[SIGNATURE PAGE FOLLOWS]

The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned as of the date first above written.

HOOKIPA Pharma Inc.

By: ______________________________

Name:

Title:

Address:

____

____

____

The undersigned hereby acknowledges receiving and reviewing a copy of the Plan, including, without limitation, Section 9 thereof, and understands that this Stock Option is subject to the terms of the Plan and of this Agreement. This Agreement is hereby accepted, and the terms and conditions of the Plan, the Grant Notice and this Agreement, SPECIFICALLY INCLUDING THE ARBITRATION PROVISIONS SET FORTH IN SECTION 7 AND THE WAIVER OF STATUTORY INFORMATION RIGHTS SET FORTH IN SECTION 8 OF THIS AGREEMENT, are hereby agreed to, by the undersigned as of the date first above written.

OPTIONEE:

____

Name:

Address:

____

____

____

DESIGNATED BENEFICIARY:

Beneficiary's Address:

Appendix A

STOCK OPTION EXERCISE NOTICE

HOOKIPA Pharma Inc.

Attention: [ ]

Pursuant to the terms of the grant notice and stock option agreement between the undersigned and HOOKIPA Pharma Inc. (the "Company") dated (the "Agreement") under the HOOKIPA Pharma Inc. 2018 Stock Option and Grant Plan, I, [Insert Name] , hereby [Circle One] partially/fully exercise such option by including herein payment in the amount of $ representing the purchase price for [Fill in number of Shares] Shares. I have chosen the following form(s) of payment:

o 1. Cash

o 2. Certified or bank check payable to HOOKIPA Pharma Inc.

o 3. Other (as referenced in the Agreement and described in the Plan (please describe)) .

In connection with my exercise of the option as set forth above, I hereby represent and warrant to the Company as follows:

(i) I am purchasing the Shares for my own account for investment only, and not for resale or with a view to the distribution thereof.

(ii) I have had such an opportunity as I have deemed adequate to obtain from the Company such information as is necessary to permit me to evaluate the merits and risks of my investment in the Company and have consulted with my own advisers with respect to my investment in the Company.

(iii) I have sufficient experience in business, financial and investment matters to be able to evaluate the risks involved in the purchase of the Shares and to make an informed investment decision with respect to such purchase.

(iv) I can afford a complete loss of the value of the Shares and am able to bear the economic risk of holding such Shares for an indefinite period of time.

(v) I understand that the Shares may not be registered under the Securities Act of 1933 (it being understood that the Shares are being issued and sold in reliance on the exemption provided in Rule 701 thereunder) or any applicable state securities or "blue sky" laws and may not be sold or otherwise transferred or disposed of in the absence of an effective registration statement under the Securities Act of 1933 and under any applicable state securities or "blue sky" laws (or exemptions from the registration requirement thereof). I further acknowledge that certificates representing Shares will bear restrictive legends reflecting the foregoing and/or that book entries for uncertificated Shares will include similar restrictive notations.

(vi) I have read and understand the Plan and acknowledge and agree that the Shares are subject to all of the relevant terms of the Plan, including without limitation, the transfer restrictions set forth in Section 9 of the Plan.

(vii) I understand and agree that the Company has a right of first refusal with respect to the Shares pursuant to Section 9(b) of the Plan.

(viii) I understand and agree that the Company has certain repurchase rights with respect to the Shares pursuant to Section 9(c) of the Plan.

(ix) I understand and agree that I may not sell or otherwise transfer or dispose of the Shares for a period of time following the effective date of a public offering by the Company as described in Section 9(f) of the Plan.

(x) I understand and agree to the waiver of statutory information rights as set forth in Section 8 of the Agreement.

Sincerely yours,

____
Name:

Address:

____

____

____

Date: ______________________________

Appendix B

Joinder to Shareholders' Agreement

In consideration of and in connection with the sale and issuance by Hookipa Pharma Inc., a Delaware corporation (the "Company"), of Common Stock, par value $0.0001, the undersigned hereby agrees that as of the date hereof, it is a party to and bound by the terms and conditions of the following agreements (in the capacities indicated) that certain Shareholders Agreement, dated as of [ ], 2018, by and among the Company and the holders party, as the same may be amended from time to time, as a Founder (as defined therein).

Name:

Final Form

NON-QUALIFIED STOCK OPTION GRANT NOTICE
UNDER THE HOOKIPA PHARMA INC.
2018 STOCK OPTION AND GRANT PLAN

Pursuant to the HOOKIPA Pharma Inc. 2018 Stock Option and Grant Plan (the "Plan"), HOOKIPA Pharma Inc., a Delaware corporation (together with any successor, the "Company"), has granted to the individual named below, an option (the "Stock Option") to purchase on or prior to the Expiration Date, or such earlier date as is specified herein, all or any part of the number of shares of Common Stock, par value $0.0001 per share ("Common Stock"), of the Company indicated below (the "Shares"), at the Option Exercise Price per share, subject to the terms and conditions set forth in this Non-Qualified Stock Option Grant Notice (the "Grant Notice"), the attached Non-Qualified Stock Option Agreement (the "Agreement") and the Plan. This Stock Option is not intended to qualify as an "incentive stock option" as defined in Section 422(b) of the Internal Revenue Code of 1986, as amended from time to time (the "Code").

Name of Optionee:		(the "Optionee")
No. of Shares:	Shares of Common Stock	
Grant Date:		
Vesting Commencement Date:		(the "Vesting Commencement Date")
Expiration Date:		(the "Expiration Date")
Option Exercise Price/Share:	$	(the "Option Exercise Price")
Vesting Schedule:	25 percent of the Shares shall vest and become exercisable on the first anniversary of the Vesting Commencement Date; provided that the Optionee continues to have a Service Relationship with the Company at such time. Thereafter, the remaining 75 percent of the Shares shall vest and become exercisable in 12 equal quarterly installments following the first anniversary of the Vesting Commencement Date, provided the Optionee continues to have a Service Relationship with the Company on each vesting date. Notwithstanding anything in the Agreement to the contrary, in the case of a Sale Event, this Stock Option and the Shares shall be treated as provided in Section 3(c) of the Plan Provided, however, that notwithstanding anything herein to the contrary, in the event (and only in the event) that this Stock Option or the Shares are assumed or continued by the Company or its successor entity in the sole discretion of the parties to a Sale Event and thereafter remains in effect following such Sale Event, then 50% of the then-unvested Shares shall be deemed vested in full upon the date on which the	

Optionee’s Service Relationship with the Company and its Subsidiaries or successor entity terminates if (A) such termination occurs in connection with and effective as of the date of, or within 12 months following the date of, such Sale Event and (B) such termination is either by the Company without Cause or by the Optionee for Good Reason.

Attachments: Non-Qualified Stock Option Agreement, 2018 Stock Option and Grant Plan

NON-QUALIFIED STOCK OPTION AGREEMENT
UNDER THE HOOKIPA PHARMA INC.
2018 STOCK OPTION AND GRANT PLAN

All capitalized terms used herein and not otherwise defined shall have the respective meanings set forth in the Grant Notice and the Plan.

1. Vesting, Exercisability and Termination.

(a) No portion of this Stock Option may be exercised until such portion shall have vested and become exercisable.

(b) Except as set forth below, and subject to the determination of the Committee in its sole discretion to accelerate the vesting schedule hereunder, this Stock Option shall be vested and exercisable on the respective dates indicated below:

(i) This Stock Option shall initially be unvested and unexercisable.

(ii) This Stock Option shall vest and become exercisable in accordance with the Vesting Schedule set forth in the Grant Notice.

(c) Termination. Except as may otherwise be provided by the Committee, if the Optionee's Service Relationship is terminated, the period within which to exercise this Stock Option will be subject to earlier termination as set forth below (and if not exercised within such period, shall thereafter terminate subject, in each case, to Section 3(c) of the Plan) four weeks following receipt of the first Exercise Notice (as defined below) following the termination of Optionee's Service Relationship; provided however, if the Optionee's Service Relationship is terminated for Cause, this Stock Option shall terminate immediately upon the date of such termination.

For purposes hereof, the Committee's determination of the reason for termination of the Optionee's Service Relationship shall be conclusive and binding on the Optionee and his or her representatives or legatees and any Permitted Transferee. Any portion of this Stock Option that is not vested and exercisable on the date of termination of the Service Relationship shall terminate immediately and be null and void.

2. Exercise of Stock Option.

(a) The Options may be exercised only within the relevant exercise periods set forth in (i) and (ii) below (each an "Exercise Period").

(i) After an IPO of the Company, any time that is not declared a restricted period by the Committee shall be considered an Exercise Period.

(ii) Prior to an IPO of the Company, an Exercise Period shall start upon receipt by the Optionee of an Option Window Notice and shall expire four weeks following receipt of the Option Winddow Notice which shall be deemed to be received by each Beneficiary on the seventh day from sending. An Option Window Notice shall be sent by the Company to the Optionee twice each business year and shall include the amount of vested Options.

(b) At any time during the Exercise Period, the Optionee may exercise this Stock Option only in the following manner: Prior to the Expiration Date, the Optionee may deliver a Stock Option exercise notice (an "Exercise Notice") in the form of Appendix A hereto indicating his or her election to purchase some or all of the Shares with respect to which this Stock Option is then exercisable together with an executed joinder to the page to the Shareholders Agreement, dated as of [ ], 2018, by and among the Company and the holders party, as the same may be amended from time to time, in the form of Appendix B. The Exercise Notice shall specify the number of Shares to be purchased. Payment of the purchase price may be made by one or more of the methods described in Section 5 of the Plan, subject to the limitations contained in such Section of the Plan, including the requirement that the Committee specifically approve in advance certain payment methods.

(c) Notwithstanding any other provision hereof or of the Plan, no portion of this Stock Option shall be exercisable after the Expiration Date.

(d) The Optionee agrees that the purchased Shares shall be delivered to and held by an escrow agent until the expiry of any lock-up period following the Initial Public Offering of the Company.

(e) In case the Company is required to pay or withhold any tax on behalf of the Optionee, the Optionee shall promptly reimburse the Company.

(f) Subject to applicable law, if the Optionee is a non-US Person, the Company shall use its commercially reasonable efforts to minimize, in accordance with applicable US law, any required tax withholdings from Optionee.

3. Incorporation of Plan. Notwithstanding anything herein to the contrary, this Stock Option shall be subject to and governed by all the terms and conditions of the Plan.

4. Transferability of Stock Option. This Stock Option is personal to the Optionee and is not transferable by the Optionee in any manner other than by will or by the laws of descent and distribution. The Stock Option may be exercised during the Optionee's lifetime only by the Optionee (or by the Optionee's guardian or personal representative in the event of the Optionee's incapacity). The Optionee may elect to designate a beneficiary by providing written notice of the name of such beneficiary to the Company, and may revoke or change such designation at any time by filing written notice of revocation or change with the Company; such beneficiary may exercise the Optionee's Stock Option in the event of the Optionee's death to the extent provided herein. If the Optionee does not designate a beneficiary, or if the designated beneficiary predeceases the Optionee, the legal representative of the Optionee may exercise this Stock Option to the extent provided herein in the event of the Optionee's death.

5. Restrictions on Transfer of Shares. The Shares acquired upon exercise of the Stock Option shall be subject to certain transfer restrictions and other limitations including, without limitation, the provisions contained in Section 9 of the Plan.

6. Miscellaneous Provisions.

(a) Equitable Relief. The parties hereto agree and declare that legal remedies may be inadequate to enforce the provisions of this Agreement and that equitable relief, including specific performance and injunctive relief, may be used to enforce the provisions of this Agreement.

(b) Adjustments for Changes in Capital Structure. If, as a result of any reorganization, recapitalization, reincorporation, reclassification, stock dividend, stock split, reverse stock split or other similar change in the Common Stock, the outstanding shares of Common Stock are increased or decreased or are exchanged for a different number or kind of securities of the Company, the restrictions contained in this Agreement shall apply with equal force to additional and/or substitute securities, if any, received by the Optionee in exchange for, or by virtue of his or her ownership of, this Stock Option or Shares acquired pursuant thereto.

(c) Change and Modifications. This Agreement may not be orally changed, modified or terminated, nor shall any oral waiver of any of its terms be effective. This Agreement may be changed, modified or terminated only by an agreement in writing signed by the Company and the Optionee.

(d) Governing Law. This Agreement shall be governed by and construed in accordance with the General Corporation Law of the State of Delaware as to matters within the scope thereof, and as to all other matters shall be governed by and construed in accordance with the internal laws of Delaware, without regard to conflict of law principles that would result in the application of any law other than the law of the State of Delaware.

(e) Headings. The headings are intended only for convenience in finding the subject matter and do not constitute part of the text of this Agreement and shall not be considered in the interpretation of this Agreement.

(f) Saving Clause. If any provision(s) of this Agreement shall be determined to be illegal or unenforceable, such determination shall in no manner affect the legality or enforceability of any other provision hereof.

(g) Notices. All notices, requests, consents and other communications shall be in writing and be deemed given when delivered personally, by telex or facsimile transmission or when received if mailed by first class registered or certified mail, postage prepaid. Notices to the Company or the Optionee shall be addressed as set forth underneath their signatures below, or to such other address or addresses as may have been furnished by such party in writing to the other.

(h) Benefit and Binding Effect. This Agreement shall be binding upon and shall inure to the benefit of the parties hereto, their respective successors, assigns, and legal representatives. The Company has the right to assign this Agreement, and such assignee shall become entitled to all the rights of the Company hereunder to the extent of such assignment.

(i) Counterparts. For the convenience of the parties and to facilitate execution, this Agreement may be executed in two or more counterparts, each of which shall be deemed an original, but all of which shall constitute one and the same document.

(j) Integration. This Agreement constitutes the entire agreement between the parties with respect to this Stock Option and supersedes all prior agreements and discussions between the parties concerning such subject matter.

7. Dispute Resolution.

(a) Except as provided below, any dispute arising out of or relating to the Plan or this Stock Option, this Agreement, or the breach, termination or validity of the Plan, this Stock Option or this Agreement, shall be finally settled by binding arbitration conducted expeditiously in accordance with the J.A.M.S./Endispute Comprehensive Arbitration Rules and Procedures (the “J.A.M.S. Rules”). The arbitration shall be governed by the United States Arbitration Act, 9 U.S.C. Sections 1-16, and judgment upon the award rendered by the arbitrators may be entered by any court having jurisdiction thereof. The place of arbitration shall be New York, New York.

(b) The arbitration shall commence within 60 days of the date on which a written demand for arbitration is filed by any party hereto. In connection with the arbitration proceeding, the arbitrator shall have the power to order the production of documents by each party and any third-party witnesses. In addition, each party may take up to three depositions as of right, and the arbitrator may in his or her discretion allow additional depositions upon good cause shown by the moving party. However, the arbitrator shall not have the power to order the answering of interrogatories or the response to requests for admission. In connection with any arbitration, each party to the arbitration shall provide to the other, no later than seven business days before the date of the arbitration, the identity of all persons that may testify at the arbitration and a copy of all documents that may be introduced at the arbitration or considered or used by a party’s witness or expert. The arbitrator’s decision and award shall be made and delivered within six months of the selection of the arbitrator. The arbitrator’s decision shall set forth a reasoned basis for any award of damages or finding of liability. The arbitrator shall not have power to award damages in excess of actual compensatory damages and shall not multiply actual damages or award punitive damages, and each party hereby irrevocably waives any claim to such damages.

(c) The Company, the Optionee, each party to the Agreement and any other holder of Shares issued pursuant to this Agreement (each, a “Party”) covenants and agrees that such party will participate in the arbitration in good faith. This Section 7 applies equally to requests for temporary, preliminary or permanent injunctive relief, except that in the case of temporary or preliminary injunctive relief any party may proceed in court without prior arbitration for the limited purpose of avoiding immediate and irreparable harm.

(d) Each Party (i) hereby irrevocably submits to the jurisdiction of any United States District Court of competent jurisdiction for the purpose of enforcing the award or decision in any such proceeding, (ii) hereby waives, and agrees not to assert, by way of motion, as a defense, or otherwise, in any such suit, action or proceeding, any claim that it is not subject personally to the jurisdiction of the above named courts, that its property is exempt or immune

from attachment or execution (except as protected by applicable law), that the suit, action or proceeding is brought in an inconvenient forum, that the venue of the suit, action or proceeding is improper or that this Agreement or the subject matter hereof may not be enforced in or by such court, and (iii) hereby waives and agrees not to seek any review by any court of any other jurisdiction which may be called upon to grant an enforcement of the judgment of any such court. Each Party hereby consents to service of process by registered mail at the address to which notices are to be given. Each Party agrees that its, his or her submission to jurisdiction and its, his or her consent to service of process by mail is made for the express benefit of each other Party. Final judgment against any Party in any such action, suit or proceeding may be enforced in other jurisdictions by suit, action or proceeding on the judgment, or in any other manner provided by or pursuant to the laws of such other jurisdiction.

8. Waiver of Statutory Information Rights. The Optionee understands and agrees that, but for the waiver made herein, the Optionee would be entitled, upon written demand under oath stating the purpose thereof, to inspect for any proper purpose, and to make copies and extracts from, the Company’s stock ledger, a list of its stockholders, and its other books and records, and the books and records of subsidiaries of the Company, if any, under the circumstances and in the manner provided in Section 220 of the General Corporation Law of Delaware (any and all such rights, and any and all such other rights of the Optionee as may be provided for in Section 220, the “Inspection Rights”). In light of the foregoing, until the first sale of Stock of the Company to the general public pursuant to a registration statement filed with and declared effective by the Securities and Exchange Commission under the Securities Act, the Optionee hereby unconditionally and irrevocably waives the Inspection Rights, whether such Inspection Rights would be exercised or pursued directly or indirectly pursuant to Section 220 or otherwise, and covenants and agrees never to directly or indirectly commence, voluntarily aid in any way, prosecute, assign, transfer, or cause to be commenced any claim, action, cause of action, or other proceeding to pursue or exercise the Inspection Rights. The foregoing waiver shall not affect any rights of a director, in his or her capacity as such, under Section 220. The foregoing waiver shall not apply to any contractual inspection rights of the Optionee under any other written agreement between the Optionee and the Company.

9. Consent of the Optionee. The Optionee herby (i) agrees that the Plan and the Stock Option granted herein replace all former stock option plans of HOOKIPA Biotech AG and all stock options granted to the Optionee by HOOKIPA Biotech AG and (ii) waives any rights relating to the conditional capital of HOOKIPA Biotech AG pursuant to Section 3.6 of the articles of association of HOOKIPA Biotech AG.

[SIGNATURE PAGE FOLLOWS]

The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned as of the date first above written.

HOOKIPA Pharma Inc.

By: ______________________________
Name:
Title:

Address:

The undersigned hereby acknowledges receiving and reviewing a copy of the Plan, including, without limitation, Section 9 thereof, and understands that this Stock Option is subject to the terms of the Plan and of this Agreement. This Agreement is hereby accepted, and the terms and conditions of the Plan, the Grant Notice and this Agreement, SPECIFICALLY INCLUDING THE ARBITRATION PROVISIONS SET FORTH IN SECTION 7 AND THE WAIVER OF STATUTORY INFORMATION RIGHTS SET FORTH IN SECTION 8 OF THIS AGREEMENT, are hereby agreed to, by the undersigned as of the date first above written.

OPTIONEE:

Name:

Address:

DESIGNATED BENEFICIARY:

Beneficiary's Address:

Appendix A

STOCK OPTION EXERCISE NOTICE

HOOKIPA Pharma Inc.

Attention: [ ]

Pursuant to the terms of the grant notice and stock option agreement between the undersigned and HOOKIPA Pharma Inc. (the "Company") dated (the "Agreement") under the HOOKIPA Pharma Inc. 2018 Stock Option and Grant Plan, I, [Insert Name] , hereby [Circle One] partially/fully exercise such option by including herein payment in the amount of $ representing the purchase price for [Fill in number of Shares] Shares. I have chosen the following form(s) of payment:

o 1. Cash

o 2. Certified or bank check payable to HOOKIPA Pharma Inc.

o 3. Other (as referenced in the Agreement and described in the Plan (please describe)) .

In connection with my exercise of the option as set forth above, I hereby represent and warrant to the Company as follows:

(i) I am purchasing the Shares for my own account for investment only, and not for resale or with a view to the distribution thereof.

(ii) I have had such an opportunity as I have deemed adequate to obtain from the Company such information as is necessary to permit me to evaluate the merits and risks of my investment in the Company and have consulted with my own advisers with respect to my investment in the Company.

(iii) I have sufficient experience in business, financial and investment matters to be able to evaluate the risks involved in the purchase of the Shares and to make an informed investment decision with respect to such purchase.

(iv) I can afford a complete loss of the value of the Shares and am able to bear the economic risk of holding such Shares for an indefinite period of time.

(v) I understand that the Shares may not be registered under the Securities Act of 1933 (it being understood that the Shares are being issued and sold in reliance on the exemption provided in Rule 701 thereunder) or any applicable state securities or "blue sky" laws and may not be sold or otherwise transferred or disposed of in the absence of an effective registration statement under the Securities Act of 1933 and under any applicable state securities or "blue sky" laws (or exemptions from the registration requirement thereof). I further acknowledge that certificates representing Shares will bear restrictive legends reflecting the foregoing and/or that book entries for uncertificated Shares will include similar restrictive notations.

(vi) I have read and understand the Plan and acknowledge and agree that the Shares are subject to all of the relevant terms of the Plan, including without limitation, the transfer restrictions set forth in Section 9 of the Plan.

(vii) I understand and agree that the Company has a right of first refusal with respect to the Shares pursuant to Section 9(b) of the Plan.

(viii) I understand and agree that the Company has certain repurchase rights with respect to the Shares pursuant to Section 9(c) of the Plan.

(ix) I understand and agree that I may not sell or otherwise transfer or dispose of the Shares for a period of time following the effective date of a public offering by the Company as described in Section 9(f) of the Plan.

(x) I understand and agree to the waiver of statutory information rights as set forth in Section 8 of the Agreement.

Sincerely yours,

____
Name:

Address:

____

____

____

Date: __________________________

Appendix B

Joinder to Shareholders' Agreement

In consideration of and in connection with the sale and issuance by Hookipa Pharma Inc., a Delaware corporation (the "Company"), of Common Stock, par value $0.0001, the undersigned hereby agrees that as of the date hereof, it is a party to and bound by the terms and conditions of the following agreements (in the capacities indicated) that certain Shareholders Agreement, dated as of [ ], 2018, by and among the Company and the holders party, as the same may be amended from time to time, as a Founder (as defined therein).

____
Name: