7,350,000 Shares

Common Stock

This is an initial public offering of shares of our common stock. We are offering 7,350,000 shares of our common stock. Prior to this offering, there has been no public market for our common stock. Our Class A common stock will trade on The Nasdaq Global Select Market under the symbol ''BCEL''. The initial public offering price of our common stock is $17.00 per share.

We are an ''emerging growth company'' under applicable Securities and Exchange Commission rules and will be subject to reduced public company reporting requirements for this prospectus and future filings.

Following this offering, we will have two classes of common stock: Class A common stock and Class B common stock. The rights of the holders of Class A common stock and Class B common stock are identical, except with respect to voting and conversion. Each share of Class A common stock will be entitled to one vote and shares of Class B common stock will be non-voting, except as may be required by law. Each share of Class B common stock may be converted at any time into one share of Class A common stock at the option of its holder, subject to the ownership limitations provided for in our amended and restated certificate of incorporation to become effective upon the closing of this offering.

Our business and an investment in our Class A common stock involve significant risks. These risks are described under the caption ''Risk Factors'' beginning on page 13 of this prospectus.

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

	Per Share	*Total*
Public offering price	**$ 17.00**	**$ 124,950,000**
Underwriting discount[(1)]	**$ 1.19**	**$ 8,746,500**
Proceeds, before expenses, to us	**$ 15.81**	**$ 116,203,500**

(1) See ''Underwriting'' for a description of the compensation payable to the underwriters.

The underwriters may also purchase up to an additional 1,102,500 shares of our Class A common stock from us at the public offering price, less the underwriting discount, within 30 days from the date of this prospectus to cover overallotments.

In addition, certain existing stockholders known to us to beneficially own more than 5% of our capital stock prior to this offering have agreed to purchase approximately $63 million of shares of our common stock in this offering at the initial public offering price. All shares of common stock purchased by entities affiliated with Baker Brothers Life Sciences L.P. will initially be issued in the form of Class B common stock that will be convertible into an equivalent number of shares of our Class A common stock. No other purchasers will be issued Class B common stock in this offering. The public offering price of and underwriting discount on such shares of Class B common stock is identical to the shares of Class A common stock otherwise offered hereby. Unless otherwise indicated or as the context otherwise requires, references to Class A common stock being offered hereby include the shares of Class A common stock into which shares of our Class B common stock purchased in this offering are convertible.

The underwriters expect to deliver the shares against payment in New York, New York on June 24, 2019.

Cowen **Evercore ISI** **Stifel**

Canaccord Genuity

Arcadia Securities

June 19, 2019

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

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

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

Atreca, Inc. and our logo are our trademarks and are used in this prospectus. This prospectus also includes trademarks, tradenames and service marks that are the property of other organizations. Solely for convenience, our trademarks and tradenames referred to in this prospectus appear without the™ symbol, but those references are not intended to indicate, in any way, that we will not assert, to the fullest extent under applicable law, our rights, or the right of the applicable licensor to these trademarks and tradenames.

PROSPECTUS SUMMARY

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

Overview

We are a biopharmaceutical company utilizing our differentiated platform to discover and develop novel antibody-based immunotherapeutics to treat a range of solid tumor types. While more traditional oncology drug discovery approaches attempt to generate antibodies against known targets, our approach relies on the human immune system to direct us to unique antibody-target pairs from patients experiencing a clinically meaningful, active immune response against their tumors. These unique antibody-target pairs represent a potentially novel and previously unexplored landscape of immuno-oncology targets. We believe the fact that our approach has the potential to deliver novel, previously unexplored immuno-oncology targets provides us with a significant competitive advantage over traditional approaches which focus on known targets that many companies are aware of and can pursue. We have utilized our drug discovery approach to identify over 1,400 distinct human antibodies that bind preferentially to tumor tissue from patients who are not the source of the antibody. Our lead product candidate, ATRC-101, is a monoclonal antibody with a novel mechanism of action and target derived from an antibody identified using our discovery platform. ATRC-101 reacts *in vitro* with a majority of human ovarian, non-small cell lung, colorectal and breast cancer samples from multiple patients. It has demonstrated robust anti-tumor activity as a single agent in multiple preclinical models, including one model in which PD-1 checkpoint inhibitors typically display limited activity. We anticipate filing an Investigational New Drug, or IND, application for ATRC-101 in late 2019 and initiating a Phase 1b clinical trial in patients with solid tumors in early 2020, subject to U.S. Food and Drug Administration, or FDA, approval of our IND application.

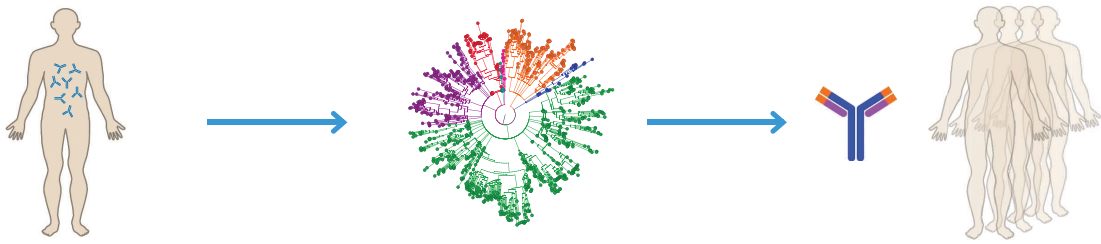
Although existing cancer therapies, including the evolving class of cancer immunotherapeutics, have advanced significantly over recent years, cancer remains the second leading cause of death in the United States. To address this unmet need, we pursue an open-aperture approach, which relies on the human immune system to direct us to antibody-target pairs that are present in patients who have experienced a clinically meaningful response to therapy.

The Atreca Drug Discovery Platform

We believe we may be able to address certain key limitations of the current oncology drug discovery paradigm by focusing on the common phenomenon driving clinical responses in cancer immunotherapy—an active human anti-tumor immune response. Our platform allows us to interrogate an active B cell response within an individual cancer patient to identify novel and relevant antibody-target pairs, which may enable us to develop antibody-based product candidates to treat large populations of patients with solid tumors. We believe that the significant time and capital invested in developing, refining and applying our differentiated discovery platform have provided us with significant first-mover advantages and created barriers to entry.

For example, establishing our non-interventional clinical studies to obtain patient samples, enabling longitudinal analyses, required approximately 1 to 2 years. We built our bioinformatics

expertise in assembling and analyzing our antibodies over seven years of operations. Our hit antibody generation process has been enhanced to deliver hits at a high rate, has already generated over 1,400 hit antibodies and is supported by a growing intellectual property portfolio. Additionally, our investments of capital and time to build industrialized wet-lab and supporting bioinformatics capacity across our platform, including the time required to identify and hire very qualified personnel, were substantial. The figure below illustrates the overall concept of our drug discovery approach:



Responder with Anti-Tumor Immune Response

Interrogation of the Active B Cell Response via Atreca Discovery Platform

Novel Antibody-Target Pairs Yielding Product Candidates

Our discovery process begins by gathering blood samples, mostly through company-sponsored non-interventional clinical studies, from cancer patients before, during and after they undergo treatment, which can induce an active anti-tumor immune response. Through this process, we have built a broad repository of over 1,200 samples from over 400 donors, representing over 25 different solid tumor types. We identify those patients with clinically meaningful responses to therapy, defined as those that reach validated surrogate endpoints of complete or partial response, stable disease for six months, or long-term progression-free survival. For those patients, we then examine their samples for rare antibody-producing B cells called plasmablasts that are elevated during an active immune response. We believe that these human immune responses, which often occur over an extended period of time, generate antibodies accessible with our platform that would be difficult to obtain through shorter term, non-human immunization or *in vitro* strategies.

If plasmablasts are elevated in a particular sample, we then employ a multi-step process to generate a potential product candidate. We start by isolating single plasmablasts and determining the sequences of the co-expressed antibody genes using our proprietary Immune Repertoire Capture® technology. We analyze these sequences to select antibodies, which we synthesize as recombinant proteins. We then test these antibodies to identify those that bind to tumor tissue from patients who are not the source of the antibody, referred to as non-autologous tumor tissue, preferentially over normal tissue. We then analyze these ''hit'' antibodies using a number of *in vitro* and *in vivo* assays, and often make structural changes to generate leads. A select number of these leads are refined further using protein engineering to enhance their drug-like properties as we identify and characterize their targets in parallel prior to initiating preclinical development and IND-enabling studies.

Key Attributes of Our Discovery Platform

We take an ''open-aperture'' approach to drug discovery, in which we are not limited by preconceptions of what constitutes a viable antibody or target. We instead allow the human immune system to direct our efforts. We believe this approach provides us access to a broad underexploited antibody and drug target space. Our approach may lead us to antibodies that are unlikely to have

arisen via more traditional approaches with targets that otherwise may not have been discoverable. We believe our approach and discovery platform provide us with the ability to:

- Generate antibodies made by the human immune system.
- Deliver potentially useful antibodies at a high rate and in a scalable fashion.
- Access a potentially large and underexploited tumor target space.
- Identify antibody-target pairs.
- Generate candidates that direct the immune system to attack tumor tissue.
- Develop potential treatments for large populations of patients across multiple tumor types.

Our Lead Product Candidate: ATRC-101 for the Treatment of Solid Tumors

ATRC-101 is a monoclonal antibody derived from an antibody identified using our discovery platform in the active immune response of a patient. We believe that ATRC-101 may have broad potential as an immunotherapeutic agent in a range of solid tumors. ATRC-101 reacts *in vitro* with a majority of human ovarian, non-small cell lung, colorectal and breast cancer samples from multiple patients. It has also demonstrated robust anti-tumor activity as a single agent in multiple preclinical syngeneic tumor models, including one model in which PD-1 checkpoint inhibitors typically display limited activity. ATRC-101 has also demonstrated preclinical activity in combination with other immunotherapeutics, including PD-1 checkpoint inhibitors. Both the mechanism of action of ATRC-101, which we refer to as Driver Antigen Engagement, and its target appear unlike those of other anti-tumor antibodies that have been or are currently in clinical development. In histology studies, we did not observe binding above background levels across a range of normal human tissues. Additionally, in repeat-dose safety studies in both mice and non-human primates, we did not observe a safety signal. We have identified the target of ATRC-101 as a ribonucleoprotein (RNP) complex. ATRC-101 binds to target reconstituted *in vitro* using a single recombinant protein, polyadenylate-binding protein 1, and *in vitro* transcribed poly(A) RNA.

We anticipate filing an IND for ATRC-101 in late 2019 and launching an open-label dose escalation trial in patients with solid tumors in early 2020. Assuming we observe an acceptable safety profile, we then anticipate dosing ATRC-101 in combination with a PD-1 checkpoint inhibitor. ATRC-101 demonstrates the ability of our platform to generate antibody candidates with novel targets and mechanisms of action.

We own worldwide rights to ATRC-101 and have filed multiple U.S. provisional patent applications relating to ATRC-101 and other variants. We intend to file a nonprovisional patent application in the first quarter of 2020.

Our Lead Generation Programs

ATRC-101, currently our only product candidate, represents one of over 1,400 antibodies that we have identified to date through our discovery platform that may have potential to generate broad anti-tumor activity via a variety of mechanisms of action. While we believe that we will be able to exploit our growing library of novel antibodies in order to develop product candidates with additional distinct and compelling mechanisms of action for tumor destruction, many of these antibodies will likely not yield product candidates for a variety of reasons. For example, while we have identified antibodies that can be coupled to T cell-activating domains in a bispecific format to kill tumor cells; others that directly target tumor cells leading to immune cell-mediated killing; and others that internalize upon binding to tumor cells and therefore may be able to deliver coupled toxins, but less than 25% of the antibodies in our hit library demonstrate one of these mechanisms. In addition, in order to be able to develop product candidates from our hit library in certain of these mechanisms, such as bispecific T cell engagers and antibody-drug conjugates, we will need to partner with biotech

companies that have developed technologies that enable engineering our antibodies into these formats. We are actively pursuing such collaborative partnerships, and plan to allocate resources to these efforts as part of our shift to focus our drug discovery efforts around building out a proprietary pipeline of clinical candidates.

We are currently pursuing numerous potential partnership opportunities, and anticipate entering into a strategic drug discovery partnership as early as 2020, and to file an IND application for a second product candidate in 2021.

Our Strategy

Our goal is to become a leading biopharmaceutical company by utilizing our differentiated platform to discover and develop antibody-based therapeutics against novel targets. In pursuit of that strategy, we intend to:

- Rapidly advance our lead product candidate, ATRC-101, into clinical trials in multiple types of solid tumors.
- Continue to develop and advance our pipeline of antibody-based product candidates for oncology.
- Continue to invest in our discovery platform for applications within oncology and potential indications outside of oncology.
- Selectively enter into collaborations to enhance and expand our product pipeline as well as our drug development capabilities.
- Continue to expand our intellectual property portfolio to further protect our discovery platform and the novel product candidates it may generate.

Our Management Team and Investors

We are led by a highly experienced management team with deep scientific and technical expertise and broad experience in discovering, developing and commercializing antibody therapeutics in oncology. Members of our executive team have held a range of corporate leadership and academic roles including founding multiple biopharmaceutical companies, driving cutting-edge academic research, leading informatics and computational biology teams, discovering and developing novel antibody-based therapeutics and executing the launch and commercialization of multiple approved products. Since our founding, we have raised a total of $219 million in equity financing primarily from leading institutional investors. See ‘‘Principal Stockholders’’.

Risk Factors Summary

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

- We are a preclinical stage biopharmaceutical company with a history of losses; we expect to continue to incur significant losses for the foreseeable future and may never achieve or maintain profitability.
- ATRC-101 is in preclinical development, has never been tested in a human subject and may fail in development or suffer delays that materially and adversely affect its commercial viability.
- If ATRC-101 is ever tested in humans, it may not demonstrate the combination of safety and efficacy necessary to become approvable or commercially viable.
- We may not be successful in our efforts to use and expand our discovery platform to build a pipeline of product candidates.

- Our approach to developing and identifying our antibodies using our discovery platform is novel and unproven and may not result in marketable products.
- If we are unable to obtain or protect intellectual property rights related to our technology and current or future product candidates, or if our intellectual property rights are inadequate, we may not be able to compete effectively.
- Patent terms may not be able to protect our competitive position for an adequate period of time with respect to our current or future technologies or product candidates.
- We may be unable to obtain U.S. or foreign regulatory approval and, as a result, be unable to commercialize ATRC-101 or potential future product candidates.
- Even if we receive regulatory approval for any of our current or potential future product candidates, we will be subject to ongoing regulatory obligations and continued regulatory review, which may result in significant additional expense.
- Our quarterly operating results may fluctuate significantly or may fall below the expectations of investors or securities analysts, each of which may cause our stock price to fluctuate or decline.

Corporate Information

We were incorporated under the laws of the state of Delaware in 2010 under the name Atreca, Inc. Our principal executive offices are located at 500 Saginaw Drive, Redwood City, CA 94063. Our telephone number is (650) 595-2595. Our website address is www.atreca.com. Information contained on, or that can be accessed through, our website is not incorporated by reference into this prospectus, and you should not consider information on our website to be part of this prospectus.

The Atreca design logo, ‘‘Atreca’’ and our other registered or common law trademarks, service marks, or trade names appearing in this prospectus are the property of Atreca, Inc. Other trade names, trademarks and service marks used in this prospectus are the property of their respective owners.

Implications of Being an Emerging Growth Company

We qualify as an ‘‘emerging growth company’’ as defined in the Jumpstart Our Business Startups Act of 2012, or JOBS Act, enacted in April 2012. An emerging growth company may take advantage of reduced reporting requirements that are otherwise applicable to public companies. These provisions include, but are not limited to:

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

We may take advantage of these provisions until the last day of our fiscal year following the fifth anniversary of the date of the first sale of our common equity securities pursuant to an effective registration statement under the Securities Act of 1933, as amended. However, if certain events occur prior to the end of such five-year period, including if we become a ‘‘large accelerated filer,’’ our

annual gross revenues exceed $1.07 billion or we issue more than $1.0 billion of non-convertible debt in any three-year period, we will cease to be an emerging growth company prior to the end of such five-year period.

We have elected to avail ourselves of an exemption that allows us to delay adopting new or revised accounting standards until such time as those standards apply to private companies. As a result, we will not be subject to the same new or revised accounting standards as other public companies that comply with the public company effective dates, including but not limited to the new lease accounting standard. We have also elected to take advantage of certain of the reduced disclosure obligations in the registration statement of which this prospectus is a part and may elect to take advantage of other reduced reporting requirements in future filings. As a result of these elections, the information that we provide to our stockholders may be different than you might receive from other public reporting companies.

The Offering

Common stock offered	7,350,000 shares
Class A common stock to be outstanding after this offering	20,850,261 shares (21,952,761 shares, if the underwriters exercise their option to purchase additional shares in full)
Class B common stock to be outstanding after this offering	5,934,191 shares
Total Class A common stock and Class B common stock to be outstanding after this offering	26,784,452 shares (27,886,952 shares, if the underwriters exercise their option to purchase additional shares in full)
Underwriters' option to purchase additional shares of Class A common stock	1,102,500 shares
Use of proceeds	Our net proceeds from the sale of our common stock from this offering will be approximately $113.8 million (or approximately $131.2 million if the underwriters exercise their option to purchase additional shares in full), based on the initial public offering price of $17.00 per share, and after deducting underwriting discounts and commissions and estimated offering expenses payable by us. We currently expect to use the net proceeds from this offering, together with our existing cash and cash equivalents, as follows: ▪ approximately $45 million to fund the development of ATRC-101 through the dose-escalation portion of our Phase 1b clinical trial and a portion of our currently planned protocol amendments to pursue combination studies and expansion cohorts; ▪ approximately $65 million to fund our ongoing efforts to develop additional clinical candidates from our discovery platform; and ▪ the remaining proceeds for continued development and utilization of our discovery platform, hiring of additional personnel, capital expenditures, costs of operating as a public company and other general corporate purposes. See the section titled ''Use of Proceeds'' for additional information.

Voting rights	Following this offering, we will have two classes of common stock: Class A common stock and Class B common stock. The rights of the holders of Class A common stock and Class B common stock are identical, except with respect to voting and conversion. Each share of Class A common stock will be entitled to one vote and shares of Class B common stock will be non-voting, except as may be required by law. Each share of Class B common stock may be converted into one share of Class A common stock at the option of its holder, subject to the ownership limitations provided for in our amended and restated certificate of incorporation to become effective upon the closing of this offering. See the section titled ''Description of Capital Stock'' for additional information.
Risk factors	See ''Risk Factors'' and the other information included in this prospectus for a discussion of factors you should carefully consider before deciding to invest in our Class A common stock.
Nasdaq Global Select Market symbol	''BCEL''

The number of shares of our Class A common stock and Class B common stock that will be outstanding after this offering is based on 15,500,261 shares of our Class A common stock and 3,934,191 shares of Class B common stock (including shares of all of our convertible preferred stock on an as-converted basis) outstanding as of March 31, 2019 and excludes:

- 2,587,996 shares of Class A common stock issuable upon exercise of stock options outstanding as of March 31, 2019 under our 2010 Equity Incentive Plan, or 2010 Plan, with a weighted-average exercise price of $7.08 per share;
- 1,065,448 shares of Class A common stock issuable upon exercise of stock options granted after March 31, 2019 under our 2010 Plan, with a weighted-average exercise price of $14.10 per share;
- 6,141,842 shares of Class A common stock reserved for future issuance under our 2019 Equity Incentive Plan, or 2019 Plan, which became effective as of the date of this prospectus, as well as (i) any additional shares of Class A common stock that become available for issuance under the 2019 Plan (including as a result of annual increases) and (ii) any shares of Class A common stock that (A) were available for issuance under the 2010 Plan as of immediately prior to the time our 2019 Plan became effective or (B) that would have otherwise returned to our 2010 Plan in accordance with its terms (which, in each case, will become available for issuance under our 2019 Plan);
- 283,333 shares of Class A common stock reserved for future issuance under our 2019 Employee Stock Purchase Plan, or the ESPP, which became effective as of the date of this prospectus, as well as any additional shares of Class A common stock that become available for issuance under our ESPP (including as a result of annual increases); and

- 49,997 shares of Class A common stock issuable upon exercise of outstanding warrants reclassified to purchase our Class A common stock as described below, each with an exercise price of $14.46 per share.

Unless otherwise indicated, the information in this prospectus assumes:

- the filing and effectiveness of our amended and restated certificate of incorporation and the adoption of our amended and restated bylaws, each of which will occur upon the closing of this offering;
- the automatic conversion of all outstanding shares of our convertible Series A preferred stock, convertible Series B preferred stock and convertible Series C1 preferred stock into 13,314,068 shares of our Class A common stock immediately upon the closing of this offering;
- the automatic conversion of all outstanding shares of our convertible Series C2 preferred stock into 3,934,191 shares of our Class B common stock immediately upon the closing of this offering;
- the issuance of 62,936 shares of Class A common stock upon the exercise of an outstanding warrant in connection with this offering, with an exercise price of $0.0006 per share;
- the automatic reclassification of all of our outstanding warrants to purchase Series A preferred stock into warrants to purchase 49,997 shares of Class A common stock, each with an exercise price of $14.46 per share, immediately upon the closing of this offering and no exercise of these warrants;
- no exercise of outstanding options to purchase our Class A common stock as described above; and
- no exercise of the underwriters' option to purchase additional shares of Class A common stock.

On June 7, 2019, we effected a 1-for-6 reverse stock split of all classes of our capital stock. Upon the effectiveness of the reverse stock split, (i) every one share of our outstanding capital stock was combined into one-sixth of one share of the same class and series of capital stock, (ii) the number of shares of our Class A common stock and our Series A preferred stock for which each outstanding option or warrant, to purchase our Class A common stock and our Series A preferred stock is exercisable was proportionally decreased on a 1-for-6 basis and (iii) the exercise price of each outstanding option or warrant to purchase our Class A common stock and our Series A preferred stock was proportionately increased on a 1-for-6 basis. All of our outstanding Class A common stock and Class B common stock share numbers (including shares of Class A common stock and Class B common stock into which our outstanding preferred stock shares are convertible), Class A common stock warrants, Series A preferred stock warrants, share prices, exercise prices and per share amounts have been adjusted in this prospectus, on a retroactive basis, to reflect this 1-for-6 reverse stock split for all periods presented. The par value per share of our common stock and preferred stock were not adjusted as a result of the reverse stock split. The authorized number of shares of our common stock and preferred stock were increased concurrently with the reverse stock split and these increases have been reflected in this prospectus on a retroactive basis, for all periods presented.

In addition, certain existing stockholders known to us to beneficially own more than 5% of our capital stock prior to this offering have agreed to purchase approximately $63 million of shares of our common stock in this offering at the initial public offering price. All shares of common stock purchased by entities affiliated with Baker Brothers Life Sciences L.P. will initially be issued in the form of Class B common stock that will be convertible into an equivalent number of shares of our

Class A common stock. No other purchasers will be issued Class B common stock in this offering. The public offering price of and underwriting discount on such shares of Class B common stock is identical to the shares of Class A common stock otherwise offered hereby. Unless otherwise indicated or as the context otherwise requires, references to Class A common stock being offered hereby include the shares of Class A common stock into which shares of our Class B common stock purchased in this offering are convertible.

Summary Consolidated Financial Data

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

	Year Ended December 31,		Three Months Ended March 31,	
	2017	2018	2018	2019
	(in thousands, except share and per share data)			
Consolidated Statements of Operations Data:				
Operating expenses				
Research and development	$ 24,873	$ 32,513	$ 6,643	$ 11,713
General and administrative	4,562	7,060	1,300	2,518
Total operating expenses	29,435	39,573	7,943	14,231
Operating loss	(29,435)	(39,573)	(7,943)	(14,231)
Interest and other income (expense)				
Other income	1,719	961	213	165
Interest income	152	714	56	545
Interest expense	(14)	(9)	(2)	(2)
Preferred stock warrant liability revaluation	6	(33)	20	(50)
Gain (loss) on disposal of property and equipment	48	(1)	—	(5)
Loss before income tax benefit (expense)	(27,524)	(37,941)	(7,656)	(13,578)
Benefit (expense) from income taxes	(3)	1	—	(1)
Net loss	$ (27,527)	$ (37,940)	$ (7,656)	$ (13,579)
Net loss per share—basic and diluted	$ (13.14)	$ (18.02)	$ (3.66)	$ (6.40)
Weighted average shares used to compute net loss per share—basic and diluted	2,094,795	2,104,861	2,093,413	2,120,925
Pro forma net loss per share—basic and diluted (unaudited)(1)		$ (1.95)		$ (0.70)
Weighted average shares used to compute pro forma net loss per share—basic and diluted (unaudited)(1)		19,416,147		19,432,211

	March 31, 2019		
	Actual	Pro Forma(1)	Pro Forma as Adjusted(2)
		(in thousands)	
Consolidated Balance Sheet Data:			
Cash, cash equivalents and investments	$100,661	$100,661	$214,465
Working capital(3)	99,219	99,219	213,023
Total assets	109,126	109,126	222,930
Preferred stock warrant liability	430	—	—
Preferred stock	209,668	—	—
Total stockholders' equity (deficit)	(105,795)	104,303	218,107

(1) Gives effect to:
- the automatic conversion of all outstanding shares of our convertible Series A preferred stock, convertible Series B preferred stock and convertible Series C1 preferred stock into 13,314,068 shares of our Class A common stock immediately upon the closing of this offering;
- the automatic conversion of all outstanding shares of our convertible Series C2 preferred stock into 3,934,191 shares of our Class B common stock immediately upon the closing of this offering;
- the issuance of 62,936 shares of Class A common stock upon the exercise of an outstanding warrant in connection with this offering, with an exercise price of $0.0006 per share, which warrant will be exercised as of June 20, 2019;
- the automatic reclassification of warrants to purchase an aggregate of 49,997 shares of our convertible Series A preferred stock, outstanding as of March 31, 2019, into warrants to purchase an equivalent number of shares of our Class A common stock, and the related reclassification of preferred stock warrant liability to stockholders' equity; and
- the filing and effectiveness of our amended and restated certificate of incorporation and the adoption of our amended and restated bylaws, each of which will occur upon the closing of this offering.

(2) Gives effect to (1) the pro forma items described in footnote (1) above and (2) the issuance and sale of 7,350,000 shares of common stock in this offering at the initial public offering price of $17.00 per share, after deducting underwriting discounts and commissions and estimated offering expenses payable by us.

(3) Working capital represents the difference between current assets and current liabilities.

RISK FACTORS

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

Risks Related to Our Business

We are a preclinical stage biopharmaceutical company with a history of losses. We expect to continue to incur significant losses for the foreseeable future and may never achieve or maintain profitability, which could result in a decline in the market value of our Class A common stock.

We are a preclinical stage biopharmaceutical company with a history of losses. Since our inception, we have devoted substantially all of our resources to research and development, raising capital, building our management team and building our intellectual property portfolio, and we have incurred significant operating losses. As of December 31, 2017, December 31, 2018 and March 31, 2019, we had accumulated deficits of $58.7 million, $96.6 million and $110.2 million, respectively. For the years ended December 31, 2017, 2018 and for the three months ended March 31, 2019, our net losses were $27.5 million, $37.9 million and $13.6 million, respectively. Substantially all of our losses have resulted from expenses incurred in connection with our research and development programs and from general and administrative costs associated with our operations. To date, we have not generated any revenue from product sales, and we have not sought or obtained regulatory approval for any product candidate. Furthermore, we do not expect to generate any revenue from product sales for the foreseeable future, and we expect to continue to incur significant operating losses for the foreseeable future due to the cost of research and development, preclinical studies and clinical trials and the regulatory approval process for our current and potential future product candidates.

We expect our net losses to increase substantially as we enter into clinical development of our lead product candidate, ATRC-101. However, the amount of our future losses is uncertain. Our ability to achieve or sustain profitability, if ever, will depend on, among other things, successfully developing product candidates, obtaining regulatory approvals to market and commercialize product candidates, manufacturing any approved products on commercially reasonable terms, entering into potential future partnerships, establishing a sales and marketing organization or suitable third-party alternatives for any approved product and raising sufficient funds to finance business activities. If we, or our potential future partners, are unable to commercialize one or more of our product candidates, or if sales revenue from any product candidate that receives approval is insufficient, we will not achieve or sustain profitability, which could have a material and adverse effect on our business, financial condition, results of operations and prospects. Any predictions you make about our future success or viability may not be as accurate as they could be if we had a history of successfully developing and commercializing pharmaceutical products.

ATRC-101 is in preclinical development and has never been tested in a human subject. It may fail in development or suffer delays that materially and adversely affect its commercial viability.

We have no products on the market or that have gained regulatory approval and ATRC-101, has not entered clinical trials. Other than ATRC-101, we currently have no product candidates. Neither ATRC-101 nor any of our potential future product candidates have ever been tested in humans. Our ability to achieve and sustain profitability depends on obtaining regulatory approvals for and successfully commercializing product candidates, either alone or with partners.

Before obtaining regulatory approval for the commercial distribution of product candidates, we or a partner must conduct extensive preclinical studies, followed by clinical trials to demonstrate the safety and efficacy of our product candidates in humans. In preliminary feedback, the U.S. Food and Drug Administration, or the FDA, has communicated to us that, while it reserves the right to make final determinations upon review of our Investigational New Drug, or IND, application for ATRC-101, it is supportive of our proposed approach, including preclinical safety assessments and overall clinical trial design. However, there can be no guarantee that upon final review of the IND application, the FDA will not require changes. We cannot be certain of the timely completion or outcome of our preclinical studies and cannot predict if the FDA or other regulatory authorities will accept our proposed clinical programs or if the outcome of our preclinical studies will ultimately support the further development of our preclinical programs. As a result, we cannot be sure that we will be able to submit INDs or similar applications for our preclinical programs on the timelines we expect, if at all, and we cannot be sure that submission of INDs or similar applications will result in the FDA or other regulatory authorities allowing clinical trials to begin.

ATRC-101 is in preclinical development, and we are subject to the risks of failure inherent in the development of product candidates based on novel approaches, targets and mechanisms of action. Although we expect to initiate a Phase 1b clinical trial for ATRC-101 in patients with solid tumors in early 2020, there can be no guarantee that we will be able to do so. Accordingly, you should consider our prospects in light of the costs, uncertainties, delays and difficulties frequently encountered by preclinical stage biopharmaceutical companies such as ours.

We may not have the financial resources to continue development of, or to enter into new collaborations for, ATRC-101 or any potential future product candidates. This may be exacerbated if we experience any issues that delay or prevent regulatory approval of, or our ability to commercialize, a product candidate, such as:

- negative or inconclusive results from our clinical trials or the clinical trials of others for product candidates similar to ours, leading to a decision or requirement to conduct additional preclinical studies or clinical trials or abandon a program;
- product-related side effects experienced by participants in our clinical trials or by individuals using drugs or therapeutic antibodies similar to ours;
- delays in submitting IND applications or comparable foreign applications, or delays or failure in obtaining the necessary approvals from regulators to commence a clinical trial, or a suspension or termination of a clinical trial once commenced;
- conditions imposed by the FDA, or other regulatory authorities regarding the scope or design of our clinical trials;
- delays in enrolling research subjects in clinical trials;
- high drop-out rates of research subjects;
- inadequate supply or quality of product candidate components or materials or other supplies necessary for the conduct of our clinical trials;
- greater-than-anticipated clinical trial costs;

- poor effectiveness of our product candidates during clinical trials;
- unfavorable FDA or other regulatory agency inspection and review of a clinical trial or manufacture site;
- failure of our third-party contractors or investigators to comply with regulatory requirements or otherwise meet their contractual obligations in a timely manner, or at all;
- delays and changes in regulatory requirements, policies and guidelines; or
- the FDA or other regulatory agencies interpreting our data differently than we do.

Further, we and our potential future partners may never receive approval to market and commercialize any product candidate. Even if we or a potential future partner obtains regulatory approval, the approval may be for targets, disease indications or patient populations that are not as broad as we intended or desired or may require labeling that includes significant use or distribution restrictions or safety warnings. We or a potential future partner may be subject to post-marketing testing requirements to maintain regulatory approval.

If ATRC-101 is ever tested in humans, it may not demonstrate the combination of safety and efficacy necessary to become approvable or commercially viable.

ATRC-101 has not been tested in humans. We may ultimately discover that ATRC-101 does not possess certain properties that we currently believe are helpful for therapeutic effectiveness and safety. For example, although ATRC-101 has exhibited encouraging results in animal studies, including anti-tumor activity and safety, it may not demonstrate the same properties in humans and may interact with human biological systems in unforeseen, ineffective or harmful ways. As a result, we may never succeed in developing a marketable product based on ATRC-101. If ATRC-101 or any of our potential future product candidates prove to be ineffective, unsafe or commercially unviable, our entire pipeline could have little, if any, value, which could require us to change our focus and approach to antibody discovery and development, which would have a material and adverse effect on our business, financial condition, results of operations and prospects.

Failure to successfully validate, develop and obtain regulatory approval for companion diagnostics for our product candidates could harm our drug development strategy and operational results.

As one of the elements of our clinical development approach, we may seek to develop lab-based tests to screen and identify subsets of patients who are more likely to benefit from our product candidates, more commonly referred to as companion diagnostics. To achieve this, we may seek to develop and commercialize such companion diagnostics ourselves or through third-party collaborators. Companion diagnostics are generally developed in conjunction with clinical programs for the associated product and can be helpful in enrolling patients in clinical studies who are more likely to respond to the specific therapeutic being developed. The approval of a companion diagnostic as part of the product label could limit the use of the product candidate to those patients who are more likely to benefit from our product candidate.

Companion diagnostics are subject to regulation by the FDA and other regulatory authorities as medical devices and require separate clearance or approval prior to their commercialization. To date, the FDA has required premarket approval of all companion diagnostics for oncology therapies. We and our third-party collaborators may encounter difficulties in developing and obtaining approval for these companion diagnostics. Any delay or failure by us or third-party collaborators to develop or obtain regulatory approval of a companion diagnostic could delay or prevent approval of our related product candidates. The time and cost associated with developing a companion diagnostic may not prove to have been necessary in order to successfully market the product.

We may not be successful in our efforts to use and expand our discovery platform to build a pipeline of product candidates.

A key element of our strategy is to use and expand our discovery platform to build a pipeline of product candidates and progress these product candidates through clinical development for the treatment of various diseases. Although our research and development efforts to date have resulted in our discovery and preclinical development of ATRC-101, ATRC-101 may not be safe or effective as a cancer treatment, and we may not be able to develop any other product candidates. Our discovery platform is evolving and may not reach a state at which building a pipeline of product candidates is possible. Even if we are successful in building our pipeline of product candidates, the potential product candidates that we identify may not be suitable for clinical development or generate acceptable clinical data, including as a result of being shown to have unacceptable toxicity or other characteristics that indicate that they are unlikely to be products that will receive marketing approval from the FDA or other regulatory authorities or achieve market acceptance. If we do not successfully develop and commercialize product candidates, we will not be able to generate product revenue in the future.

Our approach to developing and identifying our antibodies using our discovery platform is novel and unproven and may not result in marketable products.

We plan to develop a pipeline of product candidates using our discovery platform. We believe that we may be able to overcome certain key limitations of the current oncology drug discovery paradigm by focusing on an active human anti-tumor immune response that develops over time. However, our scientific research that forms the basis of our efforts to discover product candidates based on our discovery platform is ongoing. Further, the scientific evidence to support the feasibility of developing therapeutic antibodies based on our platform has not been established. We may not be correct in our beliefs about the differentiated nature of our platform to competing technologies, and our platform may not prove to be superior. If our discovery platform is not able to develop approved antibody constructs that are effective at the necessary speed or scale, it could have a material and adverse effect on our business, financial condition, results of operations and prospects.

The market may not be receptive to our current or potential future product candidates, and we may not generate any revenue from the sale or licensing of our product candidates.

Even if regulatory approval is obtained for a product candidate, including ATRC-101, we may not generate or sustain revenue from sales of the product. Market acceptance of our current and potential future product candidates will depend on, among other factors:

- the timing of our receipt of any marketing and commercialization approvals;
- the terms of any approvals and the countries in which approvals are obtained;
- the safety and efficacy of our product candidates;
- the prevalence and severity of any adverse side effects associated with our product candidates;
- limitations or warnings contained in any labeling approved by the FDA or other regulatory authority;
- relative convenience and ease of administration of our product candidates;
- the success of our physician education programs;
- the availability of coverage and adequate government and third-party payor reimbursement;
- the pricing of our products, particularly as compared to alternative treatments; and
- availability of alternative effective treatments for the disease indications our product candidates are intended to treat and the relative risks, benefits and costs of those treatments.

If any product candidate we commercialize fails to achieve market acceptance, it could have a material and adverse effect on our business, financial condition, results of operations and prospects.

If ATRC-101 or any potential future product candidate begins clinical trials or receives marketing approval and we or others later identify undesirable side effects caused by the product candidate, our ability to market and derive revenue from the product candidate could be compromised.

Undesirable side effects caused by ATRC-101 or any potential future product candidate could cause regulatory authorities 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 or other regulatory authorities. While we have not yet initiated clinical trials for ATRC-101 or any potential future product candidate, it is likely that there will be side effects associated with their use. Results of our clinical trials could reveal a high and unacceptable severity and prevalence of these side effects. In such an event, our trials could be suspended or terminated and the FDA or other regulatory authorities could order us to cease further development of or deny approval of a product candidate for any or all targeted indications. Such side effects could also affect patient recruitment or the ability of enrolled patients to complete the trial or result in potential product liability claims. Any of these occurrences may materially and adversely affect our business and financial condition and impair our ability to generate revenues.

Further, clinical trials by their nature utilize a sample of the potential patient population. With a limited number of patients and limited duration of exposure, rare and severe side effects of a product candidate may only be uncovered when a significantly larger number of patients are exposed to the product candidate or when patients are exposed for a longer period of time.

In the event that any of our current or potential future product candidates receive regulatory approval and we or others identify undesirable side effects caused by one of these products, any of the following adverse events could occur, which could result in the loss of significant revenue to us and materially and adversely affect our results of operations and business:

- regulatory authorities may withdraw their approval of the product or seize the product;
- we may be required to recall the product or change the way the product is administered to patients;
- additional restrictions may be imposed on the marketing of the particular product or the manufacturing processes for the product or any component thereof;
- we may be subject to fines, injunctions or the imposition of civil or criminal penalties;
- regulatory authorities may require the addition of labeling statements, such as a ‘‘black box’’ warning or a contraindication;
- we may be required to create a Medication Guide outlining the risks of such side effects for distribution to patients;
- we could be sued and held liable for harm caused to patients;
- the product may become less competitive; and
- our reputation may suffer.

Even if we consummate this offering, we will need substantial additional funds to advance development of product candidates and our discovery platform, and we cannot guarantee that we will have sufficient funds available in the future to develop and commercialize our current or potential future product candidates.

The development of biopharmaceutical product candidates is capital-intensive. If ATRC-101 or potential future product candidates enter and advance through preclinical studies and clinical trials, we will need substantial additional funds to expand our development, regulatory, manufacturing,

marketing and sales capabilities. We have used substantial funds to develop our discovery platform and ATRC-101 and will require significant funds to continue to develop our discovery platform and conduct further research and development, including preclinical studies and clinical trials of ATRC-101 and additional potential future product candidates, to seek regulatory approvals for ATRC-101 and potential future product candidates and to manufacture and market products, if any, that are approved for commercial sale. In addition, upon the closing of this offering, we expect to incur additional costs associated with operating as a public company.

As of March 31, 2019, we had $100.7 million in cash, cash equivalents, and investments. Based on our current operating plan, we believe that our cash and cash equivalents as of March 31, 2019, together with the estimated net proceeds from this offering, will be sufficient to fund our operations through the end of 2021. Our future capital requirements and the period for which we expect our existing resources to support our operations may vary significantly from what we expect. Our monthly spending levels vary based on new and ongoing research and development and other corporate activities. Because the length of time and activities associated with successful research and development of product candidates is highly uncertain, we are unable to estimate the actual funds we will require for development and any approved marketing and commercialization activities. The timing and amount of our operating expenditures will depend largely on:

- the timing and progress of preclinical and clinical development activities;
- the timing and progress of our development of our discovery platform;
- the price and pricing structure that we are able to obtain from our third-party contract manufacturers to manufacture our preclinical study and clinical trial materials and supplies;
- the number and scope of preclinical and clinical programs we decide to pursue;
- our ability to maintain our current licenses and research and development programs and to establish new collaborations;
- the progress of the development efforts of parties with whom we may in the future enter into collaboration and research and development agreements;
- the costs involved in obtaining, maintaining, enforcing and defending patents and other intellectual property rights;
- the cost and timing of regulatory approvals; and
- our efforts to enhance operational systems, secure sufficient laboratory space and hire additional personnel, including personnel to support development of our product candidates and satisfy our obligations as a public company.

To date, we have primarily financed our operations through the sale of equity securities and payments and other income received under discovery services agreements not related to our primary business. We may seek to raise any necessary additional capital through a combination of public or private equity offerings, debt financings, collaborations, strategic alliances, licensing arrangements and other marketing and distribution arrangements. We cannot assure you that we will be successful in acquiring additional funding at levels sufficient to fund our operations or on terms favorable to us. If we are unable to obtain adequate financing when needed, we may have to delay, reduce the scope of or suspend one or more of our preclinical studies, clinical trials, research and development programs or commercialization efforts. Because of the numerous risks and uncertainties associated with the development and commercialization of our current and potential future product candidates and the extent to which we may enter into collaborations with third parties to participate in their development and commercialization, we are unable to estimate the amounts of increased capital outlays and operating expenditures associated with our current and anticipated preclinical studies and clinical trials. To the extent that we raise additional capital through collaborations, strategic alliances or licensing arrangements with third parties, we may have to relinquish valuable rights to our current and potential future product candidates, future revenue

streams or research programs or to grant licenses on terms that may not be favorable to us. If we do raise additional capital through public or private equity or convertible debt offerings, the ownership interest of our existing stockholders will be diluted, and the terms of these securities may include liquidation or other preferences that adversely affect our stockholders' rights. If we raise additional capital through debt financing, we may be subject to covenants limiting or restricting our ability to take specific actions, such as incurring additional debt, making capital expenditures or declaring dividends.

We do not expect to realize revenue from product sales or royalties from licensed products in the foreseeable future, if at all, and unless and until our current and potential future product candidates are clinically tested, approved for commercialization and successfully marketed.

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

Because we have limited financial and managerial resources, we intend to focus our efforts on specific research and development programs, including clinical development of ATRC-101. As a result, we may forgo or delay pursuit of other opportunities, including with potential future product candidates that later prove to have greater commercial potential. Our resource allocation decisions may cause us to fail to capitalize on viable commercial products or profitable market opportunities. Our spending on current and future research and development programs and product candidates for specific indications may not yield any commercially viable product candidates. If we do not accurately evaluate the commercial potential or target market for a particular product candidate, we may relinquish valuable rights to that product candidate through partnership, licensing or other royalty arrangements in cases in which it would have been more advantageous for us to retain sole development and commercialization rights to such product candidate.

We have obtained rights to use human samples in furtherance of our research and development of our current and potential future product candidates. However, if we fail to obtain appropriate consent or exceed the scope of the permission to use these samples, we may become liable for monetary damages for, obligated to pay continuing royalties for or required to cease usage of the samples.

We begin our discovery process by gathering samples from patients. While we attempt to ensure that we, our study site partners or other providers have obtained these samples with informed consent and all necessary permissions, there is a risk that one or more patients or their representatives may assert that we have either failed to obtain informed consent or exceeded the scope of permission to use the patient's sample. We cannot guarantee that we would succeed in establishing that we had informed consent or appropriate permission, if a patient or patient representative contested the matter. In such circumstances, we could be required to pay monetary damages, to pay a continuing royalty on any products created or invented by analyzing the patient's sample or even to cease using the sample and any and all materials derived from or created through analysis of the sample, any of which could result in a change to our business plan and materially harm our business, financial condition, results of operations and prospects.

We may not be able to enter into strategic transactions on acceptable terms, if at all, which could adversely affect our ability to develop and commercialize current and potential future product candidates, impact our cash position, increase our expense, and present significant distractions to our management.

From time to time, we may consider strategic transactions, such as collaborations, acquisitions of companies, asset purchases, joint ventures and out- or in-licensing of product candidates or technologies. For example, we will evaluate and, if strategically attractive, seek to enter into

collaborations, including with biotechnology or biopharmaceutical companies or hospitals. The competition for partners is intense, and the negotiation process is time-consuming and complex. If we are not able to enter into strategic transactions, we may not have access to required liquidity or expertise to further develop our potential future product candidates or our discovery platform. Any such collaboration, or other strategic transaction, may require us to incur non-recurring or other charges, increase our near- and long-term expenditures and pose significant integration or implementation challenges or disrupt our management or business. We may acquire additional technologies and assets, form strategic alliances or create joint ventures with third parties that we believe will complement or augment our existing business, but we may not be able to realize the benefit of acquiring such assets. Conversely, any new collaboration that we do enter into may be on terms that are not optimal for us. These transactions would entail numerous operational and financial risks, including:

- exposure to unknown liabilities;
- disruption of our business and diversion of our management's time and attention in order to manage a collaboration or develop acquired products, product candidates or technologies;
- incurrence of substantial debt or dilutive issuances of equity securities to pay transaction consideration or costs;
- higher-than-expected collaboration, acquisition or integration costs, write-downs of assets or goodwill or impairment charges, increased amortization expenses;
- difficulty and cost in facilitating the collaboration or combining the operations and personnel of any acquired business;
- impairment of relationships with key suppliers, manufacturers or customers of any acquired business due to changes in management and ownership; and
- the inability to retain key employees of any acquired business.

Accordingly, although there can be no assurance that we will undertake or successfully complete any transactions of the nature described above, any transactions that we do complete may be subject to the foregoing or other risks and our business could be materially harmed by such transactions. Conversely, any failure to enter any collaboration or other strategic transaction that would be beneficial to us could delay the development and potential commercialization of our product candidates and have a negative impact on the competitiveness of any product candidate that reaches market.

In addition, to the extent that any of our future partners were to terminate a collaboration agreement, we may be forced to independently develop our current and future product candidates, including funding preclinical studies or clinical trials, assuming marketing and distribution costs and maintaining, enforcing and defending intellectual property rights, or, in certain instances, abandon product candidates altogether, any of which could result in a change to our business plan and materially harm our business, financial condition, results of operations and prospects.

If third parties on which we intend to rely to conduct certain preclinical studies, or any future clinical trials, do not perform as contractually required, fail to satisfy regulatory or legal requirements or miss expected deadlines, our development program could be delayed with material and adverse impacts on our business and financial condition.

We intend to rely on third-party clinical investigators, contract research organizations, or CROs, clinical data management organizations and consultants to design, conduct, supervise and monitor certain preclinical studies and any clinical trials. Because we intend to rely on these third parties and will not have the ability to conduct certain preclinical studies or clinical trials independently, we will have less control over the timing, quality and other aspects of such preclinical studies and clinical trials than we would have had we conducted them on our own. These investigators, CROs and

consultants will not be our employees and we will have limited control over the amount of time and resources that they dedicate to our programs. These third parties may have contractual relationships with other entities, some of which may be our competitors, which may draw time and resources from our programs. The third parties with which we may contract might not be diligent, careful or timely in conducting our preclinical studies or clinical trials, resulting in the preclinical studies or clinical trials being delayed or unsuccessful.

If we cannot contract with acceptable third parties on commercially reasonable terms, or at all, or if these third parties do not carry out their contractual duties, satisfy legal and regulatory requirements for the conduct of preclinical studies or clinical trials or meet expected deadlines, our clinical development programs could be delayed and otherwise adversely affected. In all events, we will be responsible for ensuring that each of our preclinical studies and clinical trials are conducted in accordance with the general investigational plan and protocols for the trial. The FDA may require preclinical studies to be conducted in accordance with good laboratory practices and clinical trials to be conducted in accordance with good clinical practices, including for designing, conducting, recording and reporting the results of preclinical studies and clinical trials to ensure that data and reported results are credible and accurate and that the rights, integrity and confidentiality of clinical trial participants are protected. Our reliance on third parties that we do not control will not relieve us of these responsibilities and requirements. Any adverse development or delay in our clinical trials could have a material and adverse impact on our commercial prospects and may impair our ability to generate revenue.

Clinical trials are expensive, time-consuming and difficult to design and implement.

Human clinical trials are expensive and difficult to design and implement, in part because they are subject to rigorous regulatory requirements. Because our current and potential future product candidates are based on new technologies and discovery approaches, we expect that they will require extensive research and development and have substantial manufacturing and processing costs. In addition, costs to treat patients and to treat potential side effects that may result from our product candidates may be significant. Accordingly, our clinical trial costs are likely to be high and could have a material and adverse effect on our business, financial condition, results of operations and prospects.

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

We may not be able to initiate or continue clinical trials for our current or potential future product candidates if we are unable to locate and enroll a sufficient number of eligible patients to participate in these trials as required by the FDA or other regulatory authorities. In particular, we are preparing to advance ATRC-101 into a Phase 1b clinical trial in patients with a limited number of tumor types. We cannot predict how difficult it will be to enroll patients for trials in these indications. We may experience difficulties in patient enrollment in our clinical trials for a variety of reasons. The enrollment of patients depends on many factors, including:

- the severity of the disease under investigation;
- the patient eligibility criteria defined in the clinical trial protocol;
- the size of the patient population required for analysis of the trial's primary endpoints;
- the proximity and availability of clinical trial sites for prospective patients;
- the patient referral practices of physicians;
- 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 drugs 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 completion.

In addition, our future clinical trials will compete with other clinical trials for product candidates that are in the same therapeutic areas as our product candidates, 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. Additionally, because some of our clinical trials will be in patients with advanced solid tumors, the patients are typically in the late stages of the disease and may experience disease progression or adverse events 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 the planned clinical trials, which could prevent completion of these trials and adversely affect our ability to advance the development of our product candidates.

We may not be able to conduct, or contract others to conduct, animal testing in the future, which could harm our research and development activities.

Certain laws and regulations relating to drug development require us to test our product candidates on animals before initiating clinical trials involving humans. Animal testing activities have been the subject of controversy and adverse publicity. Animal rights groups and other organizations and individuals have attempted to stop animal testing activities by pressing for legislation and regulation in these areas and by disrupting these activities through protests and other means. To the extent the activities of these groups are successful, our research and development activities may be interrupted or delayed.

Because we may rely on third parties for manufacturing and supply of our product candidates, some of which are or may be sole source vendors, for preclinical and clinical development materials and commercial supplies, our supply may become limited or interrupted or may not be of satisfactory quantity or quality.

We currently rely on third-party contract manufacturers for our preclinical and future clinical trial product materials and supplies. We do not produce any meaningful quantity of our product candidates for preclinical and clinical development, and we do not currently own manufacturing facilities for producing such supplies. Furthermore, some of our manufacturers represent our sole source of supplies of preclinical and future clinical development materials, including our source for the manufacture of ATRC-101. We cannot assure you that our preclinical or future clinical development product supplies and commercial supplies will not be limited or interrupted, especially with respect to our sole source third-party manufacturing and supply partners, or will be of satisfactory quality or continue to be available at acceptable prices. In particular, any replacement of our manufacturers could require significant effort and expertise because there may be a limited number of qualified replacements. For our current and future sole source third-party manufacturing and supply partners, we may be unable to negotiate binding agreements with them or find replacement manufacturers to support our preclinical and future clinical activities at commercially reasonable terms in the event that their services to us becomes interrupted for any reason. We do not currently have arrangements in place for a redundant or second-source supply for our sole source vendors in the event they cease to provide their products or services to us or do not timely provide sufficient quantities to us. Establishing additional or replacement sole source vendors, if

required, may not be accomplished quickly. Any delays resulting from manufacturing or supply interruptions associated with our reliance on third-party manufacturing and supply partners, including those that are sole source, could impede, delay, limit or prevent our drug development efforts, which could harm our business, result of operations, financial condition and prospects.

The manufacturing process for a product candidate is subject to FDA and other regulatory authority review. Suppliers and manufacturers must meet applicable manufacturing requirements and undergo rigorous facility and process validation tests required by regulatory authorities in order to comply with regulatory standards, such as current Good Manufacturing Practices, or cGMP. In the event that any of our manufacturers fails to comply with such requirements or to perform its obligations to us in relation to quality, timing or otherwise, or if our supply of components or other materials becomes limited or interrupted for other reasons, we may be forced to manufacture the materials ourselves, for which we currently do not have the capabilities or resources, or enter into an agreement with another third party, which we may not be able to do on reasonable terms, or at all. In some cases, the technical skills or technology required to manufacture our current and future product candidates may be unique or proprietary to the original manufacturer and we may have difficulty transferring such skills or technology to another third party and a feasible alternative may not exist. These factors would increase our reliance on such manufacturer or require us to obtain a license from such manufacturer in order to have another third party manufacture our product candidates. If we are required to change manufacturers for any reason, we will be required to verify that the new manufacturer maintains facilities and procedures that comply with quality standards and with all applicable regulations and guidelines. The delays associated with the verification of a new manufacturer could negatively affect our ability to develop product candidates in a timely manner or within budget.

We also expect to rely on third-party manufacturers if we receive regulatory approval for any product candidate. We have existing, and may enter into future, manufacturing arrangements with third parties. We will depend on these third parties to perform their obligations in a timely manner consistent with contractual and regulatory requirements, including those related to quality control and assurance. If we are unable to obtain or maintain third-party manufacturing for any product candidate, or to do so on commercially reasonable terms, we may not be able to develop and commercialize our product candidates successfully. Our or a third party's failure to execute on our manufacturing requirements and comply with cGMP could adversely affect our business in a number of ways, including:

- an inability to initiate or continue clinical trials of product candidates under development;
- delay in submitting regulatory applications, or receiving regulatory approvals, for product candidates;
- loss of the cooperation of a potential future partner;
- subjecting third-party manufacturing facilities or our potential future manufacturing facilities to additional inspections by regulatory authorities;
- requirements to cease distribution or to recall batches of product candidates; and
- in the event of approval to market and commercialize a product candidate, an inability to meet commercial demands for our products.

Our third-party manufacturers may be unable to successfully scale manufacturing of ATRC-101 or potential future product candidates in sufficient quality and quantity, which would delay or prevent us from developing product candidates and commercializing approved products, if any.

In order to conduct clinical trials for ATRC-101 as well as any potential future product candidates, we will need to manufacture large quantities of these product candidates. We may continue to and currently expect to use third parties for our manufacturing needs. Our manufacturing partners may be unable to successfully increase the manufacturing capacity for any current or potential future product candidate in a timely or cost-effective manner, or at all. In addition, quality issues may arise during scale-up activities. If our manufacturing partners are unable to successfully scale the manufacture of any current or potential future product candidate in sufficient quality and quantity, the development, testing and clinical trials of that product candidate may be delayed or infeasible, and regulatory approval or commercial launch of any potential resulting product may be delayed or not obtained, which could significantly harm our business.

If the market opportunities for our current and potential future product candidates, including ATRC-101, are smaller than we believe they are, our future product revenues may be adversely affected and our business may suffer.

Our understanding of the number of people who suffer from certain types of cancers and tumors that may be able to be treated with antibodies that have been and may in the future be identified by our discovery platform, including ATRC-101, is based on estimates. These estimates may prove to be incorrect, and new studies may reduce the estimated incidence or prevalence of these diseases. The number of patients in the United States or elsewhere may turn out to be lower than expected, may not be otherwise amenable to treatment with our current or potential future product candidates or patients may become increasingly difficult to identify and access, all of which would adversely affect our business prospects and financial condition. In particular, the treatable population for ATRC-101 may further be reduced if our estimates of addressable populations are erroneous or sub-populations of patients do not derive benefit from ATRC-101.

Further, there are several factors that could contribute to making the actual number of patients who receive our current or potential future product candidates less than the potentially addressable market. These include the lack of widespread availability of, and limited reimbursement for, new therapies in many underdeveloped markets.

We face competition from entities that have developed or may develop product candidates for the treatment of the diseases that we may target, including companies developing novel treatments and technology platforms. If these companies develop technologies or product candidates more rapidly than we do, or if their technologies or product candidates are more effective, our ability to develop and successfully commercialize product candidates may be adversely affected.

The development and commercialization of drugs and therapeutic biologics is highly competitive. We compete with a variety of large pharmaceutical companies, multinational biopharmaceutical companies, other biopharmaceutical companies and specialized biotechnology companies, as well as technology being developed at universities and other research institutions. Our competitors are often larger and better funded than we are. Our competitors have developed, are developing or will develop product candidates and processes competitive with ours. Competitive therapeutic treatments include those that have already been approved and accepted by the medical community and any new treatments that are currently in development or that enter the market. We believe that a significant number of products are currently under development, and may become commercially

available in the future, for the treatment of conditions for which we may try to develop product candidates. There is intense and rapidly evolving competition in the biotechnology, biopharmaceutical and antibody and immuno-oncology fields. We believe that while our discovery platform, its associated intellectual property, the characteristics of ATRC-101 and potential future product candidates and our scientific and technical know-how together give us a competitive advantage in this space, competition from many sources remains.

We are aware of a number of companies that are developing antibodies for the treatment of cancer. Many of these companies are well-capitalized and, in contrast to us, have significant clinical experience, and may include our future partners. In addition, these companies compete with us in recruiting scientific and managerial talent. Our success will partially depend on our ability to obtain, maintain, enforce and defend patents and other intellectual property rights with respect to antibodies that are safer and more effective than competing products. Our commercial opportunity and success will be reduced or eliminated if competing products that are safer, more effective, or less expensive than the antibodies we develop are or become available.

We expect to compete with antibody, biologics and other therapeutic platforms and development companies, including, but not limited to, companies such as Adaptive Biotechnologies Corporation, AIMM Therapeutics B.V., Neurimmune Holding AG, OncoReponse, Inc., and Vir Biotechnology, Inc. In addition, we expect to compete with large, multinational pharmaceutical companies that discover, develop and commercialize antibodies and other therapeutics for use in treating cancer such as AstraZeneca plc, Bristol-Myers Squibb Company, Genentech, Inc. and Merck & Co., Inc. If ATRC-101 or potential future product candidates are eventually approved, they will compete with a range of treatments that are either in development or currently marketed. For example, we expect that ATRC-101 and our potential future product candidates may compete against traditional cancer therapies, such as chemotherapy, as well as cell-based treatments for cancer, such as CAR-T therapies.

Many of our competitors have significantly greater financial, technical, manufacturing, marketing, sales and supply resources or experience than we do. If we successfully obtain approval for any product candidate, we will face competition based on many different factors, including the safety and effectiveness of our products, the ease with which our products can be administered, the timing and scope of regulatory approvals for these products, the availability and cost of manufacturing, marketing and sales capabilities, price, reimbursement coverage and patent position. Competing products could present superior treatment alternatives, including by being more effective, safer, less expensive or marketed and sold more effectively than any products we may develop. Competitive products may make any product we develop obsolete or noncompetitive before we recover the expense of developing and commercializing such product. Such competitors could also recruit our employees, which could negatively impact our level of expertise and our ability to execute our business plan.

Any inability to attract and retain qualified key management, technical personnel and employees would impair our ability to implement our business plan.

Our success largely depends on the continued service of key management, advisors and other specialized personnel, including John A. Orwin, our president and chief executive officer, and Tito A. Serafini, our chief strategy officer and founder. We have a written employment agreement with each of Mr. Orwin and Dr. Serafini. The loss of one or more members of our executive team, management team or other key employees or advisors could delay our research and development programs and have a material and adverse effect on our business, financial condition, results of operations and prospects.

The relationships that our key managers have cultivated within our industry make us particularly dependent upon their continued employment with us. We are dependent on the continued service of our technical personnel because of the highly technical nature of our product candidates and technologies and the specialized nature of the regulatory approval process. Because our management team and key employees are not obligated to provide us with continued service, they could terminate their employment with us at any time without penalty. Our future success will depend in large part on our continued ability to attract and retain other highly qualified scientific, technical and management personnel, as well as personnel with expertise in clinical testing, manufacturing, governmental regulation and commercialization. We face competition for personnel from other companies, universities, public and private research institutions, government entities and other organizations.

As of March 31, 2019, we had 85 full-time employees. Our focus on the development of ATRC-101 and potential future product candidates will require adequate staffing. We may need to hire and retain new employees to execute our future clinical development and manufacturing plans. We cannot provide assurance that we will be able to hire or retain adequate staffing levels to develop our current and potential future product candidates or run our operations or to accomplish all of our objectives.

We may experience difficulties in managing our growth and expanding our operations.

We have limited experience in product development and have not begun clinical trials for any product candidate. As our current and potential future product candidates enter and advance through preclinical studies and any clinical trials, we will need to expand our development, regulatory and manufacturing capabilities or contract with other organizations to provide these capabilities for us. We may also experience difficulties in the discovery and development of new potential future product candidates using our discovery platform if we are unable to meet demand as we grow our operations. In the future, we also expect to have to manage additional relationships with collaborators, suppliers and other organizations. Our ability to manage our operations and future growth will require us to continue to improve our operational, financial and management controls, reporting systems and procedures and secure adequate facilities for our operational needs. We may not be able to implement improvements to our management information and control systems in an efficient or timely manner and may discover deficiencies in existing systems and controls.

If any of our product candidates is approved for marketing and commercialization in the future and we are unable to develop sales, marketing and distribution capabilities on our own or enter into agreements with third parties to perform these functions on acceptable terms, we will be unable to successfully commercialize any such future products.

We currently have no sales, marketing or distribution capabilities or experience. We will need to develop internal sales, marketing and distribution capabilities to commercialize each current and potential future product candidate that gains FDA approval, which would be expensive and time-consuming, or enter into partnerships with third parties to perform these services. If we decide to market any approved products directly, we will need to commit significant financial and managerial resources to develop a marketing and sales force with technical expertise and supporting distribution, administration and compliance capabilities. If we rely on third parties with such capabilities to market any approved products or decide to co-promote products with partners, we will need to establish and maintain marketing and distribution arrangements with third parties, and there can be no assurance that we will be able to enter into such arrangements on acceptable terms or at all. In entering into third-party marketing or distribution arrangements, any revenue we receive will depend upon the efforts of the third parties and we cannot assure you that such third parties will establish adequate sales and distribution capabilities or be successful in gaining market acceptance

for any approved product. If we are not successful in commercializing any product approved in the future, either on our own or through third parties, our business and results of operations could be materially and adversely affected.

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

Our future growth may depend, in part, on our ability to develop and commercialize product candidates in foreign markets for which we may rely on partnership with third parties. We will not be permitted to market or promote any product candidate before we receive regulatory approval from the applicable regulatory authority in a foreign market, and we may never receive such regulatory approval for any product candidate. To obtain separate regulatory approval in foreign countries, we generally must comply with numerous and varying regulatory requirements of such countries regarding safety and efficacy and governing, among other things, clinical trials and commercial sales, pricing and distribution of a product candidate, and we cannot predict success in these jurisdictions. If we obtain approval of any of our current or potential future product candidates and ultimately commercialize any such product candidate in foreign markets, we would be subject to risks and uncertainties, including the burden of complying with complex and changing foreign regulatory, tax, accounting and legal requirements and the reduced protection of intellectual property rights in some foreign countries.

Price controls imposed in foreign markets may adversely affect our future profitability.

In some countries, particularly member states of the European Union, the pricing of prescription drugs is subject to governmental control. In these countries, pricing negotiations with governmental authorities can take considerable time after receipt of marketing approval for a product. In addition, there can be considerable pressure exerted by governments and other stakeholders on prices and reimbursement levels, including as part of cost-containment measures. Political, economic and regulatory developments, in the United States or internationally, may further complicate pricing negotiations, and pricing negotiations may continue after reimbursement has been obtained. Reference pricing used by various European Union member states and parallel distribution, or arbitrage between low-priced and high-priced member states, can further reduce prices. In some countries, we or future partners may be required to conduct clinical trials or other studies that compare the cost-effectiveness of a product candidate to other available therapies in order to obtain or maintain reimbursement or pricing approval. Publication of discounts by third-party payors or authorities may lead to further pressure on the prices or reimbursement levels within the country of publication and other countries. If reimbursement of any current or potential future product candidate that is approved for marketing in the future is unavailable or limited in scope or amount, or if pricing is set at unsatisfactory levels, our business and results of operations or prospects could be materially and adversely affected and our ability to commercialize such product candidate could be materially impaired.

Our business entails a significant risk of product liability, and our inability to obtain sufficient insurance coverage could have a material and adverse effect on our business, financial condition, results of operations and prospects.

As we move into conducting clinical trials of ATRC-101 or potential future product candidates, we will be exposed to significant product liability risks inherent in the development, testing, manufacturing and marketing of antibody treatments. Product liability claims could delay or prevent completion of our development programs. If we succeed in marketing products, such claims could result in an FDA investigation of the safety and effectiveness of our products, our manufacturing processes and facilities or our marketing programs and potentially a recall of our products or more

serious enforcement action, limitations on the approved indications for which they may be used or suspension or withdrawal of approvals. Regardless of the merits or eventual outcome, liability claims may also result in decreased demand for our products, injury to our reputation, costs to defend the related litigation, a diversion of management's time and our resources, substantial monetary awards to trial participants or patients and a decline in our stock price. Any insurance we have or may obtain may not provide sufficient coverage against potential liabilities. Furthermore, clinical trial and product liability insurance is becoming increasingly expensive. As a result, our partners or we may be unable to obtain sufficient insurance at a reasonable cost to protect us against losses caused by product liability claims that could have a material and adverse effect on our business, financial condition, results of operations and prospects.

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

We are exposed to the risk of fraud or other misconduct by our employees, principal investigators, consultants and commercial partners. Misconduct by employees could include intentional failures to comply with FDA regulations, provide accurate information to the FDA, comply with manufacturing standards we may establish, comply with federal and state healthcare fraud and abuse laws and regulations, report financial information or data accurately or disclose unauthorized activities to us. In particular, sales, marketing and business arrangements in the healthcare industry are subject to extensive laws and regulations intended 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, sales commission, customer incentive programs and other business arrangements. Such misconduct could also involve the improper use of information obtained in the course of clinical trials, which could result in regulatory sanctions and serious harm to our reputation. For example, individuals conducting the non-interventional clinical studies that we sponsor through which we obtain antibodies for development into potential antibody-based therapeutics may violate applicable laws and regulations regarding patients' personal data. It is not always possible to identify and deter misconduct, and the precautions we take to detect and prevent this activity may not be effective in controlling unknown or unmanaged risks or losses or in protecting us from governmental investigations or other actions or lawsuits stemming from a failure to be in compliance with such laws or regulations. If any such actions are instituted against us, and we are not successful in defending ourselves or asserting our rights, those actions could have a material and adverse effect on our business and financial condition, including the imposition of significant criminal, civil, and administrative fines or other sanctions, such as monetary penalties, damages, fines, disgorgement, imprisonment, exclusion from participation in government-funded healthcare programs, such as Medicare and Medicaid, integrity obligations, reputational harm and the curtailment or restructuring of our operations.

Failure to comply with health and data protection laws and regulations could lead to government enforcement actions (which could include civil or criminal penalties), private litigation or adverse publicity and could negatively affect our operating results and business.

We and our current and potential collaborators may be subject to federal, state and foreign data protection laws and regulations (*i.e.*, laws and regulations that address privacy and data security). In the United States, numerous federal and state laws and regulations, including federal health information privacy laws (*e.g.*, the Health Insurance Portability and Accountability Act, or HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act, or HITECH), state data breach notification laws, state health information privacy laws and federal and state consumer protection laws (*e.g.*, Section 5 of the Federal Trade Commission Act), that govern the collection, use, disclosure and protection of health-related and other personal information could apply

to our operations or the operations of our collaborators. In addition, we may obtain health information from third parties (including research institutions from which we obtain clinical trial data) that are subject to privacy and security requirements under the HIPAA, as amended by HITECH, or other privacy and data security laws. Depending on the facts and circumstances, we could be subject to criminal penalties if we knowingly obtain, use, or disclose individually identifiable health information maintained by a HIPAA-covered entity in a manner that is not authorized or permitted by HIPAA.

International data protection laws, including Regulation 2016/679, known as the General Data Protection Regulation (GDPR) may also apply to health-related and other personal information obtained outside of the United States. The GDPR went into effect on May 25, 2018. The GDPR introduced new data protection requirements in the European Union, as well as potential fines for noncompliant companies of up to the greater of €20 million or 4% of annual global revenue. The regulation imposes numerous new requirements for the collection, use and disclosure of personal information, including more stringent requirements relating to consent and the information that must be shared with data subjects about how their personal information is used, the obligation to notify regulators and affected individuals of personal data breaches, extensive new internal privacy governance obligations and obligations to honor expanded rights of individuals in relation to their personal information (*e.g.*, the right to access, correct and delete their data). In addition, the GDPR includes restrictions on cross-border data transfers. The GDPR will increase our responsibility and liability in relation to personal data that we process where such processing is subject to the GDPR, and we may be required to put in place additional mechanisms to ensure compliance with the GDPR, including as implemented by individual countries. Further, the United Kingdom's vote in favor of exiting the EU, often referred to as Brexit, has created uncertainty with regard to data protection regulation in the United Kingdom. In particular, it is unclear how data transfers to and from the United Kingdom will be regulated.

In addition, California recently enacted the California Consumer Privacy Act (CCPA), which creates new individual privacy rights for California consumers (as defined in the law) and places increased privacy and security obligations on entities handling personal data of consumers or households. The CCPA will require covered companies to provide new disclosure to consumers about such companies' data collection, use and sharing practices, provide such consumers new ways to opt-out of certain sales or transfers of personal information, and provide consumers with additional causes of action. The CCPA goes into effect on January 1, 2020, and the California Attorney General may bring enforcement actions for violations beginning July 1, 2020. The CCPA was amended on September 23, 2018, and it remains unclear what, if any, further modifications will be made to this legislation or how it will be interpreted. As currently written, the CCPA may impact our business activities and exemplifies the vulnerability of our business to the evolving regulatory environment related to personal data and protected health information.

Compliance with U.S. and international data protection laws and regulations could require us to take on more onerous obligations in our contracts, restrict our ability to collect, use and disclose data, or in some cases, impact our ability to operate in certain jurisdictions. Failure to comply with U.S. and international data protection laws and regulations could result in government enforcement actions (which could include civil or criminal penalties), private litigation or adverse publicity and could negatively affect our operating results and business. Moreover, clinical trial subjects about whom we or our potential collaborators obtain information, as well as the providers who share this information with us, may contractually limit our ability to use and disclose the information. Claims that we have violated individuals' privacy rights, failed to comply with data protection laws, or breached our contractual obligations, even if we are not found liable, could be expensive and time consuming to defend and could result in adverse publicity that could harm our business.

If we experience security or data privacy breaches or other unauthorized or improper access to, use of, or destruction of our proprietary or confidential data, employee data or personal data, we may face costs, significant liabilities, harm to our brand and business disruption.

In connection with our discovery platform and efforts, we may collect and use a variety of personal data, such as name, mailing address, email addresses, phone number and clinical trial information. Although we have extensive measures in place to prevent the sharing and loss of patient data in our sample collection process associated with our discovery platform, any failure to prevent or mitigate security breaches or improper access to, use of, or disclosure of our clinical data or patients' personal data could result in significant liability under state (*e.g.*, state breach notification laws), federal (*e.g.*, HIPAA, as amended by HITECH), and international law (*e.g.*, the GDPR). Any failure to prevent or mitigate security breaches or improper access to, use of, or disclosure of our clinical data or patients' personal data may cause a material adverse impact to our reputation, affect our ability to conduct new studies and potentially disrupt our business. We may also rely on third-party service providers to host or otherwise process some of our data and that of users, and any failure by such third party to prevent or mitigate security breaches or improper access to or disclosure of such information could have similarly adverse consequences for us. If we are unable to prevent or mitigate the impact of such security or data privacy breaches, we could be exposed to litigation and governmental investigations, which could lead to a potential disruption to our business.

We depend on sophisticated information technology systems to operate our business and a cyber-attack or other breach of these systems could have a material adverse effect on our business.

We rely on information technology systems that we or our third-party vendors operate to process, transmit and store electronic information in our day-to-day operations. The size and complexity of our information technology systems makes them vulnerable to a cyber-attack, malicious intrusion, breakdown, destruction, loss of data privacy or other significant disruption. A successful attack could result in the theft or destruction of intellectual property, data, or other misappropriation of assets, or otherwise compromise our confidential or proprietary information and disrupt our operations. Cyber-attacks are becoming more sophisticated and frequent. We have invested in our systems and the protection and recoverability of our data to reduce the risk of an intrusion or interruption, and we monitor and test our systems on an ongoing basis for any current or potential threats. There can be no assurance that these measures and efforts will prevent future interruptions or breakdowns. If we or our third-party vendors fail to maintain or protect our information technology systems and data integrity effectively or fail to anticipate, plan for or manage significant disruptions to these systems, we or our third-party vendors could have difficulty preventing, detecting and controlling such cyber-attacks and any such attacks could result in losses described above as well as disputes with physicians, patients and our partners, regulatory sanctions or penalties, increases in operating expenses, expenses or lost revenues or other adverse consequences, any of which could have a material adverse effect on our business, results of operations, financial condition, prospects and cash flows.

Our information technology systems could face serious disruptions that could adversely affect our business.

Our information technology and other internal infrastructure systems, including corporate firewalls, servers, leased lines and connection to the internet, face the risk of systemic failure that could disrupt our operations. A significant disruption in the availability of our information technology and other internal infrastructure systems could cause interruptions and delays in our research and development work.

If we do not comply with laws regulating the protection of the environment and health and human safety, our business could be adversely affected.

Our research, development and manufacturing involves the use of hazardous materials and various chemicals. We maintain quantities of various flammable and toxic chemicals in our facilities that are required for our research, development and manufacturing activities. We are subject to federal, state and local laws and regulations governing the use, manufacture, storage, handling and disposal of these hazardous materials. We believe our procedures for storing, handling and disposing of these materials in our facilities comply with the relevant guidelines of the state of California and the Occupational Safety and Health Administration of the U.S. Department of Labor. Although we believe that our safety procedures for handling and disposing of these materials comply with the standards mandated by applicable regulations, the risk of accidental contamination or injury from these materials cannot be eliminated. If an accident occurs, we could be held liable for resulting damages, which could be substantial. We are also subject to numerous environmental, health and workplace safety laws and regulations, including those governing laboratory procedures, exposure to blood-borne pathogens and the handling of animals and biohazardous materials. 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 these materials, this insurance may not provide adequate coverage against potential liabilities. Although we have some environmental liability insurance covering certain of our facilities, we may not maintain adequate insurance for all environmental liability or toxic tort claims that may be asserted against us in connection with our storage or disposal of biological or hazardous materials. Additional federal, state and local laws and regulations affecting our operations may be adopted in the future. We may incur substantial costs to comply with, and substantial fines or penalties if we violate, any of these laws or regulations.

Our current operations are concentrated in one location, and we or the third parties upon whom we depend may be adversely affected by natural or other disasters and our business continuity and disaster recovery plans may not adequately protect us from a serious disaster.

Our current operations are concentrated in the San Francisco Bay Area. Any unplanned event, such as flood, fire, explosion, extreme weather condition, medical epidemics, power shortage, telecommunication failure or other natural or manmade accidents or incidents that result in us being unable to fully utilize our facilities or the manufacturing facilities of our third-party contract manufacturers, or lose our repository of blood-based and other valuable laboratory samples, may have a material and adverse effect on our ability to operate our business, particularly on a daily basis, and have significant negative consequences on our financial and operating conditions. Loss of access to these facilities may result in increased costs, delays in the development of our product candidates or interruption of our business operations. Natural disasters such as earthquakes or wildfires, both of which are prevalent in Northern California, floods or tsunamis could further disrupt our operations, and have a material negative impact on our business, financial condition, results of operations and prospects. If a natural disaster, power outage or other event occurred that prevented us from using all or a significant portion of our headquarters, that damaged critical infrastructure, such as our research facilities or the manufacturing facilities of our third-party contract manufacturers, or that otherwise disrupted operations, it may be difficult or, in certain cases, impossible, for us to continue our business for a substantial period of time. The disaster recovery and business continuity plans we have in place may prove inadequate in the event of a serious disaster or similar event. We may incur substantial expenses as a result of the limited nature of our disaster recovery and business continuity plans, which could have a material adverse effect on our business. As part of our risk management policy, we maintain insurance coverage at levels that we believe are appropriate for our business. However, in the event of an accident or incident at these facilities, we cannot assure you that the amounts of insurance will be sufficient to satisfy any damages and losses. If our facilities, or the manufacturing facilities of our third-party contract

manufacturers, are unable to operate because of an accident or incident or for any other reason, even for a short period of time, any or all of our research and development programs may be harmed. Any business interruption may have a material and adverse effect on our business and financial condition.

Risks Related to Our Intellectual Property

If we are unable to obtain or protect intellectual property rights related to our technology and current or future product candidates, or if our intellectual property rights are inadequate, we may not be able to compete effectively.

Our success depends in part on our ability to obtain and maintain protection for our owned and in-licensed intellectual property rights and proprietary technology. We rely on patents and other forms of intellectual property rights, including in-licenses of intellectual property rights and biologic materials of others, to protect our current or future discovery platform, product candidates, methods used to manufacture our current or future product candidates, and methods for treating patients using our current or future product candidates.

We in-license exclusive rights, including patents and patent applications relating to our discovery platform, from the Board of Trustees of the Leland Stanford Junior University, or Stanford University. Patent applications for this in-licensed technology are still pending before the U.S. Patent and Trademark Office and other national patent offices. There is no guarantee that such patent applications will issue as patents, nor any guarantee that issued patents will provide adequate protection for the in-licensed technology or any meaningful competitive advantage.

We also own several patents and applications on our own technology relating to our discovery platform. There is no guarantee that any patents covering this technology will issue from the patent applications we own, or, if they do, that the issued claims will provide adequate protection for our discovery platform or any meaningful competitive advantage.

We currently do not own or in-license any issued patents or pending non-provisional patent applications in connection with ATRC-101. We have filed multiple provisional patent applications in the United States in connection with ATRC-101 and related antibody variants. A provisional patent application is not eligible to become an issued patent until, among other things, we file a non-provisional patent application within 12 months of the filing date of the provisional patent application. If we do not timely file non-provisional patent applications, we may lose our priority date with respect to our provisional patent applications and any patent protection on the inventions disclosed in our provisional patent applications. Moreover, there is no guarantee that any current or future patent applications will result in the issuance of patents that will effectively protect ATRC-101 or other product candidates or will effectively prevent others from commercializing competitive products.

The patent prosecution process is expensive, complex and time-consuming. Patent license negotiations also can be complex and protracted, with uncertain results. We may not be able to file, prosecute, maintain, enforce or license all necessary or desirable patents and patent applications at a reasonable cost or in a timely manner. It is also possible that we will fail to identify patentable aspects of our research and development output before it is too late to obtain patent protection. The patent applications that we own or in-license may fail to result in issued patents, and, even if they do issue as patents, such patents may not cover our current or future technologies or product candidates in the United States or in other countries or provide sufficient protection from competitors. In addition, the coverage claimed in a patent application can be significantly reduced before the patent is issued and its scope can be reinterpreted after issuance. Accordingly, we also rely on our

ability to preserve our trade secrets, to prevent third parties from infringing, misappropriating or violating our proprietary rights and to operate without infringing, misappropriating, or violating the proprietary rights of others.

Further, although we make reasonable efforts to ensure patentability of our inventions, we cannot guarantee that all of the potentially relevant prior art relating to our owned or in-licensed patents and patent applications has been found. For example, publications of discoveries in scientific literature often lag behind the actual discoveries, and patent applications in the United States and other jurisdictions are typically not published until 18 months after filing, and in some cases not at all. Additionally, pending patent applications that have been published can, subject to certain limitations, be later amended in a manner that could cover our discovery platform, our product candidates, or the use of our technologies. We thus cannot know with certainty whether we or our licensors were the first to make the inventions claimed in our owned or in-licensed patents or pending applications, or that we or our licensors were the first to file for patent protection of such inventions. There is no assurance that all potentially relevant prior art relating to our owned or in-licensed patents and patent applications has been found. For this reason, and because there is no guarantee that any prior art search is absolutely correct and comprehensive, we may be unaware of prior art that could be used to invalidate an issued patent or to prevent our owned or in-licensed pending patent applications from issuing as patents. Invalidation of any of our patent rights, including in-licensed patent rights, could materially harm our business.

Moreover, the patent positions of biopharmaceutical companies are generally uncertain because they may involve complex legal and factual considerations that have, in recent years, been the subject of legal development and change. As a result, the issuance, scope, validity, enforceability and commercial value of our pending patent rights is uncertain. The standards applied by the United States Patent and Trademark Office, or USPTO, and foreign patent offices in granting patents are not always certain and moreover, are not always applied uniformly or predictably. For example, there is no uniform worldwide policy regarding patentable subject matter or the scope of claims allowable in patents. 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 owned or in-licensed patents or narrow the scope of our patent protection.

Even if patents do successfully issue and even if such patents cover our current or any future technologies or product candidates, third parties may challenge their validity, enforceability or scope, which may result in such patents being narrowed, invalidated, or held unenforceable. Any successful challenge to these patents or any other patents owned by or licensed to us could deprive us of rights necessary for the successful commercialization of any current or future technologies or product candidates that we may develop. Likewise, if patent applications we own or have in-licensed with respect to our development programs and current or future technologies or product candidates fail to issue, if their breadth or strength is threatened, or if they fail to provide meaningful exclusivity, other companies could be dissuaded from collaborating with us to develop current or future technologies or product candidates. Lack of valid and enforceable patent protection could threaten our ability to commercialize current or future products and could prevent us from maintaining exclusivity with respect to the invention or feature claimed in the patent applications. Any failure to obtain or any loss of patent protection could have a material adverse impact on our business and ability to achieve profitability. We may be unable to prevent competitors from entering the market with a product that is similar to or the same as ATRC-101 or future product candidates.

The filing of a patent application or the issuance of a patent is not conclusive as to its ownership, inventorship, scope, patentability, validity or enforceability. Issued patents and patent applications may be challenged in the courts and in the patent office in the United States and

abroad. For example, our applications or applications filed by our licensors may be challenged through third-party submissions, opposition or derivation proceedings. By further example, our issued patents or the issued patents we in-license may be challenged through reexamination, *inter partes* review or post-grant review proceedings before the patent office, or in declaratory judgment actions or counterclaims. An adverse determination in any such submission, proceeding or litigation could prevent the issuance of, reduce the scope of, invalidate or render unenforceable our owned or in-licensed patent rights; limit our ability to stop others from using or commercializing similar or identical platforms and products; allow third parties to compete directly with us without payment to us; or result in our inability to manufacture or commercialize products without infringing third-party patent rights. In addition, if the breadth or strength of protection provided by our owned or in-licensed patents and patent applications is threatened, it could dissuade companies from collaborating with us to license, develop or commercialize current or future platforms or product candidates. Any of the foregoing could have a material adverse effect on our business, financial condition, results of operations and prospects.

Moreover, some of our owned and in-licensed patents and patent applications are or may in the future be co-owned with third parties. If we are unable to obtain an exclusive license to any such third party co-owners' interest in such patents or patent application, such co-owners may be able to license their rights to other third parties, including our competitors, and our competitors could market competing products and technology. We may need the cooperation of any such co-owners of our patents to enforce such patents against third parties, and such cooperation may not be provided to us. Any of the foregoing could have a material adverse effect on our competitive position, business prospects and financial conditions.

Our in-licensed patent rights may be subject to a reservation of rights by one or more third parties. For example, we in-license certain patent rights from Stanford University, which co-owns rights with a governmental entity. As a result, the U.S. government may have certain rights, including so-called march-in rights, to such patent rights and any products or technology developed from such patent rights. When new technologies are developed with U.S. government funding, the U.S. government generally obtains certain rights in any resulting patents, including a nonexclusive license authorizing the U.S. government to use the invention for non-commercial purposes. These rights may permit the U.S. government to disclose our confidential information to third parties and to exercise march-in rights to use or to allow third parties to use our licensed technology. The U.S. government can exercise its march-in rights if it determines that action is necessary because we fail to achieve the practical application of government-funded technology, because action is necessary to alleviate health or safety needs, to meet requirements of federal regulations, or to give preference to U.S. industry. In addition, our rights in such inventions may be subject to certain requirements to manufacture products embodying such inventions in the United States. Any exercise by the U.S. government of such rights could harm our competitive position, business, financial condition, results of operations and prospects.

If we fail to comply with our obligations under any license, collaboration or other intellectual property-related agreements, we may be required to pay damages and could lose intellectual property rights that may be necessary for developing, commercializing and protecting our current or future technologies or product candidates or we could lose certain rights to grant sublicenses.

We are heavily reliant upon in-licenses to certain patent rights and proprietary technology from third parties that are important or necessary to our discovery platform and development of product candidates. For example, we rely on an intellectual property license from Stanford University for our discovery platform.

Our current license agreements impose, and any future license agreements we enter into are likely to impose, various development, commercialization, funding, milestone, royalty, diligence, sublicensing, insurance, patent prosecution and enforcement or other obligations on us. If we breach any of these obligations, or use the intellectual property licensed to us in an unauthorized manner, we may be required to pay damages and the licensor may have the right to terminate the license. License termination could result in our inability to develop, manufacture and sell products that are covered by the licensed technology or could enable a competitor to gain access to the licensed technology. In certain circumstances, our licensed patent rights are subject to our reimbursing our licensors for their patent prosecution and maintenance costs. For example, our license agreement with Stanford University requires us to bear the costs of filing and maintaining patent applications.

Furthermore, we may not have the right to control the preparation, filing, prosecution, maintenance, enforcement and defense of patents and patent applications that we license from third parties. For example, pursuant to our license agreement with Stanford University, while we direct and are responsible for the preparation, filing, prosecution and maintenance, and, in certain circumstances, enforcement and defense of the patents and patent applications, all of these actions are subject to Stanford University's final approval. Given Stanford University's right of final approval, we therefore cannot be certain that these patents and patent applications will be prepared, filed, prosecuted, maintained, enforced and defended in a manner consistent with the best interests of our business. If our licensors and future licensors fail to prosecute, maintain, enforce and defend patents we may license, or lose rights to licensed patents or patent applications, our license rights may be reduced or eliminated. In such circumstances, our right to develop and commercialize any of our products or product candidates that is the subject of such licensed rights could be materially adversely affected.

Moreover, our licensors may own or control intellectual property that has not been licensed to us and, as a result, we may be subject to claims, regardless of their merit, that we are infringing, misappropriating or otherwise violating the licensor's intellectual property rights. In addition, while we cannot currently determine the amount of the royalty obligations we would be required to pay on sales of future products if infringement or misappropriation were found, those amounts could be significant. The amount of our future royalty obligations will depend on the technology and intellectual property we use in products that we successfully develop and commercialize, if any. Therefore, even if we successfully develop and commercialize products, we may be unable to achieve or maintain profitability.

In addition, the agreements under which we currently license intellectual property or technology from third parties are complex, and certain provisions in such agreements may be susceptible to multiple interpretations. The resolution of any contract interpretation disagreement that may arise could narrow what we believe to be the scope of our rights to the relevant intellectual property or technology, or increase what we believe to be our financial or other obligations under the relevant agreement, either of which could have a material adverse impact on our business and ability to achieve profitability. Moreover, if disputes over intellectual property that we have licensed prevent or impair our ability to maintain our current licensing arrangements on commercially acceptable terms, we may be unable to successfully develop and commercialize any affected product candidates, which could have a material adverse effect on our business and financial conditions.

Patent terms may not be able to protect our competitive position for an adequate period of time with respect to our current or future technologies or product candidates.

Patents have a limited lifespan. In the United States, the standard patent term is typically 20 years after filing. Various extensions may be available. Even so, the life of a patent and the

protection it affords are limited. As a result, our owned and in-licensed patent portfolio provides us with limited rights that may not last for a sufficient period of time to exclude others from commercializing products similar or identical to ours. For example, given the large amount of time required for the research, development, testing and regulatory review of new product candidates, patents protecting such candidates might expire before or shortly after such candidates are commercialized.

Extensions of patent term are available, but there is no guarantee that we would succeed in obtaining any particular extension—and no guarantee any such extension would confer patent term for a sufficient period of time to exclude others from commercializing products similar or identical to ours. In the United States, the Drug Price Competition and Patent Term Restoration Act of 1984 permits a patent term extension of up to five years beyond the normal expiration of the patent, which is limited to the approved indication (or any additional indications approved during the period of extension). A patent term extension cannot extend the remaining term of a patent beyond 14 years from the date of product approval; only one patent may be extended; and extension is available for only those claims covering the approved drug, a method for using it, or a method for manufacturing it. The applicable authorities, including the FDA and the USPTO in the United States, and any equivalent regulatory authority in other countries, may not agree with our assessment of whether such extensions are available, and may refuse to grant extensions to our patents, or may grant more limited extensions than we request. An extension may not be granted or may be limited where there is, for example, a failure to exercise due diligence during the testing phase or regulatory review process, failure to apply within applicable deadlines, failure to apply before expiration of relevant patents, or some other failure to satisfy applicable requirements. If this occurs, our competitors may be able to launch their products earlier by taking advantage of our investment in development and clinical trials along with our clinical and preclinical data. This could have a material adverse effect on our business and ability to achieve profitability.

Changes in U.S. patent law or the patent law of other countries or jurisdictions could diminish the value of patents in general, thereby impairing our ability to protect our current or any future technologies or product candidates.

Changes in either the patent laws or interpretation of the patent laws in the United States or elsewhere could increase the uncertainties and costs surrounding the prosecution of patent applications and the enforcement or defense of issued patents. The United States has enacted and implemented wide-ranging patent reform legislation. On September 16, 2011, the Leahy-Smith America Invents Act, or the Leahy-Smith Act, was signed into law, which could increase the uncertainties and costs surrounding the prosecution of our owned or in-licensed patent applications and the enforcement or defense of our owned or in-licensed issued patents. The Leahy-Smith Act includes a number of significant changes to U.S. patent law. These include provisions that affect the way patent applications are prosecuted, redefine prior art, may affect patent litigation and switch the U.S. patent system from a ‘‘first-to-invent’’ system to a ‘‘first-to-file’’ system. Under a first-to-file system, assuming the other requirements for patentability are met, the first inventor to file a patent application generally will be entitled to the patent on an invention regardless of whether another inventor had made the invention earlier. These provisions also allow third-party submission of prior art to the USPTO during patent prosecution and set forth additional procedures to challenge the validity of a patent by the USPTO administered post grant proceedings, including derivation, reexamination, inter partes review, post-grant review and interference proceedings. The USPTO developed additional regulations and procedures to govern administration of the Leahy-Smith Act, and many of the substantive changes to patent law associated with the Leahy-Smith Act, and, in particular, the first-to-file provisions, became effective on March 16, 2013. Accordingly, it is not clear what, if any, impact the Leahy-Smith Act will have on the operation of our business. The Leahy-

Smith Act and its implementation could increase the uncertainties and costs surrounding the prosecution of our owned or in-licensed patent applications and the enforcement or defense of our issued owned or in-licensed patents, all of which could have a material adverse impact on our business prospects and financial condition.

As referenced above, for example, courts in the U.S. continue to refine the heavily fact-and-circumstance-dependent jurisprudence defining the scope of patent protection available for therapeutic antibodies, narrowing the scope of patent protection available in certain circumstances or weakening the rights of patent owners in certain situations. This creates uncertainty about our ability to obtain patents in the future and the value of such patents. We cannot provide assurance that future developments in U.S. Congress, the federal courts and the USPTO will not adversely impact our owned or in-licensed patents or patent applications. The laws and regulations governing patents could change in unpredictable ways that could weaken our and our licensors' ability to obtain new patents or to enforce our existing owned or in-licensed patents and patents that we might obtain or in-license in the future. Similarly, changes in patent law and regulations in other countries or jurisdictions or changes in the governmental bodies that enforce them or changes in how the relevant governmental authority enforces patent laws or regulations may have a material adverse effect on our and our licensors' ability to obtain new patents or to protect and enforce our owned or in-licensed patents or patents that we may obtain or in-license in the future.

Other companies or organizations may challenge our or our licensors' patent rights or may assert patent rights that prevent us from developing and commercializing our current or future products.

As the field of antibody-based immunotherapeutics matures, patent applications are being processed by national patent offices around the world. There is uncertainty about which patents will issue, and, if they do, there is uncertainty as to when, to whom, and with what claims. In addition, third parties may attempt to invalidate our or our licensors' intellectual property rights. Even if such rights are not directly challenged, disputes could lead to the weakening of our or our licensors' intellectual property rights. Our defense against any attempt by third parties to circumvent or invalidate our intellectual property rights could be costly to us, could require significant time and attention of our management, and could have a material and adverse impact on our profitability, financial condition and prospects or ability to successfully compete.

There are many issued and pending patents that claim aspects of our current or potential future product candidates and modifications that we may need to apply to our current or potential future product candidates. There are also many issued patents that claim antibodies or portions of antibodies that may be relevant for products we wish to develop.

Further, we cannot guarantee that we are aware of all of patents and patent applications potentially relevant to our technology or products. We may not be aware of potentially relevant third-party patents or applications for several reasons. For example, U.S. applications filed before November 29, 2000, and certain U.S. applications filed after that date that will not be filed outside the U.S. remain confidential until patents issue. Patent applications in the United States and elsewhere are published approximately 18 months after the earliest filing for which priority is claimed, with such earliest filing date being commonly referred to as the priority date. Therefore, patent applications covering our product candidates or platform technologies could have been filed by others without our knowledge. Additionally, pending patent applications that have been published can, subject to certain limitations, be later amended in a manner that could cover our platform, our product candidates or the use of our technologies.

Thus, it is possible that one or more third parties will hold patent rights to which we will need a license, which may not be available on reasonable terms or at all. If such third parties refuse to grant us a license to such patent rights on reasonable terms or at all, we may be required to expend significant time and resources to redesign our technology, product candidates or the methods for manufacturing our product candidates, or to develop or license replacement technology, all of which may not be commercially or technically feasible. In such case, we may not be able to market such technology or product candidates and may not be able to perform research and development or other activities covered by these patents. This could have a material adverse effect on our ability to commercialize our product candidates and our business and financial condition.

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

Filing, prosecuting and defending patents on current or future technologies or product candidates in all countries throughout the world would be prohibitively expensive. Competitors or other third parties may use our technologies in jurisdictions where we have not obtained patent protection to develop their own products and, further, may export infringing products to territories where we have patent protection or licenses but enforcement is not as strong as that in the United States. These products may compete with our products, and our patents or other intellectual property rights may not be effective or sufficient to prevent them from competing.

Additionally, the laws of some foreign jurisdictions do not protect intellectual property rights to the same extent as the laws in the United States. Many companies have encountered significant difficulties in protecting and defending such rights in such jurisdictions. The legal systems of certain countries, including certain developing countries, do not favor the enforcement of patents and other intellectual property protection, particularly those relating to biotechnology, which could make it difficult for us to stop the infringement of our owned and in-licensed patents or the marketing of competing products in violation of our intellectual property and proprietary rights generally. Proceedings to enforce our owned or in-licensed intellectual property and proprietary rights in foreign jurisdictions could result in substantial costs and could divert our efforts and attention from other aspects of our business. Such proceedings could also put our owned or in-licensed patents at risk of being invalidated or interpreted narrowly, could put our owned or in-licensed patent applications at risk of not issuing, and could provoke third parties to assert claims against us or our licensors. We or our licensors may not prevail in any lawsuits or other adversarial proceedings that we or our licensors initiate, and the damages or other remedies awarded, if any, may not be commercially meaningful. Accordingly, our and our licensors' efforts to enforce such intellectual property and proprietary rights around the world may be inadequate to obtain a significant commercial advantage from the intellectual property that we develop or in-license.

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

Third parties may initiate legal proceedings alleging that we are infringing, misappropriating or violating their intellectual property rights, the outcome of which would be uncertain and could have a material adverse impact on the success of our business.

Our commercial success depends, in part, upon our ability or the ability of our potential future collaborators to develop, manufacture, market and sell our current or any future product candidates and to use our proprietary technologies without infringing, misappropriating or violating the proprietary and intellectual property rights of third parties. The biotechnology and pharmaceutical industries are characterized by extensive and complex litigation regarding patents and other intellectual property rights.

We or our licensors, or any future strategic partners, may be party to, or be threatened with, adversarial proceedings or litigation regarding intellectual property rights with respect to our current or any potential future product candidates and technologies, including derivation, reexamination, *inter partes* review, post-grant review or interference proceedings before the USPTO and similar proceedings in jurisdictions outside of the United States such as opposition proceedings. In some instances, we may be required to indemnify our licensors for the costs associated with any such adversarial proceedings or litigation. For example, we are obligated under our license agreement with Stanford University to indemnify, hold harmless and defend Stanford University for damages from any claim of any kind arising out of or related to the license agreement with Stanford University. Third parties may assert infringement claims against us, our licensors or our strategic partners based on existing patents or patents that may be granted in the future, regardless of their merit. There is a risk that third parties may choose to engage in litigation or other adversarial proceedings with us, our licensors or our strategic partners to enforce or otherwise assert their patent rights. Even if we believe such claims are without merit, a court of competent jurisdiction could hold that these third-party patents are valid, enforceable and infringed, which could have a material adverse impact on our ability to utilize our discovery platform or to commercialize our current or any future product candidates. In order to successfully challenge the validity of any such U.S. patent in federal court, we would need to overcome a presumption of validity by presenting clear and convincing evidence of invalidity. There is no assurance that a court of competent jurisdiction, even if presented with evidence we believe to be clear and convincing, would invalidate the claims of any such U.S. patent.

Further, we cannot guarantee that we will be able to successfully settle or otherwise resolve such adversarial proceedings or litigation. If we are unable to successfully settle future claims on terms acceptable to us, we may be required to engage in or to continue costly, unpredictable and time-consuming litigation and may be prevented from or experience substantial delays in marketing our product candidates. If we, or our licensors, or any future strategic partners are found to infringe, misappropriate or violate a third-party patent or other intellectual property rights, we could be required to pay damages, including treble damages and attorney's fees, if we are found to have willfully infringed. In addition, we, or our licensors, or any future strategic partners may choose to seek, or be required to seek, a license from a third party, which may not be available on commercially reasonable terms, if at all. Even if a license can be obtained on commercially reasonable terms, the rights may be non-exclusive, which could give our competitors access to the same technology or intellectual property rights licensed to us, and we could be required to make substantial licensing and royalty payments. We also could be forced, including by court order, to cease utilizing, developing, manufacturing and commercializing our discovery platform or product candidates deemed to be infringing. We may be forced to redesign current or future technologies or products. Any of the foregoing could have a material adverse effect on our ability to generate revenue or achieve profitability and possibly prevent us from generating revenue sufficient to sustain our operations.

In addition, we or our licensors may find it necessary to pursue claims or to initiate lawsuits to protect or enforce our owned or in-licensed patent or other intellectual property rights. The cost to us in defending or initiating any litigation or other proceeding relating to our owned or in-licensed patent or other intellectual property rights, even if resolved in our favor, could be substantial, and any litigation or other proceeding would divert our management's attention. Such litigation or proceedings could materially increase our operating losses and reduce the resources available for development activities or any future sales, marketing or distribution activities. Some of our competitors may be able to more effectively to sustain the costs of complex patent litigation because they have substantially greater resources. Uncertainties resulting from the initiation and continuation of patent litigation or other proceedings could delay our research and development efforts and materially limit our ability to continue our operations. Furthermore, because of the substantial amount of discovery required in connection with certain such proceedings, there is a risk that some of our confidential information could be compromised by disclosure. In addition, there could be public announcements of the results of hearings, motions or other interim proceedings or developments and if securities analysts or investors perceive these results to be negative, such announcements could have a material adverse effect on the price of our Class A common stock.

If we or our licensors were to initiate legal proceedings against a third party to enforce a patent covering one of our product candidates or our technology, the defendant could counterclaim that such patent is invalid or unenforceable. In patent litigation in the United States, defendant counterclaims alleging invalidity or unenforceability are commonplace. Grounds for a validity challenge could be an alleged failure to meet any of several statutory requirements, for example, claiming patent-ineligible subject matter, lack of novelty, indefiniteness, lack of written description, non-enablement, anticipation or obviousness. Grounds for an unenforceability assertion could be an allegation that someone connected with prosecution of the patent withheld relevant information from the USPTO or made a misleading statement during prosecution. The outcome of such invalidity and unenforceability claims is unpredictable. With respect to the validity question, for example, we cannot be certain that there is no invalidating prior art of which we or our licensors and the patent examiner were unaware during prosecution. If a defendant were to prevail on a legal assertion of invalidity or unenforceability, we could lose at least part, and perhaps all, of the patent protection for one or more of our product candidates or certain aspects of our platform technology. Such a loss of patent protection could have a material adverse effect on our business, financial condition, results of operations and prospects. Patents and other intellectual property rights also will not protect our product candidates and technologies if competitors or third parties design around such product candidates and technologies without legally infringing, misappropriating or violating our owned or in-licensed patents or other intellectual property rights.

Intellectual property rights of third parties could adversely affect our ability to commercialize our current or future technologies or product candidates, and we might be required to litigate or obtain licenses from third parties to develop or market our current or future technologies or product candidates, which may not be available on commercially reasonable terms or at all.

Because the antibody landscape is still evolving, it is difficult to conclusively assess our freedom to operate without infringing, misappropriating or violating third-party rights. There are numerous companies that have pending patent applications and issued patents broadly covering antibodies generally or covering antibodies directed against the same targets as, or targets similar to, those we are pursuing. Our competitive position may materially suffer if patents issued to third parties or other third-party intellectual property rights cover our current or future technologies product candidates or elements thereof or our manufacture or uses relevant to our development plans. In such cases, we may not be in a position to develop or commercialize current or future technologies, product

candidates unless we successfully pursue litigation to nullify or invalidate the third-party intellectual property right concerned, or enter into a license agreement with the intellectual property right holder, if available on commercially reasonable terms. There may be issued patents of which we are not aware, held by third parties that, if found to be valid and enforceable, could be alleged to be infringed by our current or future technologies or product candidates. There also may be pending patent applications of which we are not aware that may result in issued patents, which could be alleged to be infringed by our current or future technologies or product candidates. If such an infringement claim should successfully be brought, we may be required to pay substantial damages or be forced to abandon our current or future technologies or product candidates or to seek a license from any patent holders. No assurances can be given that a license will be available on commercially reasonable terms, if at all.

Third party intellectual property right holders may also actively bring infringement, misappropriation or violation or other claims alleging violations of intellectual property rights against us. We cannot guarantee that we will be able to successfully settle or otherwise resolve such claims. If we are unable to successfully settle future claims on terms acceptable to us, we may be required to engage in or to continue costly, unpredictable and time-consuming litigation and may be prevented from or experience substantial delays in marketing our product candidates. If we fail in any such dispute, in addition to being forced to pay damages, we may be temporarily or permanently prohibited from commercializing any of our current or future technologies or product candidates that are held to be infringing, misappropriating or otherwise violating third-party intellectual property rights. We might, if possible, also be forced to redesign current or future technologies or product candidates so that we no longer infringe, misappropriate or violate the third-party intellectual property rights. Any of these events, even if we were ultimately to prevail, could require us to divert substantial financial and management resources that we would otherwise be able to devote to our business, which could have a material adverse effect on our financial condition and results of operations.

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

As referenced above, in addition to seeking patent protection for certain aspects of our current or future technologies and product candidates, we also consider trade secrets, including confidential and unpatented know-how, important to the maintenance of our competitive position. However, trade secrets and know-how can be difficult to protect. We protect and plan to protect trade secrets and confidential and unpatented know-how, in part, by entering into non-disclosure and confidentiality agreements with parties who have access to such knowledge, such as our employees, corporate collaborators, outside scientific collaborators, CROs, contract manufacturers, consultants, advisors and other third parties. We also enter into confidentiality and invention or patent assignment agreements with our employees and consultants under which they are obligated to maintain confidentiality and to assign their inventions to us. Despite these efforts, we may not obtain these agreements in all circumstances. Moreover, individuals with whom we have such agreements may not comply with their terms. Any of these parties may breach such agreements and disclose our proprietary information, including our trade secrets, and we may not be able to obtain adequate remedies for any such breaches. We may also become involved in inventorship disputes relating to inventions and patents developed by our employees or consultants under such agreements. Enforcing a claim that a party illegally disclosed or misappropriated a trade secret, or securing title to an employee- or consultant-developed invention if a dispute arises, is difficult, expensive and time-consuming, and the outcome is unpredictable. In addition, some courts in the United States and certain foreign jurisdictions disfavor or are unwilling to protect trade secrets. Further, if any of our trade secrets were to be lawfully obtained or independently developed by a competitor, we would

have no right to prevent that competitor from using the technology or information to compete with us. If any of our trade secrets were to be disclosed to or independently developed by a competitor, our competitive position would be materially and adversely harmed.

We may be subject to claims that we or our employees or consultants have wrongfully used or disclosed alleged trade secrets or other proprietary information of our employees' or consultants' former employers or their clients.

Many of our employees or consultants and our licensors' employees or consultants were previously employed at universities or biotechnology or biopharmaceutical companies, including our competitors or potential competitors. We may be subject to claims that one or more of these employees or consultants or we have inadvertently or otherwise used or disclosed trade secrets or other proprietary information of former employers. Litigation or arbitration may be necessary to defend against these claims. If we fail in defending such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights or personnel or may be enjoined from using such intellectual property. Any such proceedings and possible aftermath would likely divert significant resources from our core business, including distracting our technical and management personnel from their normal responsibilities. A loss of key research personnel or their work product could limit our ability to commercialize, or prevent us from commercializing, our current or future technologies or product candidates, which could materially harm our business. Even if we are successful in defending against any such claims, litigation or arbitration could result in substantial costs and could be a distraction to management.

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

Periodic maintenance fees, renewal fees, annuity fees and various other government fees on patents or applications will be due to be paid to the USPTO and various government patent agencies outside of the United States over the lifetime of our owned and in-licensed patents or applications and any patent rights we may own or in-license in the future. The USPTO and various non-U.S. government patent agencies require compliance with several procedural, documentary, fee payment and other similar provisions during the patent application process. We employ reputable law firms and other professionals to help us comply with these requirements, and we are also dependent on our licensors to take the necessary action to comply with these requirements with respect to our in-licensed intellectual property. In many cases, an inadvertent lapse can be cured by payment of a late fee or by other means in accordance with the applicable rules. There are situations, however, in which non-compliance 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. In such an event, potential competitors might be able to enter the market with similar or identical products or platforms, which could have a material adverse effect on our business prospects and financial condition.

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

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

establish name recognition based on our trademarks and trade names, we may not be able to compete effectively and our business may be materially adversely affected.

Intellectual property rights do not necessarily address all potential threats to our business.

The degree of future protection afforded by our intellectual property rights is uncertain because intellectual property rights have limitations, and may not adequately protect our business. The following examples are illustrative:

- others may be able to make compounds or formulations that are similar to our product candidates, but that are not covered by the claims of any patents that we own, license or control;
- we or any strategic partners might not have been the first to make the inventions covered by the issued patents or pending patent applications that we own, license or control;
- we or our licensors might not have been the first to file patent applications covering certain of our owned and in-licensed inventions;
- others may independently develop the same, similar, or alternative technologies without infringing, misappropriating or violating our owned or in-licensed intellectual property rights;
- it is possible that our owned or in-licensed pending patent applications will not lead to issued patents;
- issued patents that we own, in-license, or control may not provide us with any competitive advantages, or may be narrowed or held invalid or unenforceable, including as a result of legal challenges;
- our competitors might conduct research and development activities in the United States and other countries that provide a safe harbor from patent infringement claims for certain research and development activities, as well as in countries where we do not have patent rights, and may then use the information learned from such activities to develop competitive products for sale in our major commercial markets;
- we may choose not to file a patent in order to maintain certain trade secrets or know-how, and a third party may subsequently file a patent covering such trade secrets or know-how; and
- the patents of others may have an adverse effect on our business.

Should any of these events occur, they could have a material adverse impact on our business and financial condition.

Risks Related to Government Regulation

Clinical development includes a lengthy and expensive process with an uncertain outcome, and results of earlier studies and trials may not be predictive of future trial results.

Our only product candidate, ATRC-101, is in preclinical development and its risk of failure is high. It is impossible to predict when or if ATRC-101 or any potential future product candidates will prove effective and safe in humans or will receive regulatory approval. Before obtaining marketing approval from regulatory authorities for the sale of any product candidate, we must complete preclinical studies and then conduct extensive clinical trials to demonstrate the safety and efficacy of that product candidate in humans. 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 development process. The results of preclinical studies and early clinical trials of any of our current or potential future product candidates may not be predictive of the results of later-stage clinical trials. 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. A number of

companies in the pharmaceutical industry have suffered significant setbacks in advanced clinical trials due to lack of efficacy or safety profiles, notwithstanding promising results in earlier trials.

We expect to prepare and submit to the FDA an IND for ATRC-101 in late 2019, and we expect to initiate a Phase 1b clinical trial for ATRC-101 in patients with solid tumors in early 2020. Commencing this clinical trial is subject to finalizing the trial design and filing an IND with the FDA. Even after we file our IND, the FDA could disagree that we have satisfied their requirements to commence our clinical trials or disagree with our study design, which may require us to complete additional preclinical studies or amend our protocols or impose stricter conditions on the commencement of clinical trials.

We may experience delays in completing our preclinical studies and initiating or completing clinical trials of ATRC-101 or potential future product candidates. We do not know whether planned preclinical studies and clinical trials will be completed on schedule or at all, or whether planned clinical trials will begin on time, need to be redesigned, enroll patients on time or be completed on schedule, if at all. Our development programs may be delayed for a variety of reasons, including delays related to:

- the FDA or other regulatory authorities requiring us to submit additional data or imposing other requirements before permitting us to initiate a clinical trial;
- obtaining regulatory approval to commence a clinical trial;
- reaching agreement on acceptable terms with prospective CROs and clinical trial sites, the terms of which can be subject to extensive negotiation and may vary significantly among different CROs and clinical trial sites;
- obtaining institutional review board, or IRB, approval at each clinical trial site;
- recruiting suitable patients to participate in a clinical trial;
- having patients complete a clinical trial or return for post-treatment follow-up;
- clinical trial sites deviating from trial protocol or dropping out of a trial;
- adding new clinical trial sites; or
- manufacturing sufficient quantities of our product candidates for use in clinical trials.

Furthermore, we expect to rely on our CROs and clinical trial sites to ensure the proper and timely conduct of our clinical trials and, while we expect to enter into agreements governing their committed activities, we have limited influence over their actual performance.

We could encounter delays if prescribing physicians encounter unresolved ethical issues associated with enrolling patients in clinical trials of our current or potential future product candidates in lieu of prescribing existing treatments that have established safety and efficacy profiles. Further, a clinical trial may be suspended or terminated by us, our partners, the IRBs of the institutions in which such trials are being conducted, the Data Safety Monitoring Board for such trial or by the FDA or other regulatory authorities due to a number of factors, including failure to conduct the clinical trial in accordance with regulatory requirements or our clinical protocols, inspection of the clinical trial operations or trial site by the FDA or other regulatory authorities resulting in the imposition of a clinical hold, unforeseen safety issues or adverse side effects, failure to demonstrate a benefit from using a drug or therapeutic biologic, changes in governmental regulations or administrative actions or lack of adequate funding to continue the clinical trial. If we experience delays in the completion of, or termination of, any clinical trial of any of our current or potential future product candidates, the commercial prospects of such product candidate will be harmed, and our ability to generate product revenue from such product candidates will be delayed. In addition, any delays in completing our clinical trials will increase our costs, slow our product development and approval process and jeopardize our ability to commence product sales and generate revenue. Any of these occurrences

may materially and adversely affect our business, financial condition, results of operations and prospects. In addition, many of the factors that cause, or lead to, a delay in the commencement or completion of clinical trials may also ultimately lead to the denial of regulatory approval of our current or potential future product candidates.

We may be unable to obtain U.S. or foreign regulatory approval and, as a result, be unable to commercialize ATRC-101 or potential future product candidates.

ATRC-101 and any potential future product candidates are subject to extensive governmental regulations relating to, among other things, research, testing, development, manufacturing, safety, efficacy, approval, recordkeeping, reporting, labeling, storage, packaging, advertising and promotion, pricing, marketing and distribution of drugs and therapeutic biologics. Rigorous preclinical testing and clinical trials and an extensive regulatory approval process are required to be successfully completed in the U.S. and in many foreign jurisdictions before a new drug or therapeutic biologic can be marketed. Satisfaction of these and other regulatory requirements is costly, time-consuming, uncertain and subject to unanticipated delays. It is possible that none of the product candidates we may develop will obtain the regulatory approvals necessary for us or our potential future partners to begin selling them.

We have very limited experience in conducting and managing the clinical trials necessary to obtain regulatory approvals, including approval by the FDA. The time required to obtain FDA and other approvals is unpredictable but typically takes many years following the commencement of clinical trials, depending upon the type, complexity and novelty of the product candidate. The standards that the FDA and its foreign counterparts use when regulating us require judgment and can change, which makes it difficult to predict with certainty how they will be applied. Any analysis we perform of data from preclinical and clinical activities is subject to confirmation and interpretation by regulatory authorities, which could delay, limit or prevent regulatory approval. We may also encounter unexpected delays or increased costs due to new government regulations, for example, from future legislation or administrative action, or from changes in FDA policy during the period of product development, clinical trials and FDA regulatory review. It is impossible to predict whether legislative changes will be enacted, or whether FDA or foreign regulations, guidance or interpretations will be changed, or what the impact of such changes, if any, may be.

Because ATRC-101 or potential future product candidates we are developing may work through mechanisms of action or work against targets with which the FDA has limited early experience, the FDA and its foreign counterparts have not yet established any definitive policies, practices or guidelines in relation to these product candidates. While we believe these product candidates are regulated as therapeutic biologics that are subject to requirements for review and approval of a Biologics License Application, or BLA, by the FDA, the lack of policies, practices or guidelines may hinder or slow review by the FDA of any regulatory filings that we may submit. Moreover, the FDA may respond to these submissions by defining requirements we may not have anticipated. Such responses could lead to significant delays in the clinical development of these product candidates, including ATRC-101. In addition, because there may be approved treatments for some of the diseases for which we may seek approval, in order to receive regulatory approval, we may need to demonstrate through clinical trials that the current or potential future product candidates we develop to treat these diseases, if any, are not only safe and effective, but safer or more effective than existing products.

Any delay or failure in obtaining required approvals could have a material and adverse effect on our ability to generate revenue from the particular product candidate for which we are seeking approval. Further, we and our potential future partners may never receive approval to market and commercialize any product candidate. Even if we or a potential future partner obtains regulatory approval, the approval may be for targets, disease indications or patient populations that are not as broad as we intended or desired or may require labeling that includes significant use or distribution restrictions or safety warnings. We or a potential future partner may be subject to post-marketing testing requirements to maintain regulatory approval. If ATRC-101 or any of our potential future product candidates prove to be ineffective, unsafe or commercially unviable, we may have to re-engineer ATRC-101 or our potential future product candidates, and our entire pipeline could have little, if any, value, which could require us to change our focus and approach to antibody discovery and development, which would have a material and adverse effect on our business, financial condition, results of operations and prospects.

We are also subject to numerous foreign regulatory requirements governing, among other things, the conduct of clinical trials, manufacturing and marketing authorization, pricing and third-party reimbursement. The foreign regulatory approval process varies among countries and may include all of the risks associated with FDA approval described above as well as risks attributable to the satisfaction of local regulations in foreign jurisdictions. Moreover, the time required to obtain approval may differ from that required to obtain FDA approval. Approval by the FDA does not ensure approval by regulatory authorities outside the United States and vice versa.

Even if we receive regulatory approval for any of our current or potential future product candidates, we will be subject to ongoing regulatory obligations and continued regulatory review, which may result in significant additional expense. Additionally, our current or potential future product candidates, if approved, could be subject to labeling and other restrictions and market withdrawal and we may be subject to penalties if we fail to comply with regulatory requirements or experience unanticipated problems with our products.

Any regulatory approvals that we or potential future partners obtain for ATRC-101 or any potential future product candidate may also be subject to limitations on the approved indicated uses for which a product may be marketed or to the conditions of approval, or contain requirements for potentially costly post-marketing testing, including ‘‘Phase 4’’ clinical trials, and surveillance to monitor the safety and efficacy of such product candidate. In addition, if the FDA or other regulatory authority approves ATRC-101 or any potential future product candidate, the manufacturing processes, labeling, packaging, distribution, adverse event reporting, storage, import, export, advertising, promotion and recordkeeping for such product 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 cGMP and good clinical practices for any clinical trials that we conduct post-approval. Later discovery of previously unknown problems with a product, including adverse events of unanticipated severity or frequency, or with our third-party manufacturers or manufacturing processes, or failure to comply with regulatory requirements, may result in, among other things:

- restrictions on the marketing or manufacturing of the product, withdrawal of the product from the market or voluntary or mandatory product recalls;
- fines, warning letters or holds on clinical trials;
- refusal by the FDA to approve pending applications or supplements to approved applications filed by us or our strategic partners;
- suspension or revocation of product license approvals;

- product seizure or detention or refusal to permit the import or export of products; and
- injunctions or the imposition of civil or criminal penalties.

The FDA's 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, which would adversely affect our business.

We may attempt to secure approval from the FDA through the use of accelerated registration pathways. If unable to obtain approval under an accelerated pathway, we may be required to conduct additional preclinical studies or clinical trials which could increase the expense of obtaining, reduce the likelihood of obtaining or delay the timing of obtaining, necessary marketing approvals. Even if we receive accelerated approval from the FDA, if our confirmatory trials do not verify clinical benefit, or if we do not comply with rigorous post-marketing requirements, the FDA may seek to withdraw accelerated approval.

We may seek an accelerated approval development pathway for our product candidates, including ATRC-101. Under the accelerated approval provisions of the Federal Food, Drug, and Cosmetic Act, or the FDCA, and the FDA's implementing regulations, the FDA may grant accelerated approval to a product designed to treat a serious or life-threatening condition that provides meaningful therapeutic advantage over available therapies and demonstrates an effect on a surrogate endpoint or intermediate clinical endpoint that is reasonably likely to predict clinical benefit. The FDA considers a clinical benefit to be a positive therapeutic effect that is clinically meaningful in the context of a given disease. For the purposes of accelerated approval, a surrogate endpoint is a marker, such as a laboratory measurement, radiographic image, physical sign or other measure that is thought to predict clinical benefit but is not itself a measure of clinical benefit. An intermediate clinical endpoint is a clinical endpoint that can be measured earlier than an effect on irreversible morbidity or mortality that is reasonably likely to predict an effect on irreversible morbidity or mortality or other clinical benefit. The accelerated approval development pathway may be used in cases in which the advantage of a new drug over available therapy may not be a direct therapeutic advantage, but is a clinically important improvement from a patient and public health perspective. If granted, accelerated approval is contingent on the sponsor's agreement to conduct, in a diligent manner, additional post-approval confirmatory studies to verify and describe the drug's clinical profile or risks and benefits for accelerated approval. The FDA may require that any such confirmatory study be initiated or substantially underway prior to the submission of an application for accelerated approval. If such post-approval studies fail to confirm the drug's clinical profile or risks and benefits, the FDA may withdraw its approval of the drug.

If we choose to pursue accelerated approval, we intend to seek feedback from the FDA or will otherwise evaluate our ability to seek and receive such accelerated approval. There can be no assurance that, after our evaluation of the feedback from the FDA or other factors, we will decide to pursue or submit a BLA for accelerated approval or any other form of expedited development, review or approval. Furthermore, if we submit an application for accelerated approval, there can be no assurance that such application will be accepted or that approval will be granted on a timely basis, or at all. The FDA also could require us to conduct further studies or trials prior to considering our application or granting approval of any type. We might not be able to fulfill the FDA's requirements in a timely manner, which would cause delays, or approval might not be granted because our submission is deemed incomplete by the FDA.

Even if we receive accelerated approval from the FDA, we will be subject to rigorous post-marketing requirements, including the completion of confirmatory post-market clinical trials to verify the clinical benefit of the product, and submission to the FDA of all promotional materials prior to their dissemination. The FDA could seek to withdraw accelerated approval for multiple reasons, including if we fail to conduct any required post-market study with due diligence; a post-market study does not confirm the predicted clinical benefit; other evidence shows that the product is not safe or effective under the conditions of use; or we disseminate promotional materials that are found by the FDA to be false and misleading.

A failure to obtain accelerated approval or any other form of expedited development, review or approval for a product candidate that we may choose to develop would result in a longer time period prior to commercializing such product candidate, could increase the cost of development of such product candidate and could harm our competitive position in the marketplace.

Healthcare legislative reform measures may have a material adverse effect on our business and results of operations.

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 Patient Protection and Affordable Care Act, or the ACA, was enacted, which substantially changed the way healthcare is financed by both governmental and private insurers, and significantly impacted the U.S. pharmaceutical industry. Among the provisions of the ACA, of greatest importance to the pharmaceutical and biotechnology industry are the following:

- an annual, nondeductible fee on any entity that manufactures or imports certain specified branded prescription drugs and biologic agents apportioned among these entities according to their market share in some government healthcare programs;
- an increase in the statutory minimum rebates a manufacturer must pay under the Medicaid Drug Rebate Program to 23.1% and 13% of the average manufacturer price for most branded and generic drugs, respectively, and capped the total rebate amount for innovator drugs at 100% of the Average Manufacturer Price (AMP);
- a new methodology by which rebates owed by manufacturers under the Medicaid Drug Rebate Program are calculated for certain drugs and biologics that are inhaled, infused, instilled, implanted or injected;
- extension of manufacturers' Medicaid rebate liability to covered drugs dispensed to individuals who are enrolled in Medicaid managed care organizations;
- expansion of eligibility criteria for Medicaid programs by, among other things, allowing states to offer Medicaid coverage to additional individuals and by adding new mandatory eligibility categories for individuals with income at or below 133% of the federal poverty level, thereby potentially increasing manufacturers' Medicaid rebate liability;
- a new Medicare Part D coverage gap discount program, in which manufacturers must agree to offer 50% (and 70% as of 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 for the manufacturer's outpatient drugs to be covered under Medicare Part D;
- expansion of the entities eligible for discounts under the Public Health program;
- a new Patient-Centered Outcomes Research Institute to oversee, identify priorities in, and conduct comparative clinical effectiveness research, along with funding for such research;
- establishment of a Center for Medicare Innovation at CMS to test innovative payment and service delivery models to lower Medicare and Medicaid spending; and
- implementation of the federal physician payment transparency requirements, sometimes referred to as the ''Physician Payments Sunshine Act''.

Some of the provisions of the ACA have yet to be fully implemented, and there have been legal and political challenges to certain aspects of the ACA. Since January 2017, President Trump has signed two executive orders and other directives designed to delay, circumvent, or loosen certain requirements 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 the Tax Act, includes a provision that repealed, 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 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 (BBA), among other things, amended the ACA, effective January 1, 2019, to close the coverage gap in most Medicare drug plans, commonly referred to as the ''donut hole.'' In July 2018, CMS published a final rule permitting further collections and payments to and from certain ACA qualified health plans and health insurance issuers under the ACA risk adjustment program in response to the outcome of federal district court litigation regarding the method CMS uses to determine this risk adjustment. On December 14, 2018, a U.S. District Court Judge in the Northern District of Texas ruled that the individual mandate is an inseverable feature of the ACA, and therefore, because it was repealed as part of the Tax Act, the remaining provisions of the ACA are invalid as well. While the Texas U.S. District Court Judge, as well as the Trump Administration and CMS have stated that the ruling will have no immediate effect, it is unclear how this decision, subsequent appeals, and other efforts to repeal and replace the ACA will impact the ACA and our business.

In addition, other legislative changes have been proposed and adopted 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. Additionally, there has been heightened governmental scrutiny recently over the manner in which manufacturers set prices for their marketed products. For example, there have been several recent Congressional inquiries and proposed and enacted federal and state legislation designed to, among other things, bring more transparency to drug pricing, review the relationship between pricing and manufacturer patient programs, and reform government program reimbursement methodologies for drug products. At the federal level, the Trump administration's budget proposal for fiscal year 2019 contains further drug price control measures that could be enacted during the 2019 budget process or in other future legislation, including, for example, measures to permit Medicare Part D plans to negotiate the price of certain drugs under Medicare Part B, to allow some states to negotiate drug prices under Medicaid, and to eliminate cost sharing for generic drugs for low-income patients. Further, the Trump administration released a ''Blueprint'' to lower drug prices and reduce out of pocket costs of drugs that contains additional proposals to increase manufacturer competition, increase the negotiating power of certain federal healthcare programs, incentivize manufacturers to lower the list price of their products and reduce

the out of pocket costs of drug products paid by consumers. In addition, on January 31, 2019, the HHS Office of Inspector General, proposed modifications to the federal Anti-Kickback Statute discount safe harbor for the purpose of reducing the cost of drug products to consumers which, among other things, if finalized, will affect discounts paid by manufacturers to Medicare Part D plans, Medicaid managed care organizations and pharmacy benefit managers working with these organizations. Although a number of these, and other potential, proposals will require additional authorization to become effective, Congress and the executive branch have each indicated that it will continue to seek new legislative or administrative measures to control drug costs. At the state level, legislatures have increasingly passed legislation and implemented regulations designed to control pharmaceutical and biological product pricing, including price or patient reimbursement constraints, discounts, restrictions on certain product access and marketing cost disclosure and transparency measures and, in some cases, designed to encourage importation from other countries and bulk purchasing. These new laws and initiatives may result in additional reductions in Medicare and other healthcare funding, which could have a material adverse effect on our future customers and accordingly, our financial operations.

We expect that additional state and federal healthcare reform measures will be adopted in the future, any of which could limit the amounts that federal and state governments will pay for healthcare products and services, which could result in reduced demand for our product candidates or additional pricing pressures.

If we or potential future partners, manufacturers or service providers fail to comply with healthcare laws and regulations, we or they could be subject to enforcement actions, which could affect our ability to develop, market and sell our products and may harm our reputation.

Healthcare providers, physicians and third-party payors, among others, will play a primary role in the prescription and recommendation of any product candidates for which we obtain marketing approval. Our current and future arrangements with third-party payors, providers and customers, among others, may expose us to broadly applicable fraud and abuse and other healthcare laws and regulations that may constrain the business or financial arrangements and relationships through which we market, sell and distribute our product candidates for which we obtain marketing approval. Restrictions under applicable federal and state healthcare laws and regulations, include the following:

- the federal Anti-Kickback Statute, which prohibits, among other things, a person or entity from knowingly and willfully soliciting, offering, paying, receiving or providing remuneration, directly or indirectly, in cash or in kind, to induce or reward either the referral of an individual for, or the purchase, lease order, arranging for or recommendation of, any good, facility, item or service, for which payment may be made, in whole or in part, by a federal healthcare program, such as Medicare or 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. In addition, a violation of the Anti-Kickback Statute can form the basis for a violation of the federal False Claims Act (discussed below);
- federal civil and criminal false claims laws and civil monetary penalties laws, including the federal False Claims Act, which provides for civil whistleblower or qui tam actions, that impose penalties against individuals or entities for knowingly presenting, or causing to be presented, to the federal government, claims for payment that are false or fraudulent or making a false statement to avoid, decrease or conceal an obligation to pay money to the federal government. In addition, the government may assert that a claim including items and services resulting from a referral made in violation of the federal Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the False Claims Act;

- HIPAA, which imposes criminal and civil liability for executing 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 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 HITECH, and its implementing regulations, including the Final Omnibus Rule published in January 2013, which impose obligations on certain covered entity healthcare providers, health plans, and healthcare clearinghouses as well as their business associates that perform certain services involving the use or disclosure of individually identifiable health information, including mandatory contractual terms, with respect to safeguarding the privacy, security and transmission of individually identifiable health information, and require notification to affected individuals and regulatory authorities of certain breaches of security of individually identifiable health information;
- the federal false statements statute, which prohibits 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;
- the federal transparency requirements known as the federal Physician Payments Sunshine Act, created as part of ACA, which requires certain manufacturers of drugs, devices, biologics and medical supplies for which payment is available under Medicare, Medicaid or the Children's Health Insurance Program to report annually to CMS information related to payments and other transfers of value made by that entity to physicians and teaching hospitals, as well as ownership and investment interests held by physicians and their immediate family members; and
- analogous local, state and foreign laws and regulations, such as state anti-kickback and false claims laws that may apply to healthcare items or services reimbursed by third party payors, including private insurers; local, state and foreign transparency laws that require manufacturers to report information related to payments and transfers of value to other healthcare providers and healthcare entities, marketing expenditures, or drug pricing; state laws that require pharmaceutical companies to register certain employees engaged in marketing activities in the location and comply with the pharmaceutical industry's voluntary compliance guidelines and the relevant compliance guidance promulgated by the federal government; and state and foreign laws governing the privacy and security of health information in certain circumstances, many of which differ from each other in significant ways and often are not preempted by HIPAA, thus complicating compliance efforts.

Ensuring that our future business arrangements with third parties comply with applicable healthcare laws and regulations could involve substantial costs. If our operations are found to be in violation of any such requirements, we may be subject to penalties, including criminal and significant civil monetary penalties, damages, fines, individual imprisonment, disgorgement, contractual damages, reputational harm, exclusion from participation in government healthcare programs, integrity obligations, injunctions, recall or seizure of products, total or partial suspension of production, denial or withdrawal of pre-marketing product approvals, private qui tam actions brought by individual whistleblowers in the name of the government, refusal to allow us to enter into supply contracts, including government contracts, additional reporting requirements and oversight if subject to a corporate integrity agreement or similar agreement to resolve allegations of non-compliance with these laws, and the curtailment or restructuring of our operations, any of which could adversely affect our ability to operate our business and our results of operations. Although effective compliance programs can mitigate the risk of investigation and prosecution for violations of these laws, these risks cannot be entirely eliminated. Any action against us for an alleged or suspected violation could cause us to incur significant legal expenses and could divert our management's attention from the

operation of our business, even if our defense is successful. In addition, achieving and sustaining compliance with applicable laws and regulations may be costly to us in terms of money, time and resources.

If we fail to comply with U.S. and foreign regulatory requirements, regulatory authorities could limit or withdraw any marketing or commercialization approvals we may receive and subject us to other penalties that could materially harm our business.

Even if we receive marketing and commercialization approval of a product candidate, we will be subject to continuing regulatory requirements, including in relation to adverse patient experiences with the product and clinical results that are reported after a product is made commercially available, both in the United States and any foreign jurisdiction in which we seek regulatory approval. The FDA has significant post-market authority, including the authority to require labeling changes based on new safety information and to require post-market studies or clinical trials to evaluate safety risks related to the use of a product or to require withdrawal of the product from the market. The FDA also has the authority to require a Risk Evaluation and Mitigation Strategy, or a REMS, after approval, which may impose further requirements or restrictions on the distribution or use of an approved drug or therapeutic biologic. The manufacturer and manufacturing facilities we use to make a future product, if any, will also be subject to periodic review and inspection by the FDA and other regulatory agencies, including for continued compliance with cGMP requirements. The discovery of any new or previously unknown problems with our third party manufacturers, manufacturing processes or facilities may result in restrictions on the product, manufacturer or facility, including withdrawal of the product from the market. We intend to rely on third-party manufacturers and we will not have control over compliance with applicable rules and regulations by such manufacturers. Any product promotion and advertising will also be subject to regulatory requirements and continuing regulatory review. If we or our existing or future partners, manufacturers or service providers fail to comply with applicable continuing regulatory requirements in the U.S. or foreign jurisdictions in which we seek to market our products, we or they may be subject to, among other things, fines, warning letters, holds on clinical trials, delay of approval or refusal by the FDA to approve pending applications or supplements to approved applications, suspension or withdrawal of regulatory approval, product recalls and seizures, administrative detention of products, refusal to permit the import or export of products, operating restrictions, injunction, civil penalties and criminal prosecution.

Even if we are able to commercialize any product candidate, such product candidate may become subject to unfavorable pricing regulations or third-party coverage and reimbursement policies, which would harm our business.

Our ability to commercialize any products successfully will depend, in part, on the extent to which coverage and adequate reimbursement for these products and related treatments will be available from third-party payors, such as government authorities, private health insurers and health maintenance organizations. Patients who are prescribed medications for the treatment of their conditions generally rely on third-party payors to reimburse all or part of the costs associated with their prescription drugs. Coverage and adequate reimbursement from government healthcare programs, such as Medicare and Medicaid, and private health insurers are critical to new product acceptance. Patients are unlikely to use our future products, if any, unless coverage is provided and reimbursement is adequate to cover a significant portion of the cost.

Cost-containment is a priority in the U.S. healthcare industry and elsewhere. As a result, government authorities and other third party payors have attempted to control costs by limiting coverage and the amount of reimbursement for particular medications. Increasingly, third party payors are requiring that drug companies provide them with predetermined discounts from list prices

and are challenging the prices charged for medical products. Third-party payors also may request additional clinical evidence beyond the data required to obtain marketing approval, requiring a company to conduct expensive pharmacoeconomic studies in order to demonstrate the medical necessity and cost-effectiveness of its product. Commercial third-party payors often rely upon Medicare coverage policy and payment limitations in setting their reimbursement rates, but also have their own methods and approval process apart from Medicare determinations. Therefore, coverage and reimbursement for pharmaceutical products in the U.S. can differ significantly from payor to payor. We cannot be sure that coverage and adequate reimbursement will be available for any product that we commercialize and, if reimbursement is available, that the level of reimbursement will be adequate. Coverage and reimbursement may impact the demand for, or the price of, any product candidate for which we obtain marketing approval. If coverage and reimbursement are not available or are available only at limited levels, we may not be able to successfully commercialize any product candidate for which we obtain marketing approval.

Additionally, the regulations that govern regulatory approvals, pricing and reimbursement for new drugs and therapeutic biologics vary widely from country to country. Some countries require approval of the sale price of a drug or therapeutic biologic before it can be marketed. In many countries, the pricing review period begins after marketing approval is granted. In some foreign markets, prescription pharmaceutical pricing remains subject to continuing governmental control even after initial approval is granted. As a result, we might obtain regulatory approval for a product in a particular country, but then be subject to price regulations that delay our commercial launch of the product, possibly for lengthy time periods, and negatively impact the revenues we are able to generate from the sale of the product in that country. Adverse pricing limitations may hinder our ability to recoup our investment in one or more product candidates, even if our product candidates obtain regulatory approval.

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

We are subject to the U.S. Foreign Corrupt Practices Act of 1977, as amended, or the FCPA, the U.S. domestic bribery statute contained in 18 U.S.C. § 201, the U.S. Travel Act, the USA PATRIOT Act, and possibly other state and national anti-bribery and anti-money laundering laws in countries in which we conduct activities. Anti-corruption laws are interpreted broadly and prohibit companies and their employees, agents, third-party intermediaries, joint venture partners and collaborators from authorizing, promising, offering or providing, directly or indirectly, improper payments or benefits to recipients in the public or private sector. We interact with officials and employees of government agencies and government-affiliated hospitals, universities and other organizations. In addition, we may engage third-party intermediaries to promote our clinical research activities abroad or to obtain necessary permits, licenses and other regulatory approvals. We can be held liable for the corrupt or other illegal activities of these third party intermediaries, our employees, representatives, contractors, partners and agents, even if we do not explicitly authorize or have actual knowledge of such activities.

In connection with this offering, we have adopted a Code of Business Conduct and Ethics, which will be effective upon the closing of this offering, and expect to prepare and implement policies and procedures to ensure compliance with such code. The Code of Business Conduct and Ethics mandates compliance with the FCPA and other anti-corruption laws applicable to our business throughout the world. However, we cannot assure you that our employees and third-party intermediaries will comply with this code or such anti-corruption laws. Noncompliance with anti-corruption and anti-money laundering laws could subject us to whistleblower complaints,

investigations, sanctions, settlements, prosecution, other enforcement actions, disgorgement of profits, significant fines, damages, other civil and criminal penalties or injunctions, suspension or debarment from contracting with certain persons, the loss of export privileges, reputational harm, adverse media coverage and other collateral consequences. If any subpoenas, investigations or other enforcement actions are launched, or governmental or other sanctions are imposed, or if we do not prevail in any possible civil or criminal litigation, our business, results of operations and financial condition could be materially harmed. In addition, responding to any action will likely result in a materially significant diversion of management's attention and resources and significant defense and compliance costs and other professional fees. In certain cases, enforcement authorities may even cause us to appoint an independent compliance monitor which can result in added costs and administrative burdens.

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

On December 20, 2017, the U.S. Congress passed the Tax Act, enacting comprehensive tax legislation that includes significant changes to the taxation of business entities. These changes include, among others: a permanent reduction to the corporate income tax rate; a partial limitation on the deductibility of business interest expense; a shift of the U.S. taxation of multinational corporations from a tax on worldwide income to a territorial system (along with certain rules designed to prevent erosion of the U.S. income tax base); and a one-time tax on accumulated offshore earnings held in cash and illiquid assets, with the latter taxed at a lower rate. Notwithstanding the reduction in the corporate income tax rate, the overall impact of this tax reform remains uncertain, and our business and financial condition could be adversely affected. This prospectus does not provide an in-depth discussion of any such tax legislation or the manner in which it might affect purchasers of our Class A common stock. We urge our stockholders to consult with their legal and tax advisors with respect to any such legislation and the potential tax consequences of investing in our Class A common stock.

Risks Related to Our Class A Common Stock and this Offering

Our quarterly operating results may fluctuate significantly or may fall below the expectations of investors or securities analysts, each of which may cause our stock price to fluctuate or decline.

We expect our operating results to be subject to quarterly fluctuations. Our net loss and other operating results will be affected by numerous factors, including:

- variations in the level of expense related to the ongoing development of our product candidates or future development programs;
- results of clinical trials, or the addition or termination of clinical trials or funding support by us or potential future partners;
- our execution of any collaboration, licensing or similar arrangements, and the timing of payments we may make or receive under potential future arrangements or the termination or modification of any such potential future arrangements;
- any intellectual property infringement, misappropriation or violation lawsuit or opposition, interference or cancellation proceeding in which we may become involved;
- additions and departures of key personnel;
- strategic decisions by us or our competitors, such as acquisitions, divestitures, spin-offs, joint ventures, strategic investments or changes in business strategy;
- if any of our product candidates receives regulatory approval, the terms of such approval and market acceptance and demand for such product candidates;
- regulatory developments affecting our product candidates or those of our competitors; and
- changes in general market and economic conditions.

If our quarterly operating results fall below the expectations of investors or securities analysts, the price of our Class A common stock could decline substantially. Furthermore, any quarterly fluctuations in our operating results may, in turn, cause the price of our stock to fluctuate substantially. We believe that quarterly comparisons of our financial results are not necessarily meaningful and should not be relied upon as an indication of our future performance.

Our stock price may be volatile and purchasers of our Class A common stock could incur substantial losses.

Our stock price is likely to be volatile. As a result of this volatility, investors may not be able to sell their Class A common stock at or above the initial public offering price. The market price for our Class A common stock may be influenced by many factors, including the other risks described in this section of the prospectus titled ''Risk Factors'' and the following:

- our ability to advance ATRC-101 or potential future product candidates into the clinic;
- results of preclinical studies and clinical trials of ATRC-101 or potential future product candidates, or those of our competitors or potential future partners;
- regulatory or legal developments in the United States and other countries, especially changes in laws or regulations applicable to our products;
- the success of competitive products or technologies;
- introductions and announcements of new products by us, our future commercialization partners, or our competitors, and the timing of these introductions or announcements;
- actions taken by regulatory agencies with respect to our products, clinical trials, manufacturing process or sales and marketing terms;
- actual or anticipated variations in our financial results or those of companies that are perceived to be similar to us;
- the success of our efforts to acquire or in-license additional technologies, products or product candidates;
- developments concerning any future collaborations, including, but not limited to, those with our sources of manufacturing supply and our commercialization partners;
- market conditions in the pharmaceutical and biotechnology sectors;
- announcements by us or our competitors of significant acquisitions, strategic partnerships, joint ventures or capital commitments;
- developments or disputes concerning patents or other proprietary rights, including patents, litigation matters and our ability to obtain patent protection for our products;
- our ability or inability to raise additional capital and the terms on which we raise it;
- the recruitment or departure of key personnel;
- changes in the structure of healthcare payment systems;
- actual or anticipated changes in earnings estimates or changes in stock market analyst recommendations regarding our Class A common stock, other comparable companies or our industry generally;
- our failure or the failure of our competitors to meet analysts' projections or guidance that we or our competitors may give to the market;
- fluctuations in the valuation of companies perceived by investors to be comparable to us;
- announcement and expectation of additional financing efforts;
- speculation in the press or investment community;
- trading volume of our Class A common stock;
- sales of our Class A common stock by us or our stockholders;
- the concentrated ownership of our Class A common stock;
- changes in accounting principles;
- terrorist acts, acts of war or periods of widespread civil unrest;

- natural disasters and other calamities; and
- general economic, industry and market conditions.

In addition, the stock markets in general, and the markets for pharmaceutical, biopharmaceutical and biotechnology stocks in particular, have experienced extreme volatility that has been often unrelated to the operating performance of the issuer. These broad market and industry factors may seriously harm the market price of our Class A common stock, regardless of our operating performance.

You will experience immediate and substantial dilution as a result of this offering and may experience additional dilution in the future.

If you purchase common stock in this offering at the initial public offering price of $17.00 per share, you will incur immediate and substantial dilution of $8.86 per share, representing the difference between the initial public offering price of $17.00 per share and our pro forma as adjusted net tangible book value per share as of March 31, 2019 after giving effect to this offering, the conversion of all outstanding shares of our Series A, Series B, and Series C1 convertible preferred stock into Class A common stock immediately upon the closing of this offering, the conversion of all outstanding shares of our Series C2 convertible preferred stock into Class B common stock immediately upon the closing of this offering and the exercise of one warrant subsequent to March 31, 2019. Moreover, we issued options, stock awards and warrants in the past to acquire Class A common stock and securities convertible into Class A common stock at prices significantly below the initial public offering price. As of March 31, 2019, there were 2,587,996 shares of our Class A common stock subject to outstanding options, 49,997 shares of our Series A convertible preferred stock subject to outstanding warrants, 62,936 shares of our Class A common stock subject to an outstanding warrant and no shares of our Class B common stock outstanding. Subsequent to March 31, 2019, we granted options for 1,065,448 shares of our Class A common stock. To the extent that any of these outstanding securities are ultimately exercised or settled, you will incur further dilution.

The future issuance of equity or of debt securities that are convertible into equity would dilute our share capital.

We may choose to raise additional capital in the future, depending on market conditions, strategic considerations and operational requirements. To the extent that additional capital is raised through the issuance of shares or other securities convertible into shares, our stockholders will be diluted. Future issuances of our Class A common stock or other equity securities, or the perception that such sales may occur, could adversely affect the trading price of our Class A common stock and impair our ability to raise capital through future offerings of shares or equity securities. No prediction can be made as to the effect, if any, that future sales of Class A common stock or the availability of Class A common stock for future sales will have on the trading price of our Class A common stock.

The dual class structure of our common stock and the option of the holder of shares of our Class B common stock to convert into shares of our Class A common stock may limit your ability to influence corporate matters.

Our Class A common stock has one vote per share, while our Class B common stock is non-voting. Nonetheless, each share of our Class B common stock may be converted at any time into one share of Class A common stock at the option of its holder, subject to the limitations provided for in our amended and restated certificate of incorporation to become effective upon the closing of this offering. Consequently, if holders of Class B common stock following this offering

exercise their option to make this conversion, this will have the effect of increasing the relative voting power of those prior holders of our Class B common stock, and correspondingly decrease the voting power of the current holders of our Class A common stock, which may limit your ability to influence corporate matters. Because our Class B common stock is generally non-voting, stockholders who own more than 10% of our common stock overall but 10% or less of our Class A common stock will not be required to report changes in their ownership from transactions in our Class B common stock pursuant to Section 16(a) of the Securities Exchange Act of 1934, as amended, or the Exchange Act, and would not be subject to the short-swing profit provisions of Section 16(b) of the Exchange Act. In addition, acquisitions of Class B common stock would not be subject to notification pursuant to the Hart-Scott-Rodino Antitrust Improvements Act of 1976, as amended.

An active trading market for our Class A common stock may not develop.

Prior to this offering, there has been no public market for our Class A common stock. The initial public offering price for our Class A common stock was determined through negotiations with the underwriters. Although our Class A common stock will trade on The Nasdaq Global Select Market, an active trading market for our shares may never develop or be sustained following this offering. If an active market for our Class A common stock does not develop, it may be difficult for you to sell shares you purchase in this offering without depressing the market price for the shares or at all.

Because our management will have flexibility in allocating the net proceeds from this offering, you may not agree with how we use them and the proceeds may not be invested successfully.

We intend to use the net proceeds to us from this offering to fund preclinical and clinical development activities, further development of our discovery platform, discover new product candidates, hire additional personnel, make capital expenditures, pay costs of operating as a public company and fund other general purposes. We may also use a portion of the net proceeds from this offering to in-license, acquire or invest in complementary businesses, technologies, products or assets. However, we have no current commitments or obligations to do so. Therefore, our management will have flexibility in allocating the net proceeds from this offering. Accordingly, you will be relying on the judgment of our management with regard to the allocation of these net proceeds, and you will not have the opportunity, as part of your investment decision, to assess whether the proceeds are being allocated appropriately. It is possible that the proceeds will be invested in a way that does not yield a favorable, or any, return for our company.

If securities or industry analysts do not publish research or reports about our company, or if they issue an adverse or misleading opinion regarding our stock, our stock price and trading volume could decline.

The trading market for our Class A common stock will be influenced by the research and reports that industry or securities analysts publish about us or our business. We do not currently have and may never obtain research coverage by securities and industry analysts. If no or few securities or industry analysts commence coverage of our company, the trading price for our Class A common stock would be negatively impacted. In the event we obtain securities or industry analyst coverage, if any of the analysts who cover us issue an adverse or misleading opinion regarding us, our business model, our intellectual property rights or our Class A common stock performance, or if our target studies and operating results fail to meet the expectations of the analysts, our stock price would likely decline. If one or more of these analysts cease coverage of our company or fail to publish reports on us regularly, we could lose visibility in the financial markets, which in turn could cause our stock price or trading volume to decline.

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

Based on the beneficial ownership of our capital stock as of March 31, 2019, prior to this offering, our executive officers and directors, together with holders of 5% or more of our capital stock before this offering and their respective affiliates, beneficially owned approximately 70.1% of our Class A common stock and Class B common stock on an as-converted basis. Following this offering, our executive officers and directors, together with holders of 5% or more of our capital stock and their respective affiliates, will beneficially own approximately 64.9% of our Class A common stock and Class B common stock, assuming no exercise of the underwriters' options to purchase additional shares and assuming no exercise of outstanding options. As a result, these stockholders, if acting together, will continue to have significant influence over the outcome of corporate actions requiring stockholder approval, including the election of directors, any merger, consolidation or sale of all or substantially all of our assets and any other significant corporate transaction. In addition, pursuant to a nominating agreement between us and Baker Brothers Life Sciences L.P. and 667, L.P., or together, Baker Brothers, following the closing of this offering and so long as Baker Brothers together with its affiliates beneficially owns at least 3,333,333 shares of our common stock, we will have the obligation to support the nomination of, and to cause our board of directors to include in the slate of nominees recommended to our stockholders for election, two individuals designated by Baker Brothers, each a Baker Designee, subject to customary conditions and exceptions, as well as the obligation to invite two board of directors observer designees of Baker Brothers to attend all meetings of our board of directors and all meetings of the committees of our board of directors as a nonvoting observer, if there is no Baker Designee on our board of directors, subject to customary conditions and exceptions. For more information regarding this agreement, see the section titled ''Certain Relationships and Related Person Transactions—Baker Brothers Nominating Agreement.'' Baker Brothers and its affiliates may therefore have influence over management and control over matters requiring stockholder approval, including the annual election of directors and significant corporate transactions, such as a merger or other sale of our company or its assets, following the closing of this offering and for the foreseeable future.

The interests of these stockholders may not be the same as, and may even conflict with, your interests. For example, these stockholders could delay or prevent a change of control of our company, even if such a change of control would benefit our other stockholders, which could deprive our stockholders of an opportunity to receive a premium for their Class A common stock as part of a sale of our company or our assets and might affect the prevailing market price of our Class A common stock. The significant concentration of stock ownership may adversely affect the trading price of our Class A common stock due to investors' perception that conflicts of interest may exist or arise.

Sales of a substantial number of shares of our Class A common stock or Class B 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 Class A 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 Class A common stock could decline. Based on 2,123,257 shares of Class A common stock and no shares of Class B common stock outstanding at March 31, 2019, and after giving effect to the conversion of our outstanding Series A, Series B, Series C1 and Series C2 convertible preferred stock, immediately upon the closing of this offering we will have outstanding a total of 20,850,261 shares of Class A common stock and 5,934,191 shares of Class B common stock, including 62,936 shares of Class A common stock that will be issued upon the exercise of a warrant as of June 20, 2019. Of these shares, only the shares of Class A 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.

We expect that the lock-up agreements pertaining to this offering will expire after 180 days from the date of this prospectus. Cowen and Company, LLC, Evercore Group L.L.C. and Stifel, Nicolaus & Company, Incorporated, 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. In addition, shares of Class A common stock that are either subject to outstanding options or reserved for future issuance under our 2019 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 Class A common stock are sold, or if it is perceived that they will be sold, in the public market, the trading price of our Class A common stock could decline.

After this offering, the holders of 17,248,259 shares of our Class A common stock (including Class A common stock issuable upon conversion of Class B common stock) at March 31, 2019 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 Class A common stock.

Future sales and issuances of our Class A common stock or Class B common stock or rights to purchase Class A common stock or Class B common stock, including pursuant to our 2019 Plan, could result in additional dilution of the percentage ownership of our stockholders and could cause our stock price to fall.

We expect that significant additional capital may be needed in the future to continue our planned operations, including further development of our discovery platform, preparing IND filings, conducting clinical trials, commercialization efforts, expanded research and development activities and costs associated with operating a public company. To raise capital, we may sell Class A common stock or Class B common stock, convertible securities or other equity securities in one or more transactions at prices and in a manner we determine from time to time. If we sell Class A common stock or Class B common stock, convertible securities or other equity securities, investors may be materially diluted by subsequent sales. Such sales may also result in material dilution to our existing stockholders, and new investors could gain rights, preferences and privileges senior to the holders of our Class A common stock, including shares of Class A common stock sold in this offering.

Pursuant to our 2019 Plan, our management is authorized to grant stock options to our employees, directors and consultants. Initially, the aggregate number of shares of our Class A common stock that may be issued pursuant to stock awards under our 2019 Plan is 6,141,842 shares. Additionally, the number of shares of our Class A common stock reserved for issuance under our 2019 Plan will automatically increase on January 1 of each year, beginning on January 1, 2020 and continuing through and including January 1, 2029, by 4% of the total number of shares of our capital stock outstanding on December 31 of the preceding calendar year, or a lesser number of shares determined by our board of directors. Unless our board of directors elects not to increase the number of shares available for future grant each year, our stockholders may experience additional dilution, which could cause our stock price to fall.

We are an ''emerging growth company'' and our election of reduced reporting requirements applicable to emerging growth companies may make our Class A common stock less attractive to investors.

We are an ''emerging growth company'' as defined in the Jumpstart Our Business Startups Act, or JOBS Act. For as long as we continue to be an emerging growth company, we may take advantage of exemptions from various reporting requirements that are applicable to other public companies that are not emerging growth companies, including not being required to comply with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act, or Section 404, reduced disclosure obligations regarding executive compensation in this prospectus and our periodic reports and proxy statements and exemptions from the requirements of holding a nonbinding advisory vote on executive compensation and stockholder approval of any golden parachute payments not previously approved. In addition, as an emerging growth company, we are only required to provide two years of audited financial statements and two years of selected financial data in this prospectus. We could be an emerging growth company for up to five years following the completion of this offering, although circumstances could cause us to lose that status earlier, including if we are deemed to be a ''large accelerated filer,'' which occurs when the market value of our Class A common stock that is held by non-affiliates exceeds $700 million as of the prior June 30, or if we have total annual gross revenue of $1.07 billion or more during any fiscal year before that time, in which cases we would no longer be an emerging growth company as of the following December 31, or if we issue more than $1.0 billion in non-convertible debt during any three-year period before that time, in which case we would no longer be an emerging growth company immediately. Even after we no longer qualify as an emerging growth company, we could 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 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 Class A common stock less attractive because we may rely on these exemptions. If some investors find our Class A common stock less attractive as a result, there may be a less active trading market for our Class A common stock and our share 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 elected to avail ourselves of an exemption that allows us to delay adopting new or revised accounting standards until such time as those standards apply to private companies. As a result, we will not be subject to the same new or revised accounting standards as other public companies that comply with the public company effective dates, including but not limited to the new lease accounting standard. We have also elected to take advantage of certain of the reduced disclosure obligations in the registration statement of which this prospectus is a part and may elect to take advantage of other reduced reporting requirements in future filings. As a result of these elections, the information that we provide to our stockholders may be different than you might receive from other public reporting companies. However, if we later decide to opt out of the extended period for adopting new accounting standards, we would need to disclose such decision and it would be irrevocable.

We will incur 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 and corporate governance practices.

As a public company, and particularly after we are no longer an emerging growth company, we will incur significant legal, accounting and other expenses that we did not incur as a private company. The Sarbanes-Oxley Act, the Dodd-Frank Wall Street Reform and Consumer Protection Act, the listing requirements of Nasdaq and other applicable securities rules and regulations impose

various requirements on public companies, including establishment and maintenance of effective disclosure and financial controls and corporate governance practices. Our management and other personnel will need to devote a substantial amount of time to these compliance initiatives. Moreover, these rules and regulations will increase our legal and financial compliance costs and will make some activities more time-consuming and costly. For example, we expect that these rules and regulations may make it more difficult and more expensive for us to obtain director and officer liability insurance, which in turn could make it more difficult for us to attract and retain qualified members of our board of directors. However, these rules and regulations are often subject to varying interpretations, in many cases due to their lack of specificity, and, as a result, their application in practice may evolve over time as new guidance is provided by regulatory and governing bodies. This could result in continuing uncertainty regarding compliance matters and higher costs necessitated by ongoing revisions to disclosure and governance practices.

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

In general, under Section 382 of the Internal Revenue Code of 1986, as amended, or the Code, a corporation that undergoes an ''ownership change'' is subject to limitations on its ability to utilize its pre-change NOL or tax credits to offset future taxable income. Our existing NOLs or credits may be subject to substantial limitations arising from previous ownership changes, and if we undergo an ownership change our ability to utilize NOLs or credits could be further limited by Section 382 of the Code. In addition, future changes in our stock ownership, many of which are outside of our control, could result in an ownership change under Section 382 of the Code. Our NOLs or credits may also be impaired under state law. Accordingly, we may not be able to utilize a material portion of our NOLs or credits. Furthermore, our ability to utilize our NOLs or credits is conditioned upon our attaining profitability and generating U.S. federal and state taxable income. As described above under ''—Risks Related to Business,'' we have incurred significant net losses since our inception and anticipate that we will continue to incur significant losses for the foreseeable future; thus, we do not know whether or when we will generate the U.S. federal or state taxable income necessary to utilize our NOLs or credits.

We have identified a material weakness in our internal control over financial reporting. If our remediation of the material weakness 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 Class A 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 audits of our financial statements as of and for the years ended December 31, 2017 and 2018, we and our auditor identified a material weakness as defined under the Exchange Act and by the Public Company Accounting Oversight Board (United States) in our internal control over financial reporting. The material weakness related to a lack of application-based controls inherent in our enterprise resource planning, or ERP, system used for maintaining our financial books and records. A material weakness is a deficiency, or a combination of deficiencies, in internal control over financial reporting such that there is a reasonable possibility that a material misstatement of our financial statements will not be prevented or detected on a timely basis.

We are implementing measures designed to improve our internal control over financial reporting to remediate this material weakness. We have implemented a new ERP system that is our system of record for our financial books and records from January 1, 2019 forward. This new ERP system has

application-based controls inherent in its design that provide an internal control infrastructure for financial reporting and for our internal control procedures. With the oversight of senior management and our audit committee, we have begun taking steps to remediate the underlying causes of the material weakness. However, the implementation of these measures may not fully address this material weakness in our internal control over financial reporting, and we may not be able to conclude that it has been fully remedied. Our failure to correct this material weakness 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.

We and our auditor were not required to perform an evaluation of our internal control over financial reporting as of December 31, 2017 and 2018 in accordance with the provisions of the Sarbanes-Oxley Act. Accordingly, we cannot provide assurance that we have identified all, or that we will not in the future have additional, material weaknesses. Material weaknesses may still exist when we report on the effectiveness of our internal control over financial reporting as required by reporting requirements under Section 404 after the completion of this offering.

If we fail to remediate the material weakness 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. Furthermore, if we fail to establish and maintain effective internal control over financial reporting in the future, our operating results and our ability to operate our business could be harmed.

Because we do not anticipate paying any cash dividends on our capital stock in the foreseeable future, capital appreciation, if any, will be your sole source of gain.

We have never declared or paid cash dividends on our capital stock. We currently intend to retain all of our future earnings, if any, to finance the growth and development of our business. As a result, capital appreciation, if any, of our Class A common stock will be your sole source of gain for the foreseeable future.

We may incur significant costs from class action litigation due to our expected stock volatility.

Our stock price may fluctuate for many reasons, including as a result of public announcements regarding the progress of our development efforts for our discovery platform and our product candidates, the development efforts of future partners or competitors, the addition or departure of our key personnel, variations in our quarterly operating results and changes in market valuations of biopharmaceutical and biotechnology companies. This risk is especially relevant to us because biopharmaceutical and biotechnology companies have experienced significant stock price volatility in recent years. When the market price of a stock has been volatile as our stock price may be, holders of that stock have occasionally brought securities class action litigation against the company that issued the stock. If any of our stockholders were to bring a lawsuit of this type against us, even if the lawsuit is without merit, we could incur substantial costs defending the lawsuit. The lawsuit could also divert the time and attention of our management.

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

Provisions in our amended and restated certificate of incorporation and our amended and restated bylaws may delay or prevent an acquisition of our company or a change in our management. In addition, these provisions may frustrate or prevent any attempts by our stockholders to replace or remove our current management by making it more difficult for stockholders to replace members of our board of directors. Because our board of directors is responsible for appointing the members of our management team, these provisions could in turn affect any attempt by our stockholders to replace current members of our management team. These provisions include:

- a prohibition on actions by our stockholders by written consent;
- a requirement that special meetings of stockholders, which our company is not obligated to call more than once per calendar year, be called only by the chairman of our board of directors, our chief executive officer, or our board of directors pursuant to a resolution adopted by a majority of the total number of authorized directors;
- advance notice requirements for election to our board of directors and for proposing matters that can be acted upon at stockholder meetings;
- division of our board of directors into three classes, serving staggered terms of three years each; and
- the authority of the board of directors to issue preferred stock with such terms as the board of directors may determine.

Moreover, because we are incorporated in Delaware, we are governed by the provisions of Section 203 of the Delaware General Corporation Law, as amended, which prohibits a person who owns in excess of 15% of our outstanding voting stock from merging or combining with us for a period of three years after the date of the transaction in which the person acquired in excess of 15% of our outstanding voting stock, unless the merger or combination is approved in a prescribed manner. These provisions would apply even if the proposed merger or acquisition could be considered beneficial by some stockholders.

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

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

- any derivative action or proceeding brought on our behalf;
- any action asserting a breach of fiduciary duty;
- any action asserting a claim against us or our directors, officers, or employees arising under the Delaware General Corporation Law, our amended and restated certificate of incorporation, or our amended and restated bylaws; and
- any action asserting a claim against us that is governed by the internal-affairs doctrine.

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

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

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

SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS

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

- the initiation, timing, progress and results of our research and development programs, preclinical studies, any clinical trials and IND and other regulatory submissions;
- our expectations regarding the activity of ATRC-101 or potential future product candidates once administered in a human subject;
- our expectations and beliefs regarding the market for cancer therapies and development of the immuno-oncology industry;
- our ability to identify and develop product candidates for treatment of additional disease indications;
- our or a potential future collaborator’s ability to obtain and maintain regulatory approval of any of our current or potential future product candidates;
- the rate and degree of market acceptance of any approved product candidates;
- the implementation of our business model and strategic plans for our business, technologies, and current or potential future product candidates;
- our or any potential future collaborator’s ability to obtain and maintain intellectual property protection for our discovery platform and current or potential future product candidates and our ability to operate our business without infringing the intellectual property rights of others; and
- our use of net proceeds to us from this offering.

You should not rely on forward-looking statements as predictions of future events. We have based the forward-looking statements contained in this prospectus primarily on our current expectations and projections about future events and trends that we believe may affect our business, financial condition and operating results. The outcome of the events described in these forward-looking statements is subject to risks, uncertainties and other factors described in the section titled ‘‘Risk Factors’’ and elsewhere in this prospectus. Moreover, we operate in a very competitive and rapidly changing environment. New risks and uncertainties emerge from time to time, and it is not possible for us to predict all risks and uncertainties that could have an impact on the forward-looking statements contained in this prospectus. The results, events and circumstances reflected in the forward-looking statements may not be achieved or occur, and actual results, events or circumstances could differ materially from those described in the forward-looking statements. You should read this prospectus and the documents that we reference in this prospectus and have filed as exhibits to the registration statement, of which this prospectus is a part, that we have filed with the SEC with the understanding that our actual future results, levels of activity, performance and achievements may be materially different from what we expect.

In addition, statements that ‘‘we believe’’ and similar statements reflect our beliefs and opinions on the relevant subject. These statements are based on information available to us as of the date of

this prospectus. While we believe that information provides a reasonable basis for these statements, that information may be limited or incomplete. Our statements should not be read to indicate that we have conducted an exhaustive inquiry into, or review of, all relevant information. These statements are inherently uncertain, and investors are cautioned not to unduly rely on these statements.

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

MARKET AND INDUSTRY DATA

This prospectus contains estimates, statistical data and other information concerning our industry and the market in which we operate, including market opportunity and market size, that is based on information on various publicly available sources, including data regarding the estimated size and patient populations of those and related markets, existing therapeutic options and the incidence of certain medical conditions. This industry and market information involves a number of assumptions and limitations, and you are cautioned not to give undue weight to such estimates.

Industry data and other third-party information have been obtained from sources believed to be reliable, but we have not independently verified any third party information. In addition, projections, assumptions and estimates of our future performance and the future performance of the industry in which we operate is necessarily subject to a high degree of uncertainty and risk due to a variety of factors, including those described in the section titled ''Risk Factors'' and elsewhere in this prospectus. 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 will receive net proceeds from this initial public offering of approximately $113.8 million (or approximately $131.2 million if the underwriters exercise their option to purchase additional shares of our Class A common stock in full) based on the initial public offering price of $17.00 per share, after deducting underwriting discounts and commissions and estimated offering expenses payable by us.

We currently expect to use the net proceeds from this offering, together with our existing cash and cash equivalents, as follows:

- approximately $45 million to fund the development of ATRC-101 through the dose-escalation portion of our Phase 1b clinical trial and a portion of our currently planned protocol amendments to pursue combination studies and expansion cohorts;
- approximately $65 million to fund our ongoing efforts to develop additional clinical candidates from our discovery platform; and
- the remaining proceeds for continued development and utilization of our discovery platform, hiring of additional personnel, capital expenditures, costs of operating as a public company and other general corporate purposes.

We may also use a portion of the net proceeds from this offering to in-license, acquire or invest in complementary businesses, technologies, products or assets. However, we have no current commitments or obligations to do so.

This expected use of net proceeds from this offering represents our intentions based upon our current plans and business conditions, and significant additional capital will be required to fund development of ATRC-101 through further stages of clinical development, if warranted, including potential Phase 2 and Phase 3 registrational studies. 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. We will have broad discretion over how to use the net proceeds to us from this offering. Pending our use of the net proceeds from this offering as described above, we intend to invest these funds in investment-grade, interest-bearing instruments.

DIVIDEND POLICY

We have never declared or paid cash dividends on our capital stock. We currently intend to retain all available funds and future earnings, if any, to fund the development and expansion of our business, and we do not anticipate paying any cash dividends in the foreseeable future. Any future determination regarding the declaration and payment of dividends, if any, will be at the discretion of our board of directors and will depend on then-existing conditions, including our financial condition, operating results, contractual restrictions, capital requirements, business prospects and other factors our board of directors may deem relevant. Our future ability to pay cash dividends on our capital stock may also be limited by the terms of any future debt or preferred securities or future credit facility.

CAPITALIZATION

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

- on an actual basis;
- on a pro forma basis to reflect: the automatic conversion of all outstanding shares of our convertible Series A preferred stock, convertible Series B preferred stock and convertible Series C1 preferred stock into 13,314,068 shares of our Class A common stock immediately upon the closing of this offering; the automatic conversion of all outstanding shares of our convertible Series C2 preferred stock into 3,934,191 shares of our Class B common stock immediately upon the closing of this offering; the issuance of 62,936 shares of Class A common stock upon the exercise of an outstanding warrant, which will occur on June 20, 2019; the automatic reclassification of all of our outstanding warrants to purchase an aggregate of 49,997 shares of our convertible Series A preferred stock into warrants to purchase an equivalent number of shares of our Class A common stock and no exercise of these warrants, the related reclassification of preferred stock warrant liability to stockholders' equity; no exercise of outstanding options to purchase our Class A common stock; and the filing and effectiveness of our amended and restated certificate of incorporation upon the closing of this offering; and
- on a pro forma as adjusted basis to give effect to: the pro forma adjustments set forth above; and the issuance and sale of 7,350,000 shares of common stock in this offering at the initial public offering price of $17.00 per share, after deducting the underwriting discounts and commissions and estimated offering expenses payable by us.

You should read the pro forma and pro forma as adjusted information below in conjunction with our consolidated financial statements and the related notes included in this prospectus and the ''Management's Discussion and Analysis of Financial Condition and Results of Operations'' section and other financial information contained in this prospectus.

	March 31, 2019		
	Actual	Pro Forma	Pro Forma as Adjusted
	(in thousands, except share and per share data)		
Cash, cash equivalents and investments	$100,661	$ 100,661	$ 214,465
Preferred stock warrant liability	$ 430	$ —	$ —
Capital lease obligations	135	135	135
Convertible Series A preferred stock, $0.0001 par value per share, Convertible Series B preferred stock, $0.0001 par value per share and Convertible Series C1 preferred stock, $0.0001 par value per share; 250,000,000 shares authorized; 13,314,068 shares issued and outstanding, actual; no shares authorized, issued and outstanding, pro forma and pro forma as adjusted	155,054	—	—
Convertible Series C2 preferred stock, $0.0001 par value per share; 50,000,000 shares authorized; 3,934,191 shares issued and outstanding, actual; no shares authorized, issued and outstanding, pro forma and pro forma as adjusted	54,615	—	—
Stockholders' equity (deficit):			
Preferred stock, $0.0001 par value per share: no shares authorized, issued or outstanding, actual; and 300,000,000 shares authorized and no shares issued or outstanding, pro forma and pro forma as adjusted	—	—	—
Class A common stock, $0.0001 par value per share; 650,000,000 shares authorized, 2,123,257 shares issued and outstanding, actual; 650,000,000 shares authorized; pro forma and pro forma as adjusted; 15,500,261 shares issued and outstanding, pro forma; 20,850,261 shares issued and outstanding, pro forma as adjusted	—	2	2
Class B common stock, $0.0001 par value per share; 50,000,000 shares authorized, no shares issued and outstanding, actual; 50,000,000 shares authorized; pro forma and pro forma as adjusted; 3,934,191 shares issued and outstanding, pro forma; 5,934,191 shares issued and outstanding, pro forma as adjusted	—	—	1
Additional paid-in capital	4,382	214,479	328,282
Accumulated other comprehensive income	23	23	23
Accumulated deficit	(110,201)	(110,201)	(110,201)
Total stockholders' equity (deficit)	(105,795)	104,303	218,107
Total capitalization	$104,438	$ 104,438	$ 218,242

The number of shares in the table above excludes:

- 2,587,996 shares of Class A common stock issuable upon exercise of stock options outstanding as of March 31, 2019 under our 2010 Equity Incentive Plan, or 2010 Plan, with a weighted-average exercise price of $7.08 per share;
- 1,065,448 shares of Class A common stock issuable upon exercise of stock options granted after March 31, 2019 under our 2010 Plan, with a weighted-average exercise price of $14.10 per share;
- 6,141,842 shares of Class A common stock reserved for future issuance under our 2019 Equity Incentive Plan, or 2019 Plan, which became effective as of the date of this prospectus, as well as (i) any additional shares of Class A common stock that become

available for issuance under the 2019 Plan (including as a result of annual increases) and (ii) any shares of Class A common stock that (A) were available for issuance under the 2010 Plan as of immediately prior to the time our 2019 Plan became effective or (B) that would have otherwise returned to our 2010 Plan in accordance with its terms (which, in each case, will become available for issuance under our 2019 Plan);

- 283,333 shares of Class A common stock reserved for future issuance under our 2019 Employee Stock Purchase Plan, or the ESPP, which became effective as of the date of this prospectus, as well as any additional shares of Class A common stock that become available for issuance under our ESPP (including as a result of annual increases); and
- 49,997 shares of Class A common stock issuable upon exercise of outstanding warrants reclassified to purchase our Class A common stock, each with an exercise price of $14.46 per share.

DILUTION

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

As of March 31, 2019, we had a historical net tangible book deficit of $105.8 million, or $49.83 per share. Our historical net tangible book deficit per share represents total tangible assets less total liabilities, divided by the number of shares of Class A common stock and Class B common stock outstanding as of March 31, 2019.

As of March 31, 2019, our pro forma net tangible book value was approximately $104.3 million, or $5.37 per share after giving effect to the conversion of all of our outstanding preferred stock into shares of our Class A common stock or Class B common stock, the exercise of one warrant to purchase 62,936 shares of our Class A common stock and the filing and effectiveness of our amended and restated certificate of incorporation, each of which will occur upon the closing of this offering.

After giving further effect to the sale of 7,350,000 shares of common stock in this offering at the initial public offering price of $17.00 per share, and after deducting the underwriting discounts and commissions and estimated offering expenses payable by us, our pro forma as adjusted net tangible book value as of March 31, 2019 would have been approximately $218.1 million, or approximately $8.14 per share. This amount represents an immediate increase in pro forma net tangible book value of $2.77 per share to our existing stockholders and an immediate dilution in pro forma net tangible book value of approximately $8.86 per share to new investors purchasing shares of common stock in this offering.

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

Initial public offering price per share		$17.00
Historical net tangible book value (deficit) per share as of March 31, 2019	$(49.83)	
Pro forma increase in historical net tangible book value per share attributable to the pro forma transactions described in the preceding paragraphs	55.20	
Pro forma net tangible book value per share as of March 31, 2019	5.37	
Increase in pro forma net tangible book value per share attributable to this offering		2.77
Pro forma as adjusted net tangible book value per share after this offering		8.14
Dilution per share to new investors in this offering		$ 8.86

If the underwriters exercise their option to purchase 1,102,500 additional shares of our Class A common stock in full, the pro forma as adjusted net tangible book value after the offering would be $8.45 per share, the increase in pro forma net tangible book value per share to existing stockholders would be $3.08 per share and the dilution per share to new investors would be $8.55 per share, in each case based on the initial public offering price of $17.00 per share.

The following table summarizes on the pro forma as adjusted basis described above, as of March 31, 2019, the differences between the number of shares purchased from us, the total consideration paid to us in cash and the average price per share paid by existing stockholders for shares issued prior to this offering and the price to be paid by investors participating in this offering. The calculation below is based on the initial public offering price of $17.00 per share, before deducting the underwriting discounts and commissions and estimated offering expenses payable by us.

	Shares Purchased		Total Consideration		Average Price per Share
	Number	Percent	Amount (in thousands)	Percent	
Existing stockholders	19,434,452	73%	$219,046	64%	$11.27
Investors participating in this offering	7,350,000	27	124,950	36	17.00
Total	26,784,452	100%	$343,996	100%	$12.84

The foregoing tables and calculations exclude:

- 2,587,996 shares of Class A common stock issuable upon exercise of stock options outstanding as of March 31, 2019 under our 2010 Equity Incentive Plan, or 2010 Plan, with a weighted-average exercise price of $7.08 per share;
- 1,065,448 shares of Class A common stock issuable upon exercise of stock options granted after March 31, 2019 under our 2010 Plan, with a weighted-average exercise price of $14.10 per share;
- 6,141,842 shares of Class A common stock reserved for future issuance under our 2019 Equity Incentive Plan, or 2019 Plan, which became effective as of the date of this prospectus, as well as (i) any additional shares of Class A common stock that become available for issuance under the 2019 Plan (including as a result of annual increases) and (ii) any shares of Class A common stock that (A) were available for issuance under the 2010 Plan as of immediately prior to the time our 2019 Plan became effective or (B) that would have otherwise returned to our 2010 Plan in accordance with its terms (which, in each case, will become available for issuance under our 2019 Plan);
- 283,333 shares of Class A common stock reserved for future issuance under our 2019 Employee Stock Purchase Plan, or the ESPP, which became effective as of the date of this prospectus, as well as any additional shares of Class A common stock that become available for issuance under our ESPP (including as a result of annual increases); and
- 49,997 shares of Class A common stock issuable upon exercise of outstanding warrants reclassified to purchase our Class A common stock, each with an exercise price of $14.46 per share.

To the extent any other outstanding options or warrants are exercised, there will be further dilution to new investors. If all of such outstanding options and warrants that were outstanding as of March 31, 2019 had been exercised as of March 31, 2019, the pro forma as adjusted net tangible book value per share after this offering inclusive of the underwriters over-allotment would be $8.34, and total dilution per share to new investors would be $8.66.

If the underwriters exercise their option to purchase additional shares of our Class A common stock in full:

- the percentage of shares of common stock issued prior to this offering and held by existing stockholders will decrease to approximately 70% of the total number of shares of our common stock outstanding after this offering; and
- the number of shares held by investors participating in this offering will increase to 8,452,500, or approximately 30% of the total number of shares of our common stock outstanding after this offering.

SELECTED CONSOLIDATED FINANCIAL DATA

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

	Year Ended December 31,		Three Months Ended March 31,	
	2017	2018	2018	2019
	(in thousands, except share and per share data)			
Consolidated Statements of Operations Data:				
Operating expenses:				
Research and development	$ 24,873	$ 32,513	$ 6,643	$ 11,713
General and administrative	4,562	7,060	1,300	2,518
Total operating expenses	29,435	39,573	7,943	14,231
Operating loss	(29,435)	(39,573)	(7,943)	(14,231)
Interest and other income (expense)				
Other income	1,719	961	213	165
Interest income	152	714	56	545
Interest expense	(14)	(9)	(2)	(2)
Preferred stock warrant liability revaluation	6	(33)	20	(50)
Gain (loss) on disposal of property and equipment	48	(1)	—	(5)
Loss before income tax benefit (expense)	(27,524)	(37,941)	(7,656)	(13,578)
Benefit (expense) from income taxes	(3)	1	—	(1)
Net loss	$ (27,527)	$ (37,940)	$ (7,656)	$ (13,579)
Net loss per share—basic and diluted	$ (13.14)	$ (18.02)	$ (3.66)	$ (6.40)
Weighted average shares used to compute net loss per share—basic and diluted	2,094,795	2,104,861	2,093,413	2,120,925
Pro forma net loss per share—basic and diluted (unaudited)(1)		$ (1.95)		$ (0.70)
Weighted average shares used to compute pro forma net loss per share—basic and diluted (unaudited)(1)		19,416,147		19,432,211

	December 31,		March 31,
	2017	2018	2019
		(in thousands)	
Consolidated Balance Sheet Data:			
Cash, cash equivalents and investments	$ 30,613	$114,504	$ 100,661
Working capital(2)	29,238	112,663	99,219
Total assets	36,112	121,684	109,126
Preferred stock warrant liability	347	380	430
Preferred stock	89,362	209,668	209,668
Total stockholders' deficit	(56,566)	(93,032)	(105,795)

(1) Gives effect to:

- the automatic conversion of all outstanding shares of our convertible Series A preferred stock, convertible Series B preferred stock and convertible Series C1 preferred stock into 13,314,068 shares of our Class A common stock immediately upon the closing of this offering;
- the automatic conversion of all outstanding shares of our convertible Series C2 preferred stock into 3,934,191 shares of our Class B common stock immediately upon the closing of this offering;
- the issuance of 62,936 shares of Class A common stock upon the exercise of an outstanding warrant in connection with this offering, with an exercise price of $0.0006 per share, which warrant will be exercised as of June 20, 2019;
- the automatic reclassification of warrants to purchase an aggregate of 49,997 shares of our convertible Series A preferred stock, outstanding as of March 31, 2019, into warrants to purchase an equivalent number of shares of our Class A common stock, and the related reclassification of preferred stock warrant liability to stockholders' equity; and
- the filing and effectiveness of our amended and restated certificate of incorporation and the adoption of our amended and restated bylaws, each of which will occur upon the closing of this offering.

(2) Working capital represents the difference between current assets and 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 our financial statements and related notes and other financial information included elsewhere in this prospectus. Some of the information contained in this discussion and analysis or set forth elsewhere in this prospectus, including information with respect to our plans and strategy for our business, includes forward-looking statements that involve risks and uncertainties. See "Special Note Regarding Forward-Looking Statements" and "Risk Factors" for a discussion of forward-looking statements and important factors that could cause actual results to differ materially from the results described in or implied by the forward-looking statements.

Overview

We are a biopharmaceutical company utilizing our differentiated platform to discover and develop novel antibody-based immunotherapeutics to treat a range of solid tumor types. While more traditional oncology drug discovery approaches attempt to generate antibodies against known targets, our approach relies on the human immune system to direct us to unique antibody-target pairs from patients experiencing a clinically meaningful, active immune response against their tumors. These unique antibody-target pairs represent a potentially novel and previously unexplored landscape of immuno-oncology targets. We believe the fact that our approach has the potential to deliver novel, previously unexplored immuno-oncology targets provides us with a significant competitive advantage over traditional approaches which focus on known targets that many companies are aware of and can pursue. We have utilized our drug discovery approach to identify over 1,400 distinct human antibodies that bind preferentially to tumor tissue from patients who are not the source of the antibody. Our lead product candidate, ATRC-101, is a monoclonal antibody with a novel mechanism of action and target derived from an antibody identified using our discovery platform. ATRC-101 reacts *in vitro* with a majority of human ovarian, non-small cell lung, colorectal and breast cancer samples from multiple patients. It has demonstrated robust anti-tumor activity as a single agent in multiple preclinical models, including one model in which PD-1 checkpoint inhibitors typically display limited activity. We anticipate filing an Investigational New Drug, or IND, application for ATRC-101 in late 2019 and initiating a Phase 1b clinical trial in patients with solid tumors in early 2020, subject to U.S. Food and Drug Administration, or FDA, approval of our IND application.

Since commencing operations in 2010, we have devoted substantially all of our resources to research and development, raising capital, building our management team and building our intellectual property portfolio. We do not have any products approved for marketing or sale and have not generated any revenue from product sales. We have funded our operations to date primarily from the sale of convertible preferred stock. We have also received more than $14 million in payments to date under our agreement with the Bill & Melinda Gates Foundation.

We have incurred significant operating losses since our inception. Our ability to generate product revenue sufficient to achieve or sustain profitability will depend on the successful development, regulatory approval and eventual commercialization of one or more of our current or future product candidates. Our net losses were $27.5 million and $37.9 million for the years ended December 31, 2017 and 2018, respectively, and $7.7 million and $13.6 million for the three months ended March 31, 2018 and 2019, respectively. As of March 31, 2019, we had an accumulated deficit of $110.2 million. We anticipate that a substantial portion of our capital resources and efforts in the foreseeable future will be focused on discovering, completing the necessary development, obtaining regulatory approval for and preparing for potential commercialization of our product candidates. As of March 31, 2019, we had cash, cash equivalents and investments of $100.7 million.

We expect to continue to incur significant expenses and increasing operating losses for the foreseeable future. Our net losses may fluctuate significantly from period to period, depending on the timing of our planned preclinical studies and clinical trials and expenditures on other research and development activities. We expect our expenses will increase substantially over time as we:

- continue preclinical studies and initiate clinical trials for ATRC-101 and initiate preclinical studies on any additional product candidates that we may pursue in the future;
- continue research and development to expand our growing library of more than 1,400 antibodies and develop potential future product candidates from that collection;
- continue to invest in advancing our differentiated discovery platform, and the underlying technologies including our Immune Repertoire Capture® technology;
- seek marketing approvals for product candidates that successfully complete clinical trials;
- maintain, protect and expand our portfolio of intellectual property rights, including patents, trade secrets and know-how;
- implement additional operational, financial and management systems; and
- attract, hire and retain additional administrative, clinical, regulatory and research personnel.

Furthermore, following the closing of this offering, we expect to incur additional costs associated with operating as a public company, including significant legal, accounting, insurance, investor relations and other expenses that we have not incurred as a private company.

Financial Operations Overview

Revenue

We have no products approved for marketing or commercial sale and have never generated any revenue from product sales.

Operating Expenses

Research and Development

Research and development expenses represent costs incurred in performing research, development and manufacturing activities in support of our own product development efforts and those of our collaborators, including intellectual property legal expenses, salaries, employee benefits and stock-based compensation for personnel contributing to research and development activities, laboratory supplies, outsourced research and development expenses, professional services and allocated facilities-related costs. We expense both internal and external research and development expenses as they are incurred. We do not currently allocate our costs by research and development program, as our research and development expenses include internal costs and external costs, neither of which are tracked by program. In particular, with respect to internal costs, several of our departments support multiple research and development programs. Non-refundable advance payments for services that will be used in or rendered for future research and development activities are recorded as prepaid expenses and recognized as expenses as the related services are performed.

We expect our research and development expenses to increase substantially for the foreseeable future as we continue to invest in our differentiated discovery platform to expand our pipeline of product candidates, advance our product candidates into and through preclinical studies and clinical trials and pursue regulatory approval of our product candidates. The processes of generating clinical candidates from our discovery platform and conducting the necessary preclinical and clinical research to obtain regulatory approval for those candidates is costly and time-consuming. Clinical trials generally become larger and more costly as they advance into later stages. The actual probability of success for our product candidates may be affected by a variety of factors, such as the

safety and efficacy of our product candidates, early clinical data, investment in our clinical programs, competition, manufacturing capability and commercial viability. We may never succeed in obtaining regulatory approval for any of our product candidates. As a result of the uncertainties discussed above and elsewhere in the prospectus, we are unable to determine the duration and completion costs of our research and development activities or when and to what extent we will generate revenue from the commercialization and sale of our product candidates.

General and Administrative

Our general and administrative expenses consist primarily of personnel costs, allocated facilities costs and other expenses for outside professional services, including legal, human resource, audit and accounting services.

Personnel costs consist of salaries, benefits and stock-based compensation for personnel not directly contributing to research and development activities. We expect to incur additional expenses as a result of operating as a public company, including expenses related to compliance with the rules and regulations of the SEC, Nasdaq and any other securities exchange on which our securities are traded, additional insurance expenses, investor relations activities and other administrative and professional services. We also expect to increase the size of our administrative function to support the growth of our business.

Interest and Other Income (Expense)

Other income (expense) includes other income which represents amounts received from partners for research and discovery services, interest income earned on our cash, cash equivalents and investments, interest expense, revaluation expense resulting from the liability recorded for certain preferred stock warrants and gains or losses on the periodic disposals of property and equipment.

Results of Operations

Comparison of the Years Ended December 31, 2017 and 2018

	Year Ended December 31,		Change	
	2017	2018	$	%
	(in thousands)			
Operating expenses:				
Research and development	$ 24,873	$ 32,513	$ 7,640	31%
General and administrative	4,562	7,060	2,498	55%
Total operating expenses	29,435	39,573	10,138	34%
Operating Loss	(29,435)	(39,573)	(10,138)	34%
Other income (expense), net:				
Other income	1,719	961	(758)	(44)%
Interest income	152	714	562	*
Interest expense	(14)	(9)	5	(36)%
Preferred stock warrant liability revaluation	6	(33)	(39)	*
Gain (loss) on disposal of property and equipment	48	(1)	(49)	*
Total other income (expense), net	1,911	1,632	(279)	(15)%
Income tax benefit (expense)	(3)	1	4	*
Net Loss	$(27,527)	$(37,940)	$(10,413)	38%

* Not meaningful

Research and Development

The following table summarizes our research and development expenses incurred during the respective periods:

	Year Ended December 31,	
	2017	2018
	(in thousands)	
Research and development		
Personnel-related (including stock-based compensation)	$ 9,558	$12,250
Product and preclinical contract services	6,195	8,453
Laboratory supplies and equipment	4,132	4,549
Consulting, legal and other services	1,980	3,614
Facility related	1,727	1,757
Other	1,281	1,890
Total research and development expenses	$24,873	$32,513

Research and development expenses increased by $7.6 million, or 31%, during the year ended December 31, 2018 compared to the same period in 2017. The increase was primarily attributable to higher personnel-related expenses of $2.7 million as a result of additional employee head count, a $2.2 million increase in product and preclinical development costs primarily associated with efforts to advance ATRC-101 towards an IND application in late 2019 and a $1.6 million increase in consulting, legal and other services costs primarily due to increasing legal costs as we work to expand our intellectual property estate around both our differentiated discovery platform and ATRC-101. Substantially all of our research and development expenses during the years ended December 31, 2017 and 2018 related to improving our discovery platform, including our Immune Repertoire Capture® technology, continuing sponsorship of our non-interventional clinical studies to collect blood-based samples and internal and external preclinical development costs associated with ATRC-101, although to date we generally have not allocated research and development expenses to specific projects or research programs.

General and Administrative

General and administrative expenses increased by $2.5 million, or 55%, during the year ended December 2018 compared to the same period in 2017. The increase was primarily due to a $1.9 million increase in personnel-related expenses, including stock-based compensation, as a result of additional employee head count, as well as due to increases in facilities and legal expenses.

Other Income

Other income is comprised of amounts earned from research and discovery services provided to partners and collaborators under service agreements. Other income decreased by $758,000 during the year ended December 31, 2018 as compared to the same period in 2017 due largely to reductions in the level of services being provided to external partners as a result of redirecting resources to internal programs, including ATRC-101.

Interest Income

Interest income increased to $714,000 during the year ended December 31, 2018 as compared to $152,000 during the year ended December 31, 2017 due to increased interest earned on our cash and cash equivalents balances which were significantly higher in 2018 as compared to 2017.

Interest Expense

Interest expense during the years ended December 31, 2017 and 2018 pertained to the interest portion of payments made on capital leases under which we acquired certain property and equipment.

Preferred Stock Warrant Liability Revaluation

Preferred stock warrant liability revaluation recognizes changes in the fair value of the preferred stock warrants. We recognized an expense of $33,000 during the year ended December 31, 2018 primarily as a result of an increase in the estimated fair market value of our company during that period.

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

	Three Months Ended March 31,		Change	
	2018	2019	$	%
	(in thousands)			
Operating expenses:				
Research and development	$ 6,643	$ 11,713	$ 5,070	76%
General and administrative	1,300	2,518	1,218	94%
Total operating expenses	7,943	14,231	6,288	79%
Operating Loss	(7,943)	(14,231)	(6,288)	79%
Other income (expense), net:				
Other income	213	165	(48)	(23)%
Interest income	56	545	489	*
Interest expense	(2)	(2)	—	—%
Preferred stock warrant liability revaluation	20	(50)	(70)	*
Gain (loss) on disposal of property and equipment	—	(5)	(5)	*
Total other income (expense), net	287	653	366	128%
Income tax benefit (expense)	—	(1)	(1)	*
Net Loss	$(7,656)	$(13,579)	$(5,923)	77%

* Not meaningful

Research and Development

The following table summarizes our research and development expenses incurred during the respective periods:

	Three Months Ended March 31,	
	2018	2019
	(in thousands)	
Research and development		
Personnel-related (including stock-based compensation)	$2,885	$ 4,574
Product and preclinical contract services	1,049	3,183
Laboratory supplies and equipment	1,142	1,525
Consulting, legal and other services	802	1,275
Facility related	461	1,014
Other	304	142
Total research and development expenses	$6,643	$11,713

Research and development expenses increased by $5.1 million, or 76%, during the three months ended March 31, 2019 compared to the same period in 2018. The increase was primarily attributable to higher personnel-related expenses of $1.7 million as a result of additional employee head count, a $2.1 million increase in product and preclinical development costs primarily associated with efforts to advance ATRC-101 towards an IND application in late 2019, $553,000 and $383,000 of increases in facility and lab related expenses due to expansion of lab facilities and activities in an additional location, and a $473,000 increase in consulting, legal and other services costs primarily due to increasing legal costs as we work to expand our intellectual property estate around both our differentiated discovery platform and ATRC-101.

General and Administrative

General and administrative expenses increased by $1.2 million, or 94%, during the three months ended March 31, 2019 compared to the same period in 2018. The increase was primarily due to an $816,000 increase in personnel-related expenses, including stock-based compensation, as a result of additional employee head count, as well as due to increases in facilities and legal expenses.

Other Income

Other income is comprised of amounts earned from research and discovery services provided to partners and collaborators under service agreements. Other income decreased by $48,000 during the three months ended March 31, 2019 compared to the same period in 2018 due largely to reductions in the level of services being provided to external partners as a result of redirecting resources to internal programs, including ATRC-101.

Interest Income

Interest income increased to $545,000 during the three months ended March 31, 2019 as compared to $56,000 during the three months ended March 31, 2018 due to increased interest earned on our cash, cash equivalents and investment balances which were significantly higher in 2019 as compared to 2018.

Interest Expense

Interest expense during the three months ended March 31, 2018 and 2019 pertained to the interest portion of payments made on capital leases under which we acquired certain property and equipment.

Preferred Stock Warrant Liability Revaluation

Preferred stock warrant liability revaluation recognizes changes in the fair value of the preferred stock warrants. We recognized an expense of $50,000 during the three months ended March 31, 2019 primarily as a result of an increase in the estimated fair market value of our company during that period.

Liquidity and Capital Resources; Plan of Operations

Liquidity

Due to our significant research and development expenditures, we have generated significant operating losses since inception. We have funded our operations primarily through the sale of convertible preferred stock. We have also received more than $15 million under our agreement with the Bill & Melinda Gates Foundation to date. In September 2018, we issued and sold 8,941,325 shares of Series C1 convertible preferred stock and Series C2 convertible preferred stock for gross proceeds of approximately $125.0 million. In August 2017, we issued and sold an aggregate of 3,001,421 shares of Series B convertible preferred stock for gross proceeds of approximately $35.0 million. As of March 31, 2019, we had available cash, cash equivalents and investments of $100.7 million and an accumulated deficit of $110.2 million.

Funding Requirements

Our primary uses of cash are to fund operating expenses, which consist primarily of funding our research, preclinical and clinical development activities, and related personnel and facilities costs. The timing and amount of future funding requirements depends on many factors, including the following:

- the scope, rate of progress, results and cost of our preclinical studies, clinical trials and other related activities;
- the cost of process development and manufacturing of clinical supplies, and establishing commercial supplies of our product candidates and any products that we may develop;
- the number and characteristics of product candidates that we pursue;
- the cost, timing and outcomes of regulatory approvals;
- the terms and timing of any other collaborative, licensing and other arrangements that we may establish;
- the timing, receipt and amount of sales, profit sharing or royalties, if any, from our potential products;
- the cost of preparing, filing, prosecuting, defending and enforcing any patent claims and other intellectual property rights;
- the extent to which we acquire or invest in businesses, products or technologies, although we currently have no commitments or agreements relating to any of these types of transactions;
- the compliance and administrative costs associated with being a public company; and
- the cost of attracting, hiring and retaining additional administrative, clinical, regulatory and scientific personnel.

Based on our current business plans, we believe that our existing cash, cash equivalents and investments, will be sufficient to fund our planned operations for at least 12 months from the date of this prospectus. Including the net proceeds from this offering, we believe we will have sufficient resources to fund our planned operations through the end of 2021. However, we will require additional funding to complete development of our product candidates and commercialize our products, if approved.

We may seek to raise any necessary additional capital through a combination of public or private equity offerings, debt financings, collaborations, strategic alliances, licensing arrangements and other marketing and distribution arrangements. There can be no assurance that we will be successful in acquiring additional funding at levels sufficient to fund our operations or on terms favorable to us. If we are unable to obtain adequate financing when needed, we may have to delay, reduce the scope of or suspend one or more of our preclinical studies and clinical trials, research and development programs or commercialization efforts. Because of the numerous risks and uncertainties associated with the development and commercialization of our product candidates and the extent to which we may enter into collaborations with third parties to participate in their development and commercialization, we are unable to estimate the amounts of increased capital outlays and operating expenditures associated with our current and anticipated preclinical studies and clinical trials. To the extent that we raise additional capital through collaborations, strategic alliances or licensing arrangements with third parties, we may have to relinquish valuable rights to our product candidates, future revenue streams or research programs or to grant licenses on terms that may not be favorable to us. If we raise additional capital through public or private equity or convertible debt offerings, the ownership interest of our existing stockholders will be diluted, and the terms of these securities may include liquidation or other preferences that adversely affect our stockholders' rights. If we raise additional capital through debt financing, we may be subject to

covenants limiting or restricting our ability to take specific actions, such as incurring additional debt, making capital expenditures or declaring dividends.

Cash Flows

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

	Year Ended December 31,		Three Months Ended March 31,	
	2017	2018	2018	2019
	(in thousands)			
Cash used in operating activities	$(25,096)	$ (34,700)	$(8,097)	$(12,977)
Cash (used in) provided by investing activities	(8,969)	20,658	7,294	(74,428)
Cash provided by (used in) financing activities	34,289	120,304	(12)	(56)
Net increase (decrease) in cash and cash equivalents and restricted cash	$ 224	$106,262	$ (815)	$(87,461)

Cash Flows from Operating Activities

For the year ended December 31, 2018, cash used in operating activities was $34.7 million, which consisted of a net loss of $37.9 million, partially offset by $2.9 million in non-cash charges and a net change of $378,000 in our net operating assets and liabilities. The non-cash charges primarily consisted of stock-based compensation of $1.4 million and depreciation and amortization of $1.4 million. The change in operating assets and liabilities was primarily due to the net effect of an increase in payables and accruals of $1.8 million and an increase in prepaid expenses and other current assets of $1.4 million resulting from the timing of payments made for research and development activities.

For the year ended December 31, 2017, cash used in operating activities was $25.1 million, which consisted of a net loss of $27.5 million, partially offset by $1.6 million in non-cash charges and a net change of $871,000 in our net operating assets and liabilities. The non-cash charges consisted of depreciation and amortization of $1.2 million and stock-based compensation of $409,000. The change in operating assets and liabilities was primarily due to a decrease in prepaid expenses and other current assets of $596,000 resulting from the timing of payments from service agreements.

For the three months ended March 31, 2019, cash used in operating activities was $13.0 million, which consisted of a net loss of $13.6 million, partially offset by $1.2 million in non-cash charges and a net change of $626,000 in our net operating assets and liabilities. The non-cash charges consisted of depreciation and amortization of $397,000 and stock-based compensation of $776,000. The change in operating assets and liabilities was primarily due to an increase in prepaid expenses and other current assets of $562,000 resulting from the timing of payments from service agreements.

For the three months ended March 31, 2018, cash used in operating activities was $8.1 million, which consisted of a net loss of $7.7 million, partially offset by $419,000 in non-cash charges and a net change of $860,000 in our net operating assets and liabilities. The non-cash charges consisted of depreciation and amortization of $326,000 and stock-based compensation of $113,000. The change in operating assets and liabilities was primarily due to a decrease in accrued expenses of $1.0 million resulting from the payment of annual bonus compensation.

Cash Flows from Investing Activities

For the year ended December 31, 2018, cash provided by investing activities of $20.7 million was primarily attributable to maturities of investments totaling $22.4 million, partially offset by investments in property and equipment of $1.8 million.

For the year ended December 31, 2017, cash used in investing activities of $9.0 million was primarily related to $7.6 million in net purchases of investments along with $1.4 million of investments in property and equipment.

For the three months ended March 31, 2019, cash used in investing activities of $74.4 million was primarily related to $74.3 million in net purchases of investments. For the three months ended March 31, 2018, cash provided by investing activities of $7.3 million was primarily related to $7.4 million in net maturities of investments.

Cash Flows from Financing Activities

For the year ended December 31, 2018, cash provided by financing activities of $120.3 million was related primarily to $125.0 million in cash proceeds received from the September 2018 issuance of our Series C1 convertible preferred stock and our Series C2 convertible preferred stock, net of $4.7 million of issuance costs.

For the year ended December 31, 2017, cash provided by financing activities of $34.3 million was related primarily to $35.0 million in cash proceeds received from the August 2017 issuance of our Series B convertible preferred stock, net of $667,000 of issuance costs.

For the three months ended March 31, 2018 and 2019, cash used in financing activities of $12,000 and $56,000, respectively, primarily related to the payment of lease obligations.

Contractual Obligations and Other Commitments

The following table summarizes our contractual obligations as of March 31, 2019:

	Payments Due by Period				
	Less than 1 Year	1 to 3 Years	4 to 5 Years	More than 5 Years	Total
			(in thousands)		
Contractual obligations:					
Operating lease obligations	$ 3,378	$ 4,500	$ —	$ —	$ 7,878
Capital lease obligations	52	93	—	—	145
Total contractual obligations	$ 3,430	$ 4,593	$ —	$ —	$ 8,023

The operating lease obligations noted above represent operating lease obligations related to our currently occupied premises at 500 Saginaw Drive in Redwood City, California. These leases expire in the first half of 2020 and we are currently evaluating locations for a new corporate headquarters. Additionally, in January 2019, we entered into a commercial lease agreement for an additional 33,000 square feet of office space in a separate facility. The lease term commenced on March 1, 2019 and expires 36 months from the commencement date. The initial base rent is approximately $181,000 per month and represents a total minimum rental commitment under the lease of approximately $6.7 million.

The capital lease obligations noted above represent certain property and equipment we acquired under capital leases. In 2017, we financed purchases of $226,000 in equipment under a capital

lease agreement. Outstanding amounts under the capital lease agreements are generally secured by liens on the related property and equipment.

In addition, we enter into contracts in the normal course of business with contract research organizations for preclinical and clinical studies as well as with contract development manufacturing organizations for the manufacture of materials for those studies. These agreements generally provide for termination at the request of either party with less than one-year notice and are, therefore, cancelable contracts and not reflected in the table above.

Off-Balance Sheet Arrangements

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

Quantitative and Qualitative Disclosures about Market Risk

The primary objectives of our investment activities are to ensure liquidity and to preserve capital. We are exposed to market risks in the ordinary course of our business. These risks include interest rate sensitivities. We held cash, cash equivalents and investments of $114.5 million and $100.7 million as of December 31, 2018 and March 31, 2019, respectively. We generally hold our cash in interest-bearing money market accounts. Historical fluctuations in interest rates have not been significant for us. Due to the short-term maturities of our cash equivalents and the low risk profile of our investments, an immediate 100 basis point change in interest rates would not have a material effect on the fair market value of our cash equivalents or investments.

Critical Accounting Policies and Estimates

Our management's discussion and analysis of our financial condition and results of operations is based on our financial statements, which have been prepared in accordance with generally accepted accounting principles. The preparation of these financial statements requires us to make estimates and assumptions that affect the reported amounts of assets and liabilities and the disclosure of contingent assets and liabilities at the date of the financial statements, as well as the reported revenue generated, and reported expenses incurred during the reporting periods. Our estimates are based on our historical experience and on various other factors that we believe are reasonable under the circumstances, the results of which form the basis for making judgments about the carrying value of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates under different assumptions or conditions.

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

Research and Development Expenses and Accrued Research and Development Costs

We expense research and development costs as incurred. Research and development expenses consist of personnel costs for our research and product development employees. Also included are non-personnel costs such as professional fees payable to third parties for preclinical studies, clinical trials and research services, laboratory supplies and equipment maintenance and depreciation, intellectual property licenses and other consulting costs.

We estimate preclinical studies, clinical trials and research expenses based on the services performed, pursuant to contracts with research institutions that conduct and manage preclinical studies, clinical trials and research services on our behalf. We estimate these expenses based on discussions with management and external service providers as to the progress or stage of

completion of services and the contracted fees to be paid for such services. We record the estimated costs of research and development activities based upon the estimated amount services provided but not yet invoiced, and include these costs in development expenses. We accrue for these costs based on factors such as estimates of the work completed and in accordance with agreements established with our third party service provides under the service agreements. We make significant judgments and estimates in determining the accrued liabilities balance in each reporting period. As actual costs become known, we adjust our accrued liabilities. We have not experienced any material differences between accrued costs and actual costs incurred. However, the status and timing of actual services performed may vary from our estimates, resulting in adjustments to expense in future periods. Changes in these estimates that result in material changes to our accruals could materially affect our results of operations. Payments associated with licensing agreements to acquire exclusive license to develop, use, manufacture and commercialize products that have not reached technological feasibility and do not have alternate future use are expensed as incurred.

Payments made to third parties under these arrangements in advance of the performance of the related services by the third parties are recorded as prepaid expenses until the services are rendered. We evaluate these payments for current or long-term classification based on when we expect to receive these services.

Stock-Based Compensation

We maintain a stock-based compensation plan as a long-term incentive for employees, consultants and members of our board of directors. The plan allows for the issuance of non-statutory options, or NSOs, incentive stock options, restricted stock and restricted stock units to employees and NSOs to nonemployees.

Stock-based payments are measured using fair-value-based measurements and recognized as compensation expense over the service period in which the awards are expected to vest. Our fair-value-based measurements of awards to employees and directors as of the grant date utilize the single-option award-valuation approach, and we use the straight-line method for expense attribution. The valuation model used for calculating the estimated fair value of stock awards is the Black-Scholes option-pricing model. The Black-Scholes model requires us to make assumptions and judgments about the variables used in the calculations, including the expected term (weighted-average period of time that the options granted are expected to be outstanding), the expected volatility of our common stock, the related risk-free interest rate and the expected dividend. We have elected to recognize forfeitures of stock-based payment awards as they occur.

For stock-based awards issued to non-employees, we record expense related to stock options based on the fair value of the options calculated using the Black-Scholes option-pricing model over the service performance period.

The Black-Scholes option-pricing model requires the use of highly subjective assumptions which determine the fair value of stock-based awards. These assumptions include:

- *Expected Term.* The expected term represents the period that stock-based awards are expected to be outstanding. The expected term for option grants is determined using the simplified method. The simplified method deems the term to be the average of the time-to-vesting and the contractual life of the stock-based awards.
- *Expected Volatility.* Since we have been privately held and do not have any trading history for our common stock, the expected volatility was estimated based on the average volatility for comparable publicly traded biotechnology companies over a period equal to the

expected term of the stock option grants. The comparable companies were chosen based on their similar size, stage in the life cycle or area of specialty.

- *Risk-Free Interest Rate.* The risk-free interest rate is based on the U.S. Treasury zero coupon issues in effect at the time of grant for periods corresponding with the expected term of option.
- *Expected Dividend.* We have never paid dividends on our common stock and have no plans to pay dividends on our common stock. Therefore, we used an expected dividend yield of zero.

Fair Value of Common Stock

Historically, for all periods prior to this initial public offering, the fair values of the shares of common stock underlying our stock-based awards were determined on each grant date by our board of directors. Given the absence of a public trading market for our common stock, our board of directors exercised reasonable judgment and considered a number of objective and subjective factors to determine the best estimate of the fair value of our common stock, including our stage of development; our actual operating results and financial performance; progress of our research and development efforts; conditions in the industry and economy in general; the rights, preferences and privileges of our convertible preferred stock relative to those of our common stock; the likelihood of achieving a liquidity event for the holders of our common stock, such as an initial public offering or a sale of our company, given prevailing market conditions; equity market conditions affecting comparable public companies; the lack of marketability of our common stock and the results of independent third party valuations. Valuations of our common stock were prepared by an unrelated third party valuation firm in accordance with the guidance provided by the American Institute of Certified Public Accountants 2013 Practice Aid, Valuation of Privately-Held-Company Equity Securities Issued as Compensation.

For our valuations performed prior to August 31, 2018, we used the Option Pricing Model Backsolve method to estimate the fair value of our common stock. In an option pricing method, or OPM, framework, the backsolve method for inferring the equity value implied by a recent financing transaction involves making assumptions for the expected time to liquidity, volatility and risk-free rate and then solving for the value of equity such that value for the most recent financing equals the amount paid. Furthermore, as of each of the valuation dates prior to August 31, 2018, we were at an early stage of development and future liquidity events were difficult to forecast. We applied a discount for lack of marketability to account for a lack of access to an active public market.

For valuations on or after August 31, 2018, we utilized a hybrid approach that primarily relies on the probability-weighted expected return method, or PWERM, an accepted valuation method under the American Institute of Certified Public Accountants Practice Guide, for determining the fair value of our common stock. The PWERM is a scenario-based analysis that estimates the value per share of common stock based on the probability-weighted present value of expected future equity values for the common stock, under various possible future liquidity event scenarios, in light of the rights and preferences of each class of stock, discounted for a lack of marketability. Under our hybrid approach, the Option Pricing Model Backsolve approach was utilized to determine the fair value of our common stock in certain of the scenarios used in the PWERM approach.

After the closing of this offering, our board of directors will determine the fair value of each share of underlying common stock based on the closing price as reported on the date of grant on the primary stock exchange on which our common stock is traded.

The intrinsic value of all outstanding options as of March 31, 2019 was $25.7 million based on the initial public offering price of $17.00 per share.

On April 5, 2019, May 23, 2019 and June 19, 2019, we granted options to purchase an aggregate of 1,065,448 shares of Class A common stock to our employees, directors and consultants. The April 5, 2019 and May 23, 2019 grants were made under our 2010 Plan and the June 19, 2019 grants were made under our 2019 Plan. A majority of these options vest over a four-year period, with the remaining vesting over a three-year period. The total compensation expense for these unvested options is expected to be approximately $11.6 million and recognized over the service term of three to four years.

Recent Accounting Pronouncements

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

Internal Control over Financial Reporting

In connection with the audit of our financial statements, we and our independent registered public accounting firm identified a material weakness in our internal control over financial reporting. The material weakness related to a lack of application-based controls inherent in our enterprise resource planning, or ERP, system used for maintaining our financial books and records. A material weakness is a deficiency, or a combination of deficiencies, in internal control over financial reporting such that there is a reasonable possibility that a material misstatement of our financial statements will not be prevented or detected on a timely basis. If we fail to establish and maintain effective internal control over financial reporting in the future, our operating results and our ability to operate our business could be harmed.

We are implementing measures designed to improve our internal control over financial reporting to remediate this material weakness. We have implemented a new ERP system that is our system of record for our financial books and records from January 1, 2019 forward. This new ERP system has strong application-based controls inherent in its design that provide a much stronger internal control infrastructure for financial reporting and for our internal control procedures. With the oversight of senior management and our audit committee, we have begun taking steps to remediate the underlying causes of the material weakness.

We and our independent registered public accounting firm were not required to perform an evaluation of our internal control over financial reporting as of December 31, 2017 and 2018 in accordance with the provisions of the Sarbanes-Oxley Act. Accordingly, we cannot provide assurance that we have identified all, or that we will not in the future have additional, material weaknesses. Material weaknesses may still exist when we report on the effectiveness of our internal control over financial reporting as required by reporting requirements under Section 404 of the Sarbanes-Oxley Act after the completion of this offering.

Emerging Growth Company Status

We are an emerging growth company, as defined in the JOBS Act. Under the JOBS Act, emerging growth companies can delay adopting new or revised accounting standards issued subsequent to the enactment of the JOBS Act until such time as those standards apply to private companies.

We elected to use this extended transition period for complying with new or revised accounting standards, including but not limited to the new lease accounting standard, that have different effective dates for public and private companies until the earlier of the date that we (i) are no longer an emerging growth company or (ii) affirmatively and irrevocably opt out of the extended transition period provided in the JOBS Act. As a result, these financial statements may not be comparable to

companies that comply with the new or revised accounting pronouncements as of public company effective dates. We early adopted Accounting Standards Update 2014-09, *Revenue from Contracts with Customers* (Accounting Standards Codification Topic 606), and Accounting Standards Update 2018-07, *Improvements to Nonemployee Share-Based Payment Accounting (Accounting Standards Codification Topic 718)*, as the JOBS Act does not preclude an emerging growth company from early adopting a new or revised accounting standard earlier than the time that such standard applies to private companies. We expect to use the extended transition period for any other new or revised accounting standards during the period in which we remain an emerging growth company.

We will remain an emerging growth company until the earliest of (i) the last day of our first fiscal year (a) following the fifth anniversary of the completion of this offering, (b) in which we have total annual gross revenues of at least $1.07 billion or (c) in which we are deemed to be a large accelerated filer, which means the market value of our common stock that is held by non-affiliates exceeds $700.0 million as of the prior June 30th and (ii) the date on which we have issued more than $1.0 billion in non-convertible debt securities during the prior three-year period.

BUSINESS

Overview

We are a biopharmaceutical company utilizing our differentiated platform to discover and develop novel antibody-based immunotherapeutics to treat a range of solid tumor types. While more traditional oncology drug discovery approaches attempt to generate antibodies against known targets, our approach relies on the human immune system to direct us to unique antibody-target pairs from patients experiencing a clinically meaningful, active immune response against their tumors. These unique antibody-target pairs represent a potentially novel and previously unexplored landscape of immuno-oncology targets. We believe the fact that our approach has the potential to deliver novel, previously unexplored immuno-oncology targets provides us with a significant competitive advantage over traditional approaches which focus on known targets that many companies are aware of and can pursue. We have utilized our drug discovery approach to identify over 1,400 distinct human antibodies that bind preferentially to tumor tissue from patients who are not the source of the antibody. Our lead product candidate, ATRC-101, is a monoclonal antibody with a novel mechanism of action and target derived from an antibody identified using our discovery platform. ATRC-101 reacts *in vitro* with a majority of human ovarian, non-small cell lung, colorectal and breast cancer samples from multiple patients. It has demonstrated robust anti-tumor activity as a single agent in multiple preclinical models, including one model in which PD-1 checkpoint inhibitors typically display limited activity. We anticipate filing an Investigational New Drug, or IND, application for ATRC-101 in late 2019 and initiating a Phase 1b clinical trial in patients with solid tumors in early 2020, subject to U.S. Food and Drug Administration, or FDA, approval of our IND application.

Our discovery process begins by gathering blood samples, mostly through company-sponsored non-interventional clinical studies, from cancer patients before, during and after they undergo treatment, which can induce an active anti-tumor immune response. Through this process, we have built a broad repository of over 1,200 samples from over 400 donors, representing over 25 different solid tumor types. We identify those patients with clinically meaningful responses to therapy, defined as those that reach validated surrogate endpoints of complete or partial response, stable disease for six months, or long-term progression-free survival. For those patients, we then examine their samples for rare antibody-producing B cells called plasmablasts that are elevated during an active immune response. We believe that these human immune responses, which often occur over an extended period of time, generate antibodies accessible with our platform that would be difficult to obtain through shorter term, non-human immunization or *in vitro* strategies.

If plasmablasts are elevated in a particular sample, we then employ a multi-step process to generate a potential product candidate. We start by isolating single plasmablasts and determining the sequences of the co-expressed antibody genes using our proprietary Immune Repertoire Capture® technology. We analyze these sequences to select antibodies, which we synthesize as recombinant proteins. We then test these antibodies to identify those that bind to tumor tissue from patients who are not the source of the antibody, referred to as non-autologous tumor tissue, preferentially over normal tissue. We then analyze these ‘‘hit’’ antibodies using a number of *in vitro* and *in vivo* assays, and often make structural changes to generate leads. A select number of these leads are refined further using protein engineering to enhance their drug-like properties as we identify and characterize their targets in parallel prior to initiating preclinical development and IND-enabling studies.

Key attributes of our discovery platform

We take an ‘‘open-aperture’’ approach to drug discovery, in which we are not limited by preconceptions of what constitutes a viable antibody or target. We instead allow the human immune system to direct our efforts. We believe this approach provides us access to a broad underexploited

antibody and drug target space. Our approach may lead us to antibodies that are unlikely to have arisen via more traditional approaches with targets that otherwise may not have been discoverable. We believe our approach and discovery platform provide us with the ability to:

- Generate antibodies made by the human immune system.
- Deliver potentially useful antibodies at a high rate and in a scalable fashion.
- Access a potentially large and underexploited tumor target space.
- Identify antibody-target pairs.
- Generate candidates that direct the immune system to attack tumor tissue.
- Develop potential treatments for large populations of patients across multiple tumor types.

Our lead product candidate: ATRC-101

Our lead product candidate, ATRC-101, is a monoclonal antibody derived from an antibody identified using our discovery platform and having robust preclinical anti-tumor activity. ATRC-101 functions through a novel mechanism of action, which we refer to as Driver Antigen Engagement. Driver Antigen Engagement involves systemic delivery of an agent that causes extensive remodeling of the tumor microenvironment and the destruction of tumor cells via both the innate and adaptive immune systems. We believe that the mechanism of action and target of ATRC-101 are unlike those of other anti-tumor antibodies that have been or are currently in clinical development. We have identified the target of ATRC-101 as a ribonucleoprotein (RNP) complex. ATRC-101 binds to target reconstituted *in vitro* using a single recombinant protein, polyadenylate-binding protein 1, and *in vitro* transcribed poly(A) RNA.

ATRC-101, currently our only product candidate, represents one of over 1,400 antibodies that we have identified to date through our discovery platform that may have potential to generate broad anti-tumor activity via a variety of mechanisms of action. While we believe that we will be able to exploit our growing library of novel antibodies in order to develop product candidates with additional distinct and compelling mechanisms of action for tumor destruction, many of these antibodies will likely not yield product candidates for a variety of reasons. For example, we have identified antibodies that can be coupled to T cell-activating domains in a bispecific format to kill tumor cells; others that directly target tumor cells leading to immune cell-mediated killing; and others that internalize upon binding to tumor cells and therefore may be able to deliver coupled toxins, but less than 25% of the antibodies in our hit library demonstrate one of these mechanisms. In addition, in order to be able to develop product candidates from our hit library in certain of these mechanisms, such as bispecific T cell engagers and antibody-drug conjugates, we will need to partner with biotech companies that have developed technologies that enable engineering our antibodies into these formats. We are actively pursuing such collaborative partnerships, and plan to allocate resources to these efforts as part of our shift to focus our drug discovery efforts around building out a proprietary pipeline of clinical candidates.

Our management team and institutional investors

We are led by a highly experienced management team with deep scientific and technical expertise and broad experience in discovering, developing and commercializing antibody therapeutics in oncology. Members of our executive team have founded multiple biopharmaceutical companies and have experience in senior roles at leading oncology firms including Genentech, Merck, Amgen, Pfizer, MedImmune and ARMO Biosciences. The breadth of our team's experience includes leading informatics and computational biology teams at Genentech and Merck, running clinical trials for novel antibody constructs at Amgen and leading the launch and commercialization of multiple products at Relypsa and the BioOncology Business Unit at Genentech. Additionally, members of our team have served as faculty members, established new laboratories or led research

initiatives at institutions including the University of California, Berkeley and the Fred Hutchinson Cancer Research Institute.

Since our founding, we have raised a total of $219 million in equity financing primarily from leading institutional investors including funds managed by Aisling Capital, Boxer Capital of the Tavistock Group, Cormorant Asset Management, EcoR1 Capital, Redmile Group, Samsara BioCapital and Tekla Capital Management. For more information on our investors, see ''Principal Stockholders''.

Our Strategy

Our goal is to become a leading biopharmaceutical company by utilizing our differentiated platform to discover and develop antibody-based therapeutics against novel targets. In pursuit of that strategy we intend to:

- **Rapidly advance our lead product candidate, ATRC-101, into clinical trials in multiple types of solid tumors.** ATRC-101 is the first candidate identified using our discovery platform that we plan to advance into clinical trials. ATRC-101 displays broad reactivity across a variety of human solid tumor samples and has demonstrated potent single-agent anti-tumor activity in preclinical models via a unique mechanism of action, which we term Driver Antigen Engagement. We intend to file an IND application with the FDA for ATRC-101 in late 2019 and to evaluate this candidate in the clinical setting as both a monotherapy and in combination with other agents in multiple types of solid tumors.
- **Continue efforts to develop a pipeline of antibody-based product candidates for oncology.** While our only product candidate that we are currently moving into clinical development is ATRC-101, we have utilized our differentiated drug discovery approach to identify over 1,400 distinct human antibodies targeting human tumors that can potentially provide the basis for additional product candidates. Our ongoing efforts are focused on identifying, analyzing and refining antibodies to generate clinical candidates that take advantage of various mechanisms of action and novel targets. We engineer some of our antibodies into various drug formats, such as bispecific antibodies, to drive anti-tumor activity. We intend to build out a proprietary pipeline of product candidates addressing large populations of patients across a range of solid tumors. We currently own worldwide rights to the oncology product candidates derived from our platform.
- **Continue to invest in our discovery platform for applications within oncology and potential indications outside of oncology.** A key pillar of our discovery platform is our proprietary sample repository, which includes over 1,200 blood-derived samples sourced from over 400 patients representing over 25 different types of solid tumors. We plan to expand the scope of our repository and enhance other portions of our platform in order to maintain our leadership position in the identification of novel targets in non-autologous tumor tissue and antibodies that bind to them. We also plan to enhance our capabilities to translate these proprietary findings into product candidates. We believe our differentiated approach may have applications across a variety of diseases that involve an active immune response, including some outside of oncology.
- **Selectively enter into collaborations to enhance and expand our product pipeline as well as our drug development capabilities.** We believe that the single agent anti-tumor activity of many of the antibodies discovered using our platform could be enhanced by incorporating potential collaborator technologies. We intend to selectively form collaborations with partners to gain access to complementary technologies and expertise in order to develop product candidates with increased potential for anti-tumor activity. We may

also enter into agreements to extend the reach of our platform outside oncology, such as our existing agreement with the Bill & Melinda Gates Foundation.

- **Continue to expand our intellectual property portfolio to further protect our discovery platform and the novel product candidates it may generate.** The intellectual property surrounding our platform consists of patents and patent applications, trade secrets and know-how, and we plan to expand our intellectual property as we continue to develop our platform. We also intend to protect our product candidates by pursuing composition-of-matter and method-of-use patents typical for antibody-based therapeutics. Furthermore, as our platform identifies novel antibody-target pairs in which a human antibody may bind to a previously underappreciated target in a useful manner, we plan to pursue additional intellectual property supporting our candidates deriving from their interactions with targets.

Our Strengths

We believe that the following key attributes and assets will enable us to execute on our strategy and become a leading biopharmaceutical company:

- Lead immunotherapeutic product candidate directed at potentially large patient populations across multiple oncology indications with a novel mechanism of action and robust preclinical data.
- Strongly differentiated and industrialized discovery platform that accesses a potentially large and underexploited target space to generate product candidates derived from human immune responses targeting tumors.
- Growing library of more than 1,400 human antibodies directed to targets in non-autologous tumor tissue that can be exploited to generate product candidates.
- Deep scientific, research and development and operational expertise supporting the discovery and development of cutting-edge product candidates.
- Leading institutional investors with a long-term outlook and alignment with our management to build a pioneering company.

Background on Cancer and Cancer Immunotherapeutics

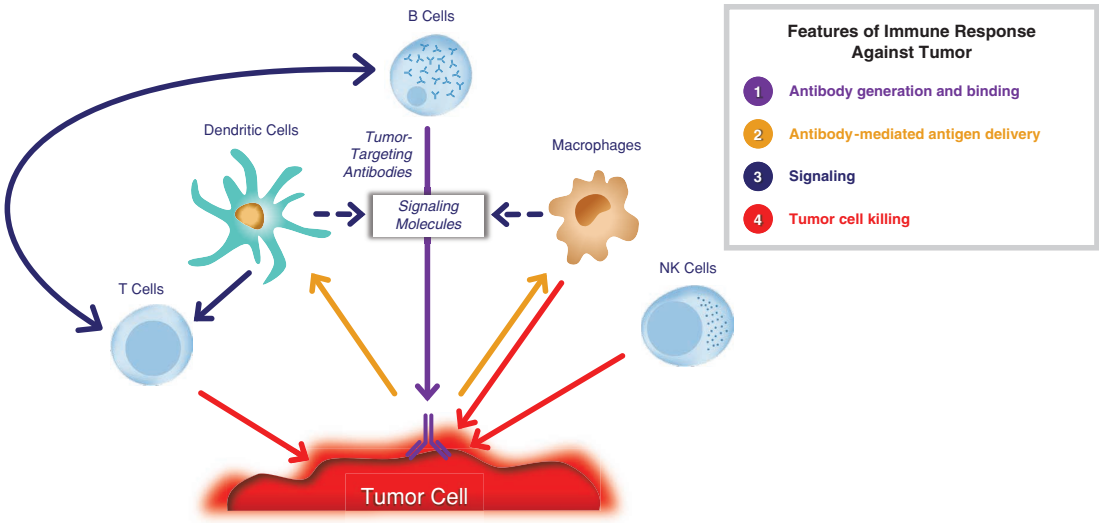
Cancer is a broad group of diseases in which cells divide and grow in an uncontrolled fashion, often spreading and forming malignancies that invade other parts of the body. According to the Centers for Disease Control and Prevention, cancer is the second leading cause of death in the United States with more than 600,000 deaths annually. In 2018, there were an estimated 1.7 million new cases of cancer diagnosed.

The most common methods of treating patients with cancer are surgery, radiation and drug therapy. Among cancer drug therapies, cancer immunotherapy, sometimes referred to broadly as immuno-oncology, is playing an increasingly important role. The goal of cancer immunotherapy is to direct a patient's own immune system to destroy tumor tissue. Though challenges remain, immuno-oncology products have enjoyed substantial commercial success.

The immune system

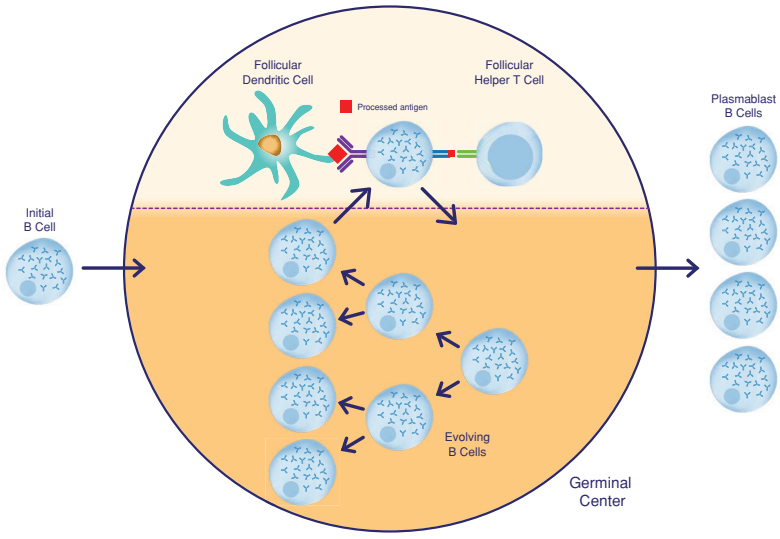
The immune system detects and defends the human body from invading pathogens and identifies and eliminates abnormal cells. It is comprised of two subsystems: the innate and adaptive immune systems. The innate immune system includes cells such as macrophages, dendritic cells and natural killer, or NK, cells. The adaptive immune system provides an evolving defense mechanism and includes B cells, which generate antibodies, and T cells, which are responsible for cell-mediated adaptive immunity.

Immune cells such as T cells, macrophages and NK cells can kill tumor cells directly. Other immune cells are involved in destroying tumor cells more indirectly, via shaping the immune response overall and by influencing and directing these killing cells. Signaling molecules, such as cytokines, which are made by many immune cells, play an important role in shaping immune responses, and some cells, such as dendritic cells and B cells, are involved in instructing T cells via cell-to-cell contacts. The antibodies made by B cells function by binding to the target or antigen they are generated against. Antibodies that bind to tumor cell targets play multiple roles in anti-tumor immune responses: to act as ‘‘signposts’’ for NK cells and macrophages to identify and kill tumor cells, to stimulate macrophages and dendritic cells and to enable them to instruct T cells how to target and kill tumor cells. Various players involved in the adaptive immune system and the innate immune system are illustrated in the figure below:



Affinity maturation and plasmablasts generation. B cells evolve during an active immune response to produce antibodies that bind to their targets with increasing specificity and affinity. Antigens are the targets, or portions of targets, that induce an adaptive immune response. The process through which B cell antibodies become better at recognizing and binding to their antigens is called affinity maturation. Affinity maturation takes place in tissues called germinal centers, which are located in lymph nodes and elsewhere, often near tumors. B cells enter the germinal centers, where they encounter types of dendritic cells and T cells, termed ‘‘follicular’’, that present to them processed antigens, including tumor antigens. The antigen presentation provides signals to drive both division of the B cell and mutation in its antibody protein sequences. The better the binding by its antibody to antigen, the stronger the signal a B cell receives to divide and evolve its antibody sequences. Eventually, through rounds of this process driven by antigen binding, groups of B cells with evolved, related antibodies, or clonal families, are generated and released from the germinal centers as B cells called plasmablasts. These cells can be found in the blood, and elevated numbers

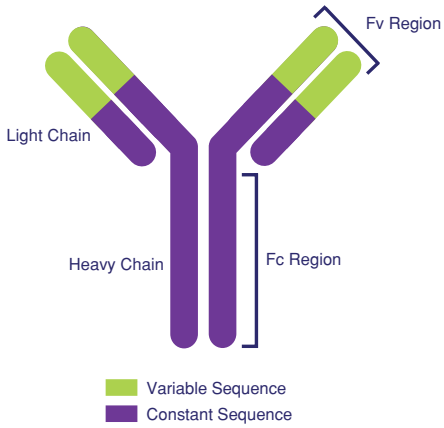
of plasmablasts indicate an active immune response. The affinity maturation process and plasmablast generation are illustrated in the figure below:



Affinity maturation is capable of evolving antibodies that can bind well to antigens of many different molecular types. It is thought that the immune system is capable of generating an antibody that can bind to virtually any antigen. Thus, plasmablasts and their antibodies may, in principle, provide a means to identify the targets of an active immune anti-tumor response.

Components of an antibody. An antibody belongs to one of five classes (IgG, IgM, IgA, IgE or IgD) and, for IgG or IgA, belong to a specific subclass, such as IgG1 and IgG2a. An antibody of the IgG class is a Y-shaped protein made of two copies each of two different protein chains, called the heavy chain and the light chain. The heavy chain and light chain each have variable sequences, tailored typically by affinity maturation, that differ substantially from antibody to antibody, as well as sequences that are nearly constant among IgG antibodies, differing slightly across IgG subclasses. The variable sequences of one heavy chain and one light chain together form a functional region called the variable, or Fv, region, and as a result, each IgG antibody has two Fv regions. The Fv region is the portion of an antibody that binds to its antigen. Because Fv regions are formed from variable sequences, they are typically different across antibodies. Another important functional region of an antibody is formed by the constant sequences of the two heavy chains together and is called the Fc region. The Fc region does not interact with antigens but rather interacts with components of the immune system, including immune system cells. It interacts with these cells through a family of receptors expressed by these cells called IgG Fc receptors, or FcRs. These interactions allow antibodies to generate signals in and to be used by immune cells. Different types of immune system cells typically express different subsets of FcRs. Due to sequence differences, Fc regions differ across species and need to be matched with species-specific FcRs for maximum potency. Fc regions also differ enough in sequence across IgG subclasses within a species to bind with different

potencies to different FcRs. The following is a visual representation of the components that make up an antibody:



Current immunotherapeutic approaches

First-generation immunotherapies included early cancer vaccines, immune stimulants such as interferon-α and interleukin-2, and other cytokine drugs. These early immunotherapies provided important validation of the immune system's potential to treat cancer but were hindered by significant limitations such as low response rates and side effects.

As the field of immuno-oncology has evolved, new cancer immunotherapy approaches have emerged, including cellular and immune cell-engaging therapies, immunomodulators, antigen-directed therapies and checkpoint inhibitors. These approaches have built upon advances in our understanding of immune system function and tumor biology to create sophisticated therapeutic interventions intended to promote and enhance the body's immune response to cancer. Checkpoint inhibitors in particular have shown promising therapeutic effect and have been incorporated into the current standard of care for many types of cancer. Despite this broad adoption, only a minority of patients demonstrate clinical benefit from checkpoint inhibition. For example, a meta-analysis of 12 published well-controlled trials of PD-1 or PD-L1 checkpoint inhibitors found that 2.2% of patients achieved complete responses compared with 0.5% of control patients. Partial responses were seen in 18.9% of treated patients compared to 8.9% of control patients. These results are indicative of a significant treatment gap, representing a large, unmet need for the majority of cancer patients who fail to obtain clinical benefit from currently available therapeutics.

Challenges in cancer immunotherapy drug discovery and development

The development of cancer immunotherapies typically requires the identification of a therapeutic target and generation of a molecule, often an antibody, to interact with that target. Historically, this discovery of targets for cancer immunotherapies has been driven by genetic sequencing and proteomic analysis of tumors as well as by hypotheses regarding how the binding to particular targets by antibodies, among other approaches, might impact disease. Once a target has been established, drug developers generate a human or humanized antibody to engage that target. Today, human antibodies are generated in multiple organisms, including humanized rodents, and in multiple *in vitro* discovery systems.

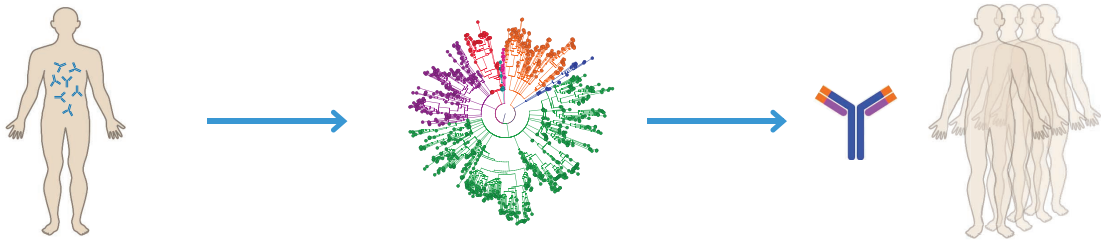
We believe this process suffers from certain limitations, including:

- focus on a limited set of potential targets relative to the full range of potential targets that exist;

- identifying traditional amino acid-based protein antigens, but generally not other classes of potential tumor targets;
- targets having potentially uncertain therapeutic relevance; and
- generating antibodies relying on non-human systems that interact with targets outside their physiological context over a relatively brief period of time.

Our Solution: The Atreca Drug Discovery Platform

We believe we may be able to address certain key limitations of the current immuno-oncology drug discovery paradigm by focusing on the common phenomenon driving clinical responses in cancer immunotherapy—an active human anti-tumor immune response. Our platform allows us to interrogate an active B cell response within an individual cancer patient to identify novel and relevant antibody-target pairs, which may enable us to develop antibody-based product candidates to treat large populations of patients with solid tumors. The figure below illustrates the overall concept of our drug discovery approach:

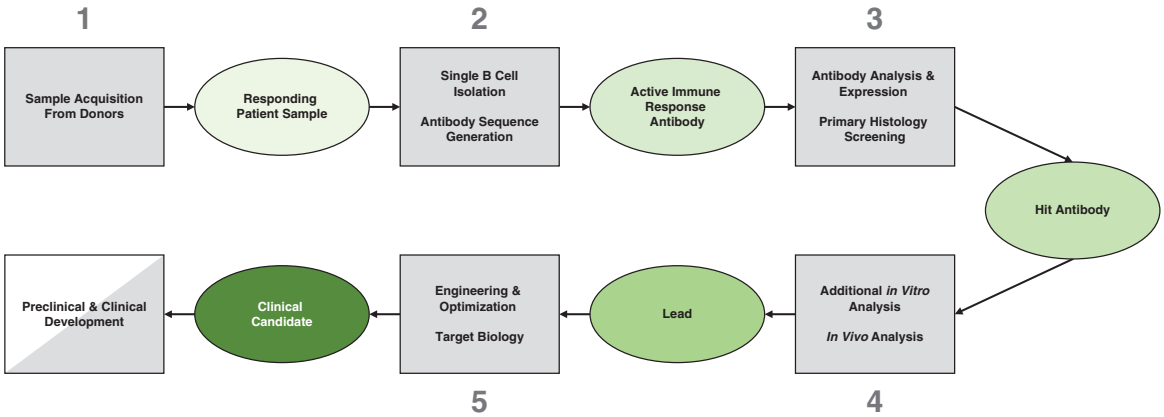


Responder with Anti-Tumor Immune Response

Interrogation of the Active B Cell Response via Atreca Discovery Platform

Novel Antibody-Target Pairs Yielding Product Candidates

We built our discovery platform to enable the pursuit of our open-aperture approach to drug discovery and development. The steps in our process are as follows:



1. Our discovery process begins by gathering blood samples, mostly through company-sponsored non-interventional clinical studies, from cancer patients before, during and after they undergo treatment, which can induce an active anti-tumor immune response. We identify those patients with clinically meaningful responses to therapy, defined as those that reach validated surrogate endpoints of complete or partial response, stable disease for six months, or long-term progression-free survival. For those patients, we then examine their samples for rare antibody-producing B cells called plasmablasts that are elevated during an active immune response. We have built a broad repository of over 1,200 samples from over 400 donors, representing over 25 different solid tumors.

2. If we determine plasmablasts are elevated in a particular sample, we then isolate single plasmablasts and sequence the co-expressed heavy and light chain antibody genes. To do this, we use our proprietary Immune Repertoire Capture® technology, which enables us to accurately reconstruct the original antibody sequences from a single B cell in parallel with other B cells in the sample.
3. We analyze these sequences and select antibodies to synthesize as recombinant proteins for further analysis in the laboratory. We generally select approximately one percent of the identified antibodies for wet-lab analysis. In this group, we identify hit antibodies that bind to tumor tissue from patients who are not the original source of the antibody and bind to tumor tissue preferentially over normal tissue.
4. We analyze the hit antibodies in a series of *in vitro* and *in vivo* assays, including multiple animal models. In some cases, we, alone or in the future with partners, may add, remove, or alter protein or other molecular components as we analyze the antibodies to generate relevant function, such as T cell engagement via a ''bispecific'' format. We refer to the antibodies or antibody-derived entities that we select for advancement from these assays as leads.
5. Finally, we convert some of these leads into potential clinical candidates by engineering them to enhance their binding, activity, stability, manufacturability and other properties. In parallel, we also conduct analyses to identify and characterize the antibody target.

   For additional information on our drug discovery platform and approach please see the section titled ''Business—The Atreca Discovery Platform''.

Key Attributes of our Discovery Platform

We believe our approach and discovery platform provide us with the following competitive advantages:

Our leads are derived from antibodies made by the human immune system. The antibodies from which we derive our leads have been generated by fully human immune systems in a fully human biological context. This suggests, and our experience confirms, that our antibodies will generally express well as recombinant proteins. They also have been generated through a process of affinity maturation and therefore typically have good affinity and specificity. Our antibodies are generated in human immune responses typically over many months, which we believe allows us to discover antibodies that would be difficult to obtain through shorter term, non-human immunization or *in vitro* strategies.

Our platform delivers potentially useful antibodies at a high rate and in a scalable fashion. The high rate at which our platform delivers potentially useful hit antibodies allows us to use multiple strategies and formats for generating pipeline assets, and provides the potential for multiple collaborations. This productivity also allows us to focus on the most promising hits and leads. Our hit generation process is also scalable and can continue to be expanded cost-effectively.

We are accessing a potentially large and underexploited tumor target space. Based on our current data as well as our understanding of the immune response, we believe we are accessing a potentially large and underexploited tumor target space. The human immune system recognizes a vast target space, which includes targets generated by phenomena such as variation in usage of parts of genes (exons), attachment of sugars (glycosylation) and other non-protein molecules, molecular complex formation, protein folding, expression and localization. We believe our differentiated platform and approach provide us access to yet-to-be explored opportunities.

Our platform identifies antibody-target pairs. Our discovery platform identifies antibodies binding to particular targets selected by the human immune response that generated the antibodies.

This is differentiated from traditional antibody drug discovery approaches, which require the separate development of an antibody directed to a predetermined target. We believe that our approach may provide an expedited path for discovering novel candidates that are more relevant for treating tumors.

Our platform delivers candidates that direct the immune system to tumor. Our approach is distinct from other strategies that interrupt signaling pathways between immune cells and tumor cells, such as checkpoint inhibitors, as well as other strategies that interrupt growth promoting pathways, such as HER2 and EGFR. We believe that our candidates can direct immune responses against tumors via multiple strategies, with different antigen-target pairs having different utility depending upon the format used.

Our product candidates have the potential to treat large populations of patients across multiple tumor types. In contrast with personalized therapies, our platform delivers candidates that bind to tumor from multiple patients beyond the donor patient. Our data suggest that many of these shared tumor targets will be expressed in multiple solid tumor types, increasing the potential range and utility of our treatments.

We believe that the significant time and capital we have invested in developing, refining and applying our differentiated discovery platform have provided us first-mover advantages and created barriers to entry. For example, establishing our non-interventional clinical studies to obtain patient samples, enabling longitudinal analyses, required approximately 1 to 2 years. We built our bioinformatics expertise in assembling and analyzing our antibodies over seven years of operations. Our hit antibody generation process has been enhanced to deliver hits at a high rate, has already generated over 1,400 hit antibodies and is supported by a growing intellectual property portfolio. Additionally, our investments of capital and time to build industrialized wet-lab and supporting bioinformatics capacity across our platform, including the time required to identify and hire very qualified personnel, were substantial.

Our Multiple Approaches for Drug Development

We classify potential leads based on mechanism of action, rather than by target. We are currently pursuing programs with distinct mechanisms of action, including:

Mechanism of Action	Description	Current Status
Driver Antigen Engagement	Tumor target binding by antibody activates the innate and adaptive immune systems to modify the tumor microenvironment and destroy tumor	ATRC-101 preclinical data demonstrate this mechanism of action and we are working to identify other antibody-target pairs that are active via this mechanism of action
T Cell Engagers	‘‘Bispecifics’’ link tumor-targeting domains to domains that bind to T cells, simultaneously activating and directing T cells to the tumor for cell killing via T cell-dependent cellular cytotoxicity (TDCC)	Approximately 6% of our hit antibody Fv regions test positive in a single bispecific format in TDCC assays (>375 hit antibodies analyzed)
Directed Killing	With antibody-dependent cellular cytotoxicity (ADCC) or antibody-dependent cellular phagocytosis (ADCP), antibodies direct innate immune cells to kill tumor upon binding to them	Approximately 17% of our hit antibodies test positive in ADCC or ADCP assays (>375 hit antibodies analyzed)
Toxin-Conjugates (ADCs)	Cellular toxins are conjugated to internalizing tumor-targeting antibodies to generate cytotoxicity	Approximately 2% of our hit antibodies test positive in internalization assays (>700 hit antibodies analyzed)

Our Lead Candidate: ATRC-101 for the Treatment of Solid Tumors

Overview

ATRC-101 is a monoclonal antibody derived from an antibody identified using our discovery platform. We believe that ATRC-101 may have broad potential as an immunotherapeutic agent in a range of solid tumors. ATRC-101 reacts *in vitro* with a majority of human ovarian, non-small cell lung, colorectal and breast cancer samples from multiple patients. It has also demonstrated robust anti-tumor activity as a single agent in multiple preclinical syngeneic tumor models, including one model in which PD-1 checkpoint inhibitors typically display limited activity. ATRC-101 has also demonstrated preclinical activity in combination with other immunotherapeutics, including PD-1 checkpoint inhibitors. Both the mechanism of action of ATRC-101, which we refer to as Driver Antigen Engagement, and its target appear unlike those of other anti-tumor antibodies that have been or are currently in clinical development. In histology studies, we did not observe binding above background levels across a range of normal human tissues. Additionally, in repeat-dose safety studies in both mice and non-human primates, we did not observe a safety signal.

Before we can receive marketing approval for ATRC-101 from the FDA or other regulatory authorities, we must complete preclinical studies and then conduct extensive clinical trials to demonstrate the safety and efficacy of ATRC-101 in humans. We anticipate filing an IND for ATRC-101 in late 2019 and launching a Phase 1b clinical trial in patients with solid tumors in early 2020. Assuming we observe an acceptable safety profile, we then anticipate dosing ATRC-101 in combination with a PD-1 checkpoint inhibitor. ATRC-101 demonstrates the ability of our platform to generate antibody candidates with novel targets and mechanisms of action.

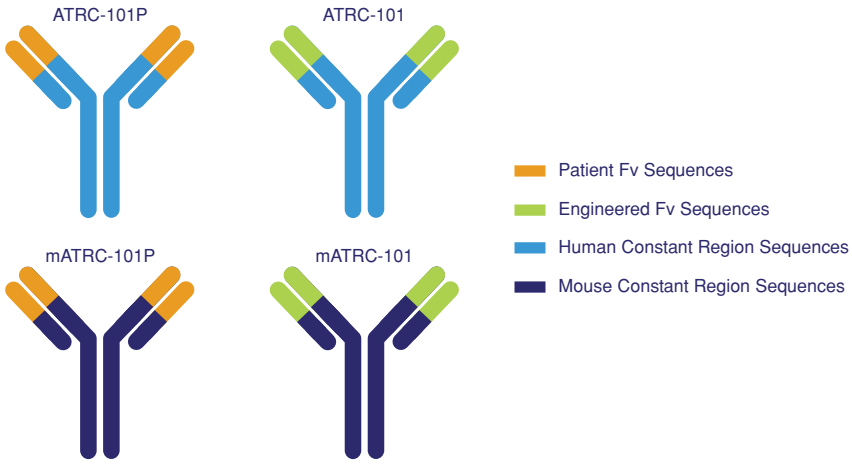
We own worldwide rights to ATRC-101 and have filed multiple U.S. provisional patent applications relating to ATRC-101 and other variants. We intend to submit a nonprovisional patent application in the first quarter of 2020.

Derivation of ATRC-101

ATRC-101 is the product candidate antibody that incorporates engineered versions of the Fv regions of an antibody found through our discovery platform by analyzing a sample from a lung adenocarcinoma patient who had benefited from immunotherapy. In order to generate ATRC-101, we made changes to the protein sequence of the antigen-binding Fv portion of the original patient antibody, and we grafted this modified Fv onto constant region sequences of the IgG1 subclass that have been used in other, successfully developed antibody drugs. We made these changes to the Fv portion to increase the antibody's drug-like qualities, such as stability and manufacturability, to reduce the risk of potential immunogenicity and to enhance its activity. The antibody we generated from these changes is our product candidate, ATRC-101.

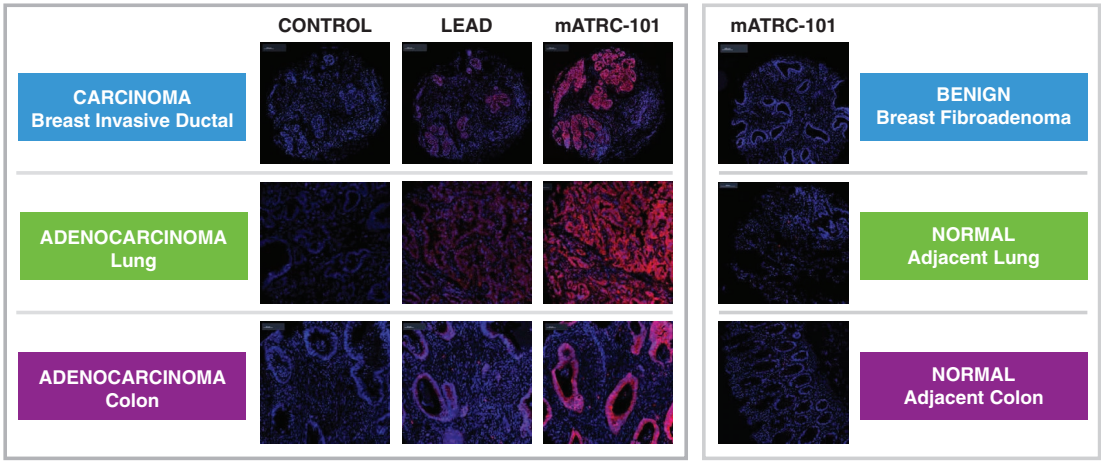
ATRC-101P is a fully human antibody with the patient's original and non-engineered Fv sequences, which was used in certain preclinical studies. Also during preclinical work, versions of ATRC-101 and ATRC-101P were used in which mouse constant region sequences were substituted for human constant region sequences. We refer to these antibodies as mATRC-101 and mATRC-101P. This substitution did not change the function of the Fv region, but it permitted a better evaluation of ATRC-101 and ATRC-101P in preclinical studies. For example, we usually made this substitution for syngeneic mouse tumor model studies, to enable better interaction of the antibody with FcRs on mouse immune cells, and in histological analyses on human tissue, to reduce

background signal. The various versions of the antibody that were used in preclinical studies are illustrated below:



Human tumor reactivity

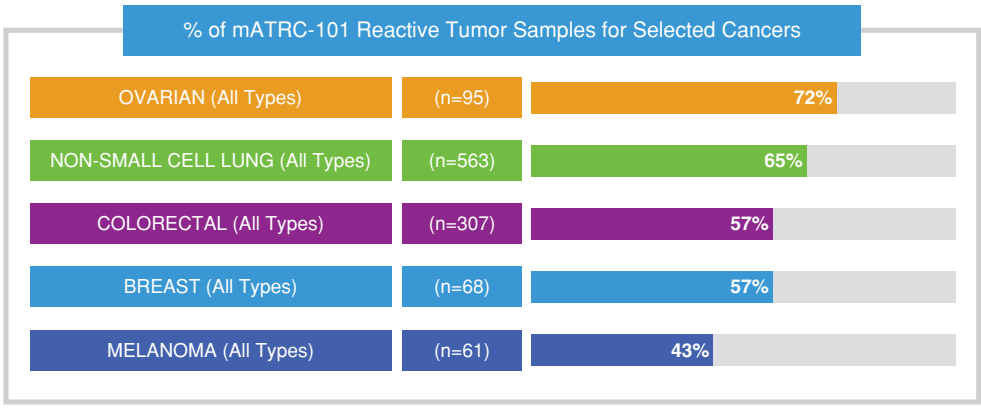
We have tested the ability of ATRC-101 (as mATRC-101) to bind to its target in a range of tumor types derived from many different patients. Within tumors, mATRC-101 binds predominantly to tumor cells and not stroma or immune cells. Additionally, we have not observed binding above background levels in a panel of 30 normal human tissues, as assessed by an independent pathologist. In the following images, the reactivity of mATRC-101P (“Lead”; second column) and mATRC-101 (third column) relative to a control antibody (first column) in multiple types of tumor tissue (carcinoma) is illustrated (red reflects tissue reactivity). Furthermore, the lack of reactivity of mATRC-101 in normal or benign tissues corresponding to those carcinomas is also illustrated.



Example of mATRC-101 reactivity in human tumor and adjacent non-tumor tissue

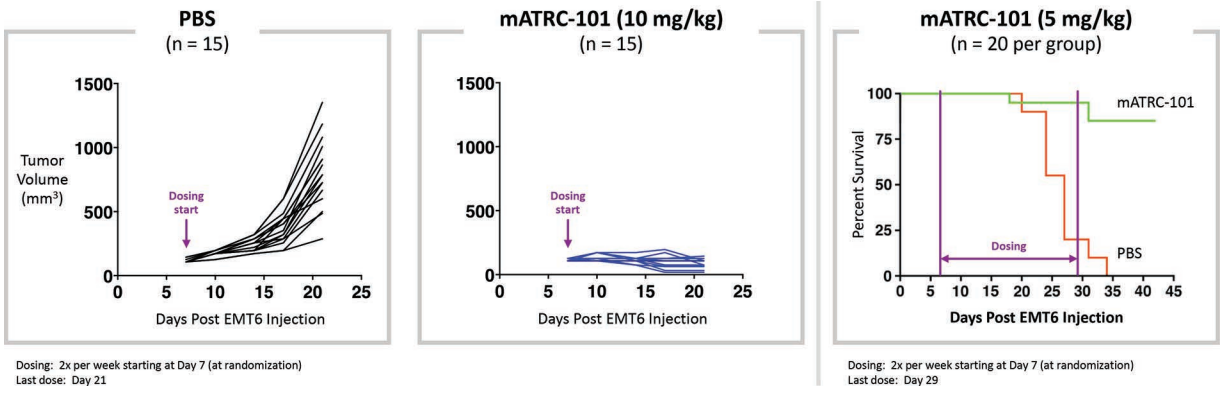
Profiling the reactivity of mATRC-101 has shown that the antibody recognizes a tumor target in non-autologus tumor tissue. mATRC-101 also reacts across multiple tumor types. Across a set of over 1,000 human tumor samples, mATRC-101 had moderate or greater reactivity (score of ≥ 2 on a scale of 0-4 and with ≥ 40% of tumor cells positive) to tumors in 72% of all ovarian cancer, 65% of all non-small cell lung cancer, 57% of all colorectal cancer, 57% of all breast cancer and 43% of

all melanoma. Reactivity was higher in particular subsets of these cancers; for example, over 80% of serous cystadenocarcinoma ovarian cancer tumors were reactive.



Activity in tumor models

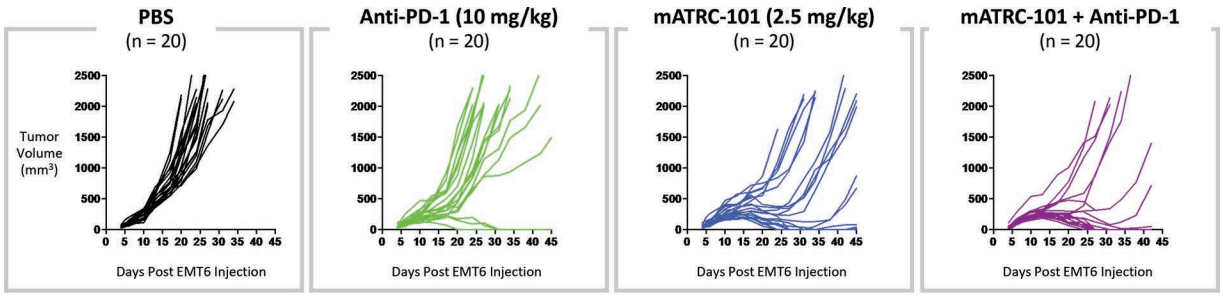
ATRC-101 (as mATRC-101) has demonstrated potent anti-tumor activity in the EMT6 mouse model. In contrast, PD-1 checkpoint inhibitors have only modest efficacy in this model, which is considered a model of the ‘‘T cell-excluded’’ tumor phenotype in patients. In this syngeneic tumor model, in which mice possess fully intact and functional immune systems, cancer cells were injected and tumors were allowed to grow before the mice were dosed with mATRC-101. At a dose of 10 mg/kg twice per week, tumor growth was completely suppressed and the tumors eliminated, with a significant effect on survival at a dose of 5 mg/kg twice per week compared to control (phosphate buffered saline, or PBS). In the first two panels below, the mice were sacrificed on day 21.



Anti-tumor activity and survival benefit of mATRC-101 in EMT6 mouse model

In a direct comparison, mATRC-101 dosed at 2.5 mg/kg twice per week had more anti-tumor activity in the EMT6 model than did an anti-PD-1 antibody dosed at 10 mg/kg twice per week.

Furthermore, dosing an anti-PD-1 (10 mg/kg) antibody with mATRC-101 (2.5 mg/kg) enhanced the anti-tumor activity observed.



Anti-PD-1: Dosing 2x per week x 2 weeks (last dose Day 21)
mATRC-101 Antibody: Dosing 2x per week x 3.5 weeks (last dose Day 28)

mATRC-101 anti-tumor activity is enhanced by dosing with an anti-PD-1 antibody

Additionally, although we have more limited data, we have observed anti-tumor activity following mATRC-101 administration in the CT26 mouse model. In the CT26 model, which is differentiated from the EMT6 model and in which PD-1 and CTLA-4 checkpoint inhibitors can display more anti-tumor activity than in the EMT6 model, tumor growth was significantly suppressed ($p < 0.01$) by dosing with mATRC-101, with statistically significant ($p < 0.01$) positive effects on survival.

Target of ATRC-101

We have identified the target of ATRC-101 as a ribonucleoprotein (RNP) complex. ATRC-101 binds to target reconstituted *in vitro* using a single recombinant protein, polyadenylate-binding protein 1, and *in vitro* transcribed poly(A) RNA. The target components were initially identified through experiments involving immunoprecipitation and mass spectrometry. ATRC-101 appears to bind selectively to its target in tumor tissue despite the fact that the target components are present widely across normal tissues.

Summary of safety studies

Normal tissue binding. In initial studies, we assessed binding of ATRC-101 (using mATRC-101) in a range of normal human tissues using immunohistochemistry. Using a concentration of antibody that readily detected its target in tumor tissue, we did not observe a definitive signal across a range of 30 different normal human tissues, including cerebrum, cerebellum, heart, lung, liver, kidney, pancreas, stomach, spleen and salivary gland.

In vivo *safety assessments.* In initial studies, ATRC-101 was administered in four repeat doses over four weeks to non-human primates. Repeat doses of up to 100 mg/kg were well-tolerated, and no definitive safety signals were observed across a range of parameters including cytokines in the serum, which were not influenced by ATRC-101 dosing. Similarly, in initial studies in tumor-bearing (EMT6 model) and normal mice, repeat dosing of up to 30 mg/kg for five doses over 15 days with both ATRC-101 and mATRC-101 were well-tolerated, with no definitive safety signals observed across a range of parameters, including serum cytokine levels.

In vivo *studies to define cellular mechanism of action*

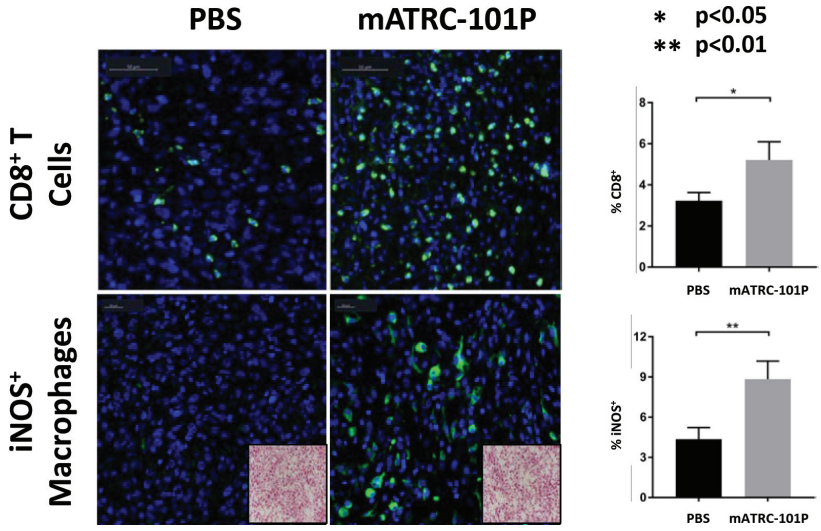
We initially select Fv regions of the antibodies identified from cancer patients using our discovery platform based on their ability to recognize tumor tissue selectively and not based on any

presumption of their targets or mechanisms of action. Our investigations into the mechanism of action of ATRC-101 (as mATRC-101P) revealed that:

- Dosing with mATRC-101P leads to
  - Remodeling of the tumor microenvironment;
  - Destruction of neoplastic cells in tumor tissue; and
  - Induction of an ''immune memory'' against the tumor.

- Activity of mATRC-101P *in vivo* requires
  - Interactions of its Fc region with innate immune cell FcRs;
  - A functional adaptive immune system; and
  - $CD8^+$ T cells.

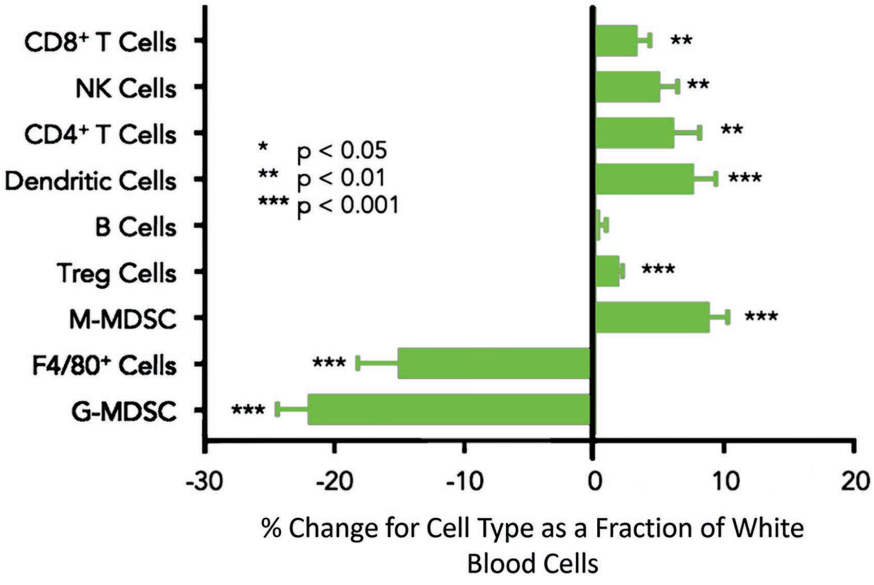
Remodeling of the tumor microenvironment. mATRC-101P leads to a statistically significant increase in $CD8^+$ T cells, also referred to as cytotoxic T cells, and M1-polarized macrophages (as measured by inducible nitric oxide synthase, or iNOS, expression) in tumors from treated animals, as assessed by quantitative immunohistochemistry. This is shown in the image below with mATRC-101P demonstrating increases in $CD8^+$ T cells and M1-polarized macrophages (green) in the tumor microenvironment. The presence of both of these cell types indicates a shift to a more anti-tumorigenic tumor microenvironment. In the figure below, the insets within the lower quadrants are a standard H&E stain of the tumor tissue.



Changes in $CD8^+$ T cell and M1-polarized ($iNOS^+$) macrophages in EMT6 tumor in response to mATRC-101P

We confirmed, using quantitative analysis via flow cytometry of relative levels of different types of immune cells found in tumors from animals treated with mATRC-101P, that mATRC-101P dosing resulted in broad changes to the immune cell population in the tumor microenvironment. In addition to significant increases in $CD8^+$ T cells in tumors relative to the total immune cell population, as was shown in the figure above, there were also increases in the relative levels of other immune cells associated with an anti-tumorigenic microenvironment, such as NK cells, $CD4^+$ T cells as a group, and dendritic cells. Relative increases were also observed in other immune cell types typically viewed as having immunosuppressive roles such as regulatory T cells (Treg) and monocytic myeloid derived suppressor cells (M-MDSCs). The largest changes in the microenvironment caused by

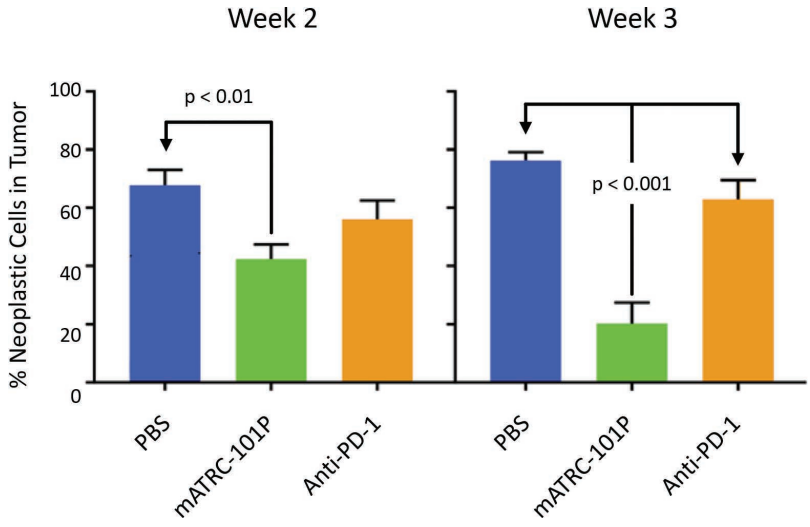
mATRC-101P treatment were significant decreases in the fraction of immune cells represented by F4/80$^+$ cells, also known as tumor-associated macrophages, and granulocytic myeloid derived suppressor cells (G-MDSCs), both of which are thought to be immunosuppressive and pro-tumorigenic. These broad changes involving cells from both the innate and adaptive immune system point to significant shifts in the constitution of immune cells in the tumor microenvironment, which we believe contribute to the activity seen in multiple animal tumor models.



Changes in selected white blood cell populations in EMT6 tumor microenvironment induced by mATRC-101P

Destruction of neoplastic cells in tumor tissue. These changes in the tumor microenvironment are also associated with killing fast-growing (neoplastic) cells, rather than other causes of tumor shrinkage. As shown in the figure below, dosing with mATRC-101P, relative to control (PBS), results in a statistically significant decrease in the percentage of neoplastic cells measured at week 2 in tumors in the EMT6 model. Dosing with mATRC-101P also results in a statistically significant

decrease in the percentage of neoplastic cells measured at week 3, relative to both PBS and dosing with an anti-PD-1 antibody.

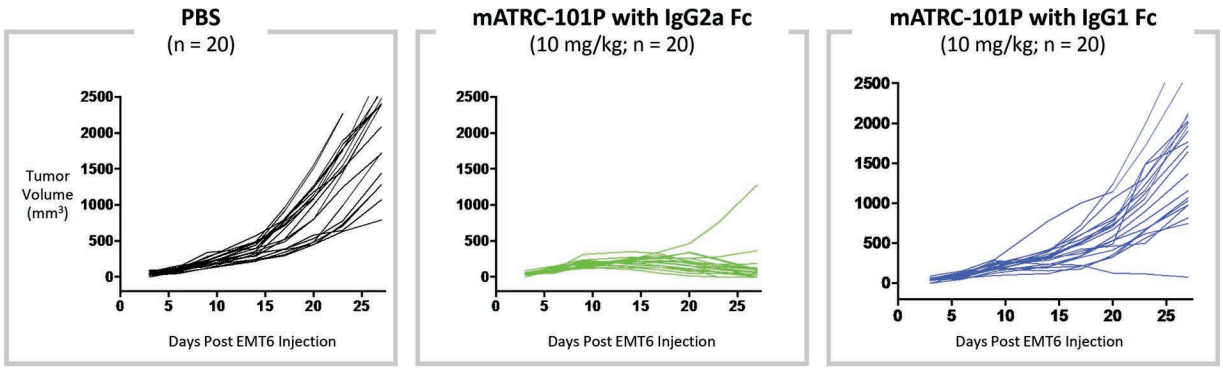


Changes in neoplastic cells in EMT6 tumor in response to treatment with mATRC-101P and anti-PD-1 antibody

Induction of an "immune memory" against the tumor. Mice implanted with EMT6 cells whose tumors had been eliminated following dosing of 5-20 mg/kg with mATRC-101P as a single agent showed resistance to developing new tumors when re-implanted with EMT6 at a different site approximately three weeks after the last dose. This washout period is believed to be sufficient for the levels of mATRC-101P to be reduced to negligible amounts. Of 31 mice re-challenged with EMT6 tumor cells without additional treatment, 30 did not develop tumors over a five-week observation period, compared to the control group where all 20 of the animals did develop tumors during the same time period. These results are consistent with the development of immune memory, a property that arises from active engagement of the adaptive immune system.

Requirement for interactions with innate immune cell FcRs. Activity of mATRC-101P requires interaction of its Fc region with FcRs on innate immune cells (such as dendritic cells and macrophages). First, if a version of the Fc region is used on mATRC-101P that is mutated so that it binds poorly to signaling FcRs on immune cells (N297A), then anti-tumor activity is dramatically decreased. Second, as shown in the diagram below, if we use a mouse IgG1 version of the Fc region, which does not bind well to two types of signaling FcRs found only on innate immune cells is used on mATRC-101P, instead of an IgG2a version, which binds well to these FcRs, then anti-tumor activity is largely eliminated. Thus, the anti-tumor activity is dependent upon the Fc region of the antibody interacting with FcRs on innate immune cells. This mechanism of action is differentiated

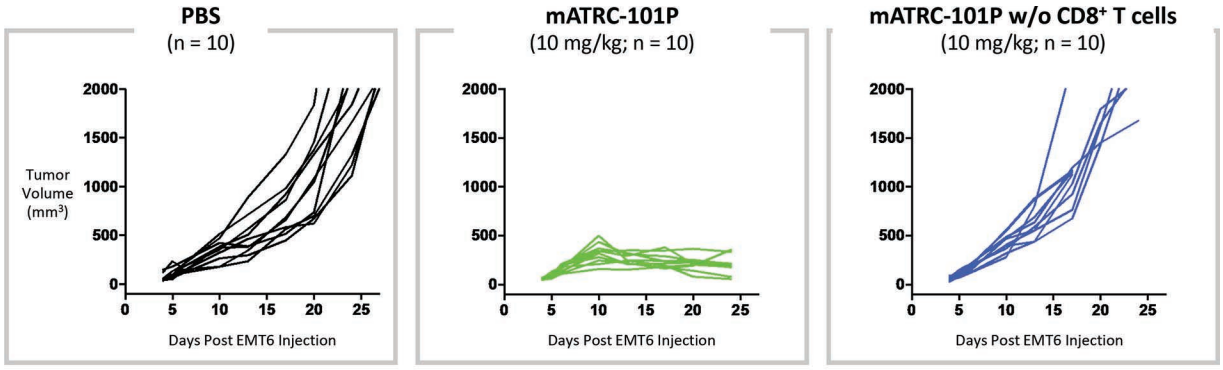
from those of checkpoint inhibitors and related compounds that target receptor-ligand pairs that are involved in the regulation of immune cell activity.



Dependence of anti-tumor activity of mATRC-101P on Fc region

Requirement for a functional adaptive immune system. mATRC-101P does not have activity in the EMT6 model if the mouse strain used has a dysfunctional adaptive immune system. The EMT6 tumor model was run in mice that lacked T cells (nude mice), and which therefore lacked a functional B cell response as well. In other words, these mice lack a functional adaptive immune system but otherwise have an intact innate immune system. Activity of mATRC-101P was not observed in these mice.

Requirement for CD8$^+$ T cells. Further evidence for involvement of the adaptive immune system comes from the dependence of mATRC-101P on cytotoxic CD8$^+$ T cells. Dosing of mATRC-101P in combination with an anti-CD8 antibody, which depletes CD8$^+$ T cells, completely blocks anti-tumor activity in the EMT6 tumor model as shown in the figure below.



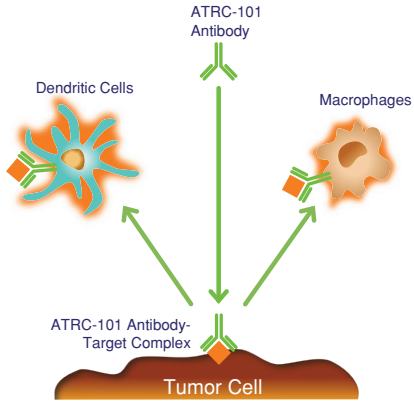
Dependence of anti-tumor activity of mATRC-101P on cytotoxic CD8$^+$ T cells

ATRC-101 mechanism of action: Driver Antigen Engagement

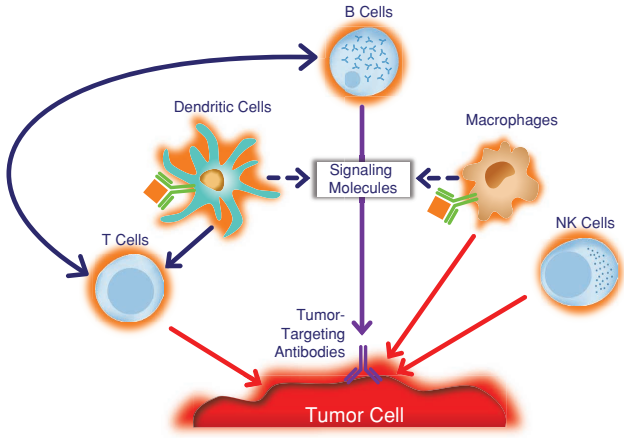
Based on our detailed *in vivo* studies of mATRC-101P, we believe that we have identified a novel mechanism of action for an oncology therapeutic, which we term Driver Antigen Engagement, involving both the innate and adaptive immune systems. Activation of the innate immune system

appears local to the tumor as we observed no significant changes in circulating levels of cytokines. Furthermore, the requirement for an adaptive immune system differentiates the mechanism of ATRC-101 from those of other antibodies that rely on the innate immune system for activity, for example NK cell-mediated ADCC (antibody-dependent cellular cytotoxicity).

Driver Antigen Engagement. After systemic administration, we believe ATRC-101 will find and bind to its tumor-specific target, facilitating the delivery of the target to tumor-resident innate immune cells via their FcRs, which then will activate these cells. Activated innate immune cells are thought to change their behavior and to secrete cytokines and other inflammatory signaling molecules, which together lead to anti-tumorigenic changes in the tumor microenvironment. These activated innate immune cells and the modified tumor microenvironment then will promote an adaptive immune response involving at least cytotoxic $CD8^+$ T cells, which attack and destroy the tumor cells. Thus, this target, a driver antigen, drives a tumor-destroying immune response involving both innate and adaptive arms of the immune system. Driver antigens have been observed in the context of autoimmune disease, in which normal tissues are attacked by the immune system, initially using specific antigens present in healthy tissue (for example, citrullinated proteins in rheumatoid arthritis). The image below depicts ATRC-101's Driver Antigen Engagement mechanism of action:



Step 1: Target recognition and local activation of the innate immune system



Step 2: Activation of the adaptive immune system and tumor killing

Clinical trials

We believe that ATRC-101 has the potential to become an important treatment for solid tumors based on several factors: its broad reactivity across different types of human solid tumor samples; its differentiated mechanism of action; its potent preclinical anti-tumor activity; and its safety profile observed to date in preclinical studies. We intend to file an IND application with the FDA for ATRC-101 in late 2019 and, subject to authorization from the FDA, initiate a Phase 1b clinical trial in patients with solid tumors in early 2020. The FDA has communicated to us that, while it reserves the right to make final determinations upon reviewing our IND application, it is supportive of our proposed approach towards preclinical safety assessments and overall clinical trial design, including starting dose.

We expect our initial trial will be an open-label, dose escalation, monotherapy trial with an adaptive 3+3 design in which we will enroll patients with tumor types limited to those for which ATRC-101 demonstrated a reactivity of at least 50% in preclinical studies, initially: ovarian, non-small cell lung, colorectal and breast cancers. Major objectives for the trial are to determine a maximum

tolerated dose or recommended dose for future studies and to characterize the safety of ATRC-101 in enrolled subjects. Other goals include characterization of potential biomarkers and initial clinical activity. We will retrospectively analyze target expression on subject tumor tissue with a prototype *in vitro* diagnostic test currently under development.

Assuming ATRC-101 can be dosed safely as a single agent, we plan to expand this initial trial to include dosing ATRC-101 in combination with a PD-1 checkpoint inhibitor in patients who do not respond to checkpoint inhibitors.

Our Lead Generation Programs

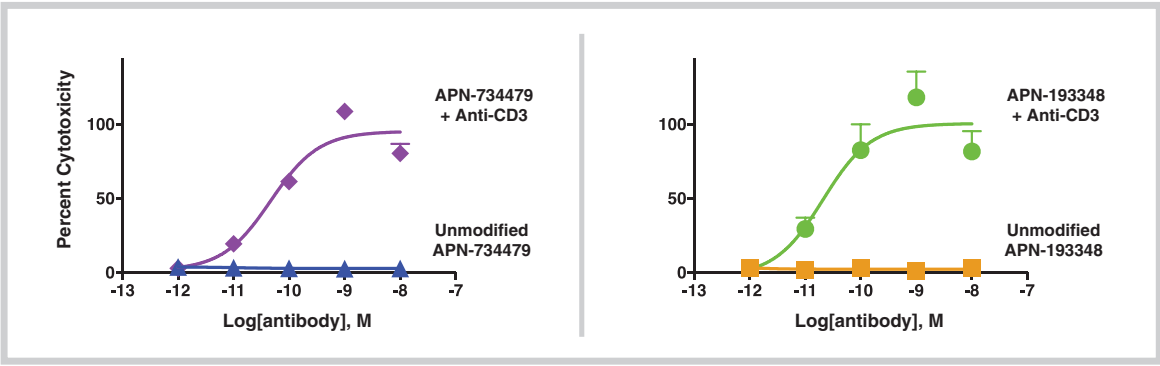
Driver Antigen Engagement

We believe the mechanism of action of ATRC-101 involves systemic delivery of an agent that causes remodeling of the tumor microenvironment and the destruction of tumor cells via both the innate and adaptive immune systems. With our knowledge of the target of ATRC-101, we believe other targets may exist that are capable of driving such activity when bound by an antibody. We are therefore working to discover and develop distinct antibodies binding other targets that utilize this novel mechanism of action.

T cell engagers

Our hit antibodies are defined by their ability to react with non-autologous tumor tissue preferentially over normal adjacent tissue. In principle, therefore, their Fv regions can be used to direct cells of the immune system, such as T cells, to tumor cells. Furthermore, if the T cells can be activated when they are brought to the tumor cell, then tumor cell killing can occur. This ‘‘T cell engagement’’ is a well-validated approach utilized in both approved and clinical stage products. In this approach, tumor-targeting domains derived from antibodies are linked to protein domains that typically bind to a particular protein (CD3) on the surface of T cells, both bringing the T cell to the tumor cell while simultaneously activating it. These antibody-derived biologics are sometimes termed ‘‘bispecific’’, in that they are capable of binding to two different targets: the tumor target and the T cell target.

We are pursuing the discovery and development of bispecifics using our proprietary collection of novel tumor-targeting antibodies. To screen for the potential utility of an antibody-target pair, we first use antibody sequence information to create a bispecific T cell engager in one or more formats. We then test this bispecific for activity *in vitro* in an industry-standard assay for T cell dependent cellular cytotoxicity (TDCC). In this assay, primary human T cells isolated from a patient blood sample are co-incubated with tumor cells. The bispecific, in which the antibody-derived portion from our hit library is known to interact with the tumor cell, is added into the assay, and tumor cell killing is assessed over time. In this assay, a number of our hit antibodies converted into bispecifics display significant tumor cell killing activity. Our current data suggest that, using a single bispecific format, approximately 6% of our hit antibody Fv regions test positive in TDCC assays (>375 hit antibodies analyzed). In the figures below, two antibodies that have been converted into a bispecific T cell engager format display tumor cell killing activity, with approximately 100% cytotoxicity in the assay observed at a low nanomolar concentration of each bispecific, while the unmodified antibodies do not show cytotoxic activity in the assay at any concentrations tested.



Measurement of cytotoxic activity in TDCC assay

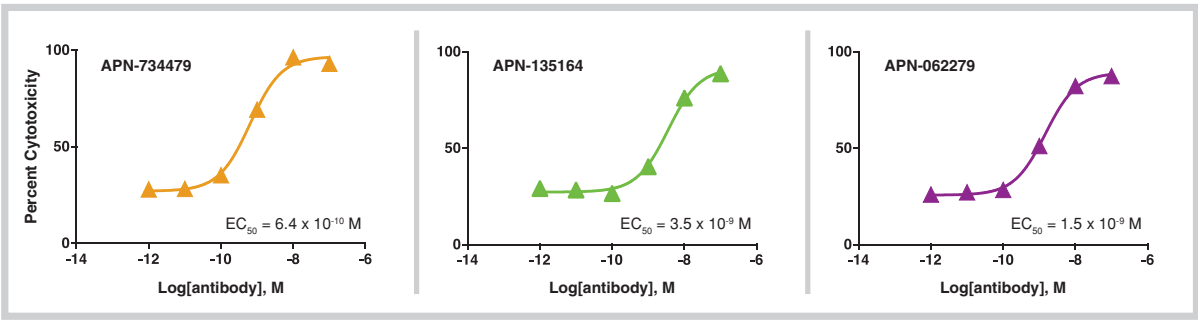
In the future, we may selectively pursue partnerships to access additional bispecific formats, technologies and know-how in order to discover and develop T cell engagers based on novel antibody-target pairs discovered using our platform.

Directed killing

Antibody-Directed Cellular Phagocytosis (ADCP) and Antibody-Directed Cellular Cytotoxicity (ADCC) are two mechanisms of action through which antibodies that bind to tumor cells can direct innate immune system cells to kill them. In both cases, the Fc portion of the antibody interacts with particular FcRs of innate immune system cells to mediate the killing. In ADCP, macrophages/ monocytes engulf tumor cells bound by antibodies, while in ADCC, NK cells use particular cellular machinery to kill antibody-bound tumor cells. Both ADCP and ADCC are validated mechanisms of action that contribute to the anti-tumor activity observed for marketed antibody drugs.

We have established *in vitro* assays for ADCC and ADCP activity and use these assays to screen our antibodies for those capable of driving tumor cell killing via ADCC and ADCP mechanisms. In these assays, a number of our hit antibodies display tumor cell killing activity. Our current data suggest that approximately 17% of our hit antibodies test positive in ADCC or ADCP assays (>375 hit antibodies analyzed). In the figure below, cell killing (cytotoxicity) activity in an ADCC assay as a function of antibody concentration is illustrated for three hit antibodies.

Given that ADCC and ADCP are thought to be more effective when a greater number of targets are bound on the surface of a tumor cell, we believe there may be utility in utilizing multiple antibodies from our hit library in combination, as separate entities or in bispecific formats, in order to drive activity via this mechanism of action. In the future, we may pursue partnerships to access particular technologies and know-how to discover and develop candidates with these mechanisms of action.



Measurement of Cytotoxic Activity in ADCC Assay

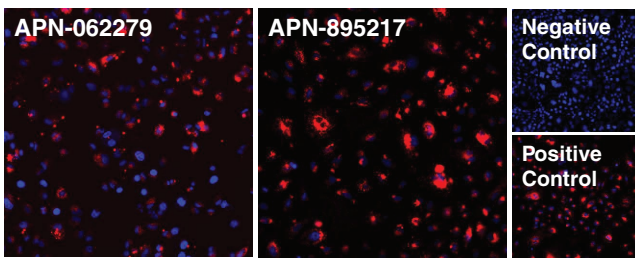
Toxin-conjugates (ADCs)

Cellular toxins can be conjugated to certain antibodies to generate cytotoxicity against tumor cells expressing their targets. Such antibody-drug conjugates (ADCs) require antibodies that internalize upon binding to their target. Once antibodies internalize, they also must be delivered to an intracellular compartment suitable for release of the toxin into the cell.

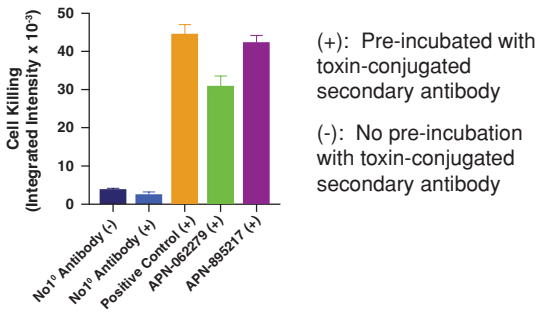
We have established *in vitro* assays to assess first whether our hit antibodies can internalize once they bind to their targets on tumor cells, and if they internalize, then whether they can deliver a toxin to an internal compartment such that the toxin is released to kill the cells. In our internalization assay, our current data suggest that approximately 2% of hit antibodies test positive (>700 hit antibodies analyzed). Our second assay measures cytotoxicity as driven by release of toxin bound to an internalized antibody (a cytotoxic payload). In this assay, internalizing hit antibodies are pre-incubated with a second antibody that is both capable of binding the internalizing antibody and has a conjugated cytotoxin. The pre-incubated antibody mixture is then incubated with tumor cells for a period of time, and cell killing is measured.

The left portion of the figure below illustrates the activity of two hit antibodies in the internalization assay (red signal), relative to positive and negative control antibodies. These two internalizing hit antibodies can also deliver a cytotoxic payload after internalization, as measured in the cytotoxicity assay, which is illustrated in the right portion of the figure below. The data indicate the amount of cell killing at the end of the period of incubation with tumor cells.

Antibody Internalization into Tumor Cells



Cytotoxic Payload Delivery



In the future, we are likely to pursue partnerships to access technologies and know-how to discover and develop product candidates with an ADC mechanism of action based on novel antibody-target pairs discovered using our platform.

Future Programs

Given our data in these programs, we believe that we will be able to exploit our growing library of novel antibodies in order to develop product candidates with additional distinct and compelling mechanisms of action for tumor destruction beyond those described above. We intend to continue to build out a pipeline of novel product candidates targeted at a range of solid tumors to advance into clinical development. We are currently pursuing numerous potential partnership opportunities, and anticipate entering into a strategic drug discovery partnership as early as 2020, and to file an IND application for a second product candidate in 2021.

Unmet Need in Solid Tumors Included in the ATRC-101 Phase 1b Clinical Trial

Our tissue profiling data and the unique mechanism of action of ATRC-101 suggest that it has potential to provide therapeutic benefit to patients with a wide range of solid tumors. These tumors include highly prevalent tumors with significant unmet need.

Tumor	Expected New Cases in 2018	Expected Deaths in 2018
Ovarian	22,240	14,070
Lung	234,030	154,050
Colorectal	140,250	50,630
Breast	266,120	40,920

Ovarian cancer

Surgery and cytotoxic chemotherapies are widely used to treat ovarian cancer; however, the five-year survival rate has improved only marginally from 42.2% in 1995 to 47.6% in patients diagnosed between 2009 and 2015. Treatment of patients with advanced, relapsed ovarian cancer with a combination of gemcitabine and carboplatin increased the progression free survival to 8.6 months from 5.8 months with carboplatin alone but had no significant effect on overall survival. Drugs such as olaparib and rucaparib that inhibit poly(ADP-ribose) polymerase, or PARP, have recently been approved based on progression free survival in the maintenance setting of up to 15.5 months. Immuno-oncology therapies, however, have to date had little impact in ovarian cancer.

Lung cancer

Lung cancer is typically divided into two groups based upon the appearance of the tumor cells—non-small cell lung cancer and small cell lung cancer. Non-small cell lung cancer accounts for approximately 80% to 85% of lung cancer cases. The treatment paradigm for non-small cell lung cancer has significantly changed over the past few years. Previously patients were primarily treated with radiation therapy or combinations of cytotoxic drugs. Recent developments have led to the development of targeted therapies based on alteration in the genes for epidermal growth factor receptor, or EGFR, and anaplastic lymphoma kinase gene, or ALK. Up to two thirds of advanced non-small cell lung cancer patients who are ineligible for or resistant to treatment with EGFR or ALK targeted therapies have tumors that express PD-L1 and are candidates for checkpoint inhibitor therapies, which lead to significant improvements in progression free survival and overall survival compared to standard chemotherapy. Despite the availability of these numerous therapies, the prognosis remains poor, with overall five-year survival for all patients diagnosed with non-small cell lung cancer as low as 23%.

Colorectal cancer

Colorectal cancer is the second leading cause of cancer deaths in the United States. Approximately 35% of patients with a new diagnosis of colorectal cancer will die within five years. Treatment of colorectal cancer typically involves the use of cytotoxic chemotherapy and radiation. Treatment with anti-EGFR antibodies, typically in combination with chemotherapy, has been shown to be effective in a subset of colorectal cancer patients; however, over 40% of patients do not respond to anti-EGFR antibody therapies and of those that do, resistance often develops. Pembrolizumab, nivolumab and a combination of nivolumab and ipilimumab have been approved for the treatment of a subset of approximately 3.5% to 5.6% of colorectal cancer patients with mutations that lead to high genetic instability.

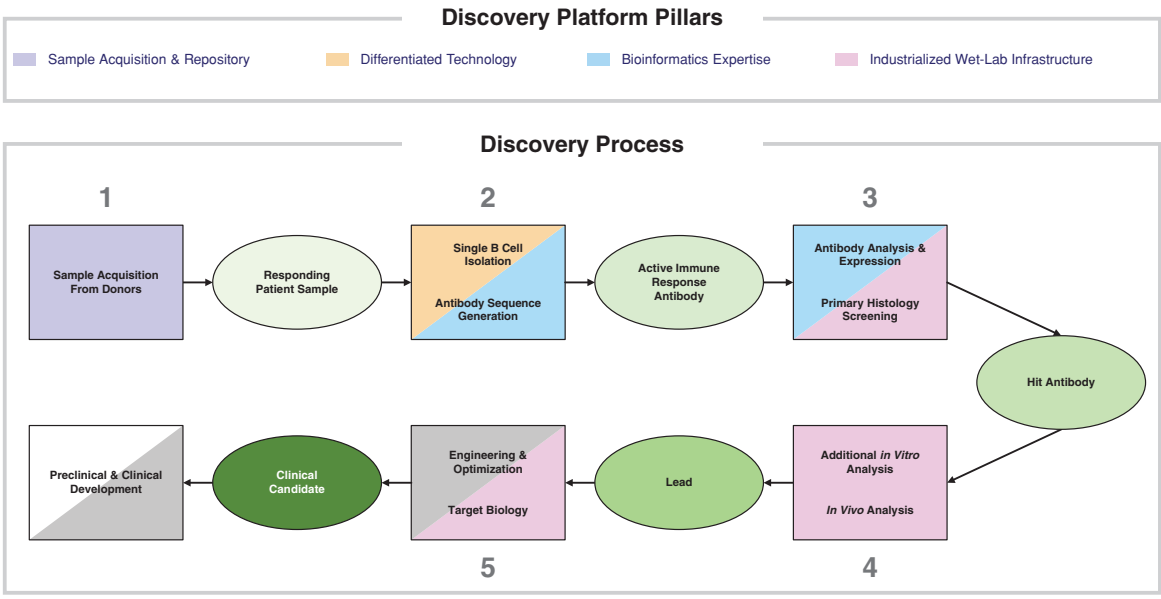
Breast cancer

Breast cancer is the second most common cancer diagnosis for women in the United States. Breast cancer is conventionally divided into three forms, depending on whether the tumor is hormone receptor-positive (HR+), HER2 receptor-positive (HER2+), or neither (triple negative). The percentage of breast cancer patients with HER2+ disease is approximately 17%; triple negative is approximately 12%; and HR+ disease is approximately 83% (note that approximately 12% of patients have overlapping HR+/HER2+ disease). The treatment paradigm for breast cancer depends on the stage of the cancer at presentation (Stage I-IV), and on whether the tumor is HR+, HER2+, or triple negative.

Although some forms of breast cancer are less aggressive and have displayed improving survival rates, there are still highly aggressive forms of disease that represent significant unmet need. For example, triple-negative breast cancer tends to present at a higher grade than other types of breast cancer (often grade 3) and grows, spreads and recurs faster than most other types. Women with triple-negative breast cancer are also more likely to develop metastasis, and typically have a poorer prognosis than other types of breast cancer due to the lack of targeted therapies available for treatment. The FDA recently approved the first immunotherapy regimen in breast cancer, a combination of nab-paclitaxel and an anti-PD-L1 immunotherapy (atezolizumab) for frontline treatment patients with unresectable locally advanced or metastatic PD-L1-positive triple-negative breast cancer. In the clinical trial supporting this approval, the objective response rate for the group of combination-treated patients was 56%.

The Atreca Discovery Platform

There are four fundamental pillars that support and distinguish our platform from other antibody drug discovery approaches. We leverage these pillars via our systematic antibody discovery process to identify, capture and analyze antibodies from patients whose immune systems are already responding to cancer treatment, and thus actively attacking their tumor tissue. Our systematic approach to discovery is scalable and differentiated from traditional discovery approaches. The following diagram shows our discovery platform pillars and discovery process:



The pillars of our discovery platform

The four fundamental pillars of our platform are: our sample acquisition and repository, our differentiated technology, our bioinformatics expertise and our industrialized wet-lab infrastructure.

Sample acquisition and repository. Our discovery approach relies on having a sufficient number of responder patient blood-derived samples. We attempt to source samples from the same patient over time, enabling longitudinal analyses, and from a wide range of tumor types. In order to accomplish this, we sponsor ongoing non-interventional clinical studies conducted at the Palo Alto Medical Foundation and Sarah Cannon Research Institute that yield samples for our growing repository. We also collaborate with academics at leading institutions in order to acquire our samples, including the University of California, San Francisco; Cleveland Clinic; Dana-Farber Cancer Institute; and Baylor Scott & White Health. In addition, we acquire some samples through an internal clinical study and commercially. We have built our current repository of over 1,200 blood-derived samples from over 400 donors, representing over 25 different solid tumor types, over a period of six years.

Differentiated technology. Based upon technology licensed from Stanford University, our proprietary Immune Repertoire Capture® technology generates sequences of natively co-expressed heavy and light chains of antibodies from single cells, with 65% efficiency for input B cells, and moreover, corrects for sequence error and bias that is inherent in the output of section analysis of a group of antibody sequences from a patient sample, which we define as a ‘‘repertoire’’. Without such error and bias correction, robust analyses of repertoires would be very difficult, since such process error is very often of the same order of magnitude as meaningful biological signal. Furthermore, we have built and utilize other differentiated technological expertise in our discovery platform. For example, we have invested heavily in flow cytometry infrastructure, expertise and process development, which enables us to use plasmablasts to focus our analysis on the active immune response in patient samples and to perform certain types of *in vitro* and *in vivo* downstream analyses that would be difficult to implement otherwise.

Bioinformatics expertise. A robust bioinformatics infrastructure and expertise underlies multiple aspects of our discovery platform. For example, in order to operationalize our Immune Repertoire Capture® technology, we have built an enhanced algorithmic pipeline in the cloud, comprising in part

proprietary algorithms, to capture, process and deliver bias- and error-corrected natively paired, heavy and light chain sequences of antibodies expressed by single B cells. Applying the bioinformatics expertise we've developed, we analyze these sequences and their related data, to select antibodies for wet-lab analysis. To extract the most value from our industrialized approach to discovery, we capture our experimental data using a laboratory information management system and analyze data using in-house developed software tools.

Industrialized wet-lab infrastructure. In order to further enhance the analysis of antibodies discovered on our platform, we have increased the capacity of multiple functions, including histology, flow cytometry, *in vitro* functional assays, animal models and others. For example, our primary histology screen, involving analysis of the binding of patient antibodies in primary human tumor tissue, still leaves capacity for generating histological data for other *in vitro* and *in vivo* experiments. In our animal model work, we have validated four different syngeneic mouse tumor models in-house. Our dedicated bioinformatics supports our industrialized experimental infrastructure.

Atreca's discovery process

The major steps in our drug discovery approach that are differentiating and enabled by our discovery platform are sample acquisition, repertoire generation and analysis, hit generation, lead generation and candidate generation.

Sample acquisition

The starting points for our drug discovery efforts are blood samples from patients undergoing cancer therapy. It is critically important, therefore, that we have access to a broad set of high quality samples. Samples from donors in our trials are collected at the initiation of treatment and at multiple points during therapy. We begin by systematically acquiring blood samples from cancer patients at various stages of their treatment and immediately freezing down a particular group of cells isolated from the blood for possible analysis. Blood samples are typically processed to yield the peripheral blood mononuclear cells, or PBMCs, present, which are then frozen and stored pending further processing. All samples for our discovery efforts are collected with Institutional Review Board approval under informed consent that grants us freedom to commercialize products without donor remuneration.

Repertoire generation: plasmablast isolation

We believe that our approach is differentiated in part due to our focus on the active immune response in a patient whose immune system is attacking tumor tissue. Focusing on the plasmablasts in the blood from which we isolate our antibodies is key to our approach. We and others have shown that plasmablasts continue to be generated during states of chronic immune system activation, such as that of a cancer patient whose immune system is attacking tumor tissue over many months.

We isolate plasmablasts from patient blood sample PBMCs using fluorescence activated cell sorting based on the expression of surface markers such as CD19 in combination with other surface markers. Our process allows us to isolate individual cells, and we have developed the expertise and resources that enable us to accomplish this with the potential throughput to process thousands of samples a year.

Repertoire generation: Immune Repertoire Capture®

From the samples of patients who exhibit evidence of clinical benefit from treatment, we generate the sequences of the antibodies expressed by plasmablasts, thus focusing our discovery

efforts on antibodies that we believe may be associated with anti-tumor immune responses to treatment.

In contrast to other approaches that identify antibody heavy and light chains separately and only later attempt to recreate native pairings, we keep these native pairings intact using our Immune Repertoire Capture® technology. During the synthesis of the cDNA from RNA, we attach to the cDNAs specialized nucleotide barcodes that are unique to each cell. These barcodes on the cDNAs of the B cell:

- Link the antibody genes back to a particular sample, and thus to the anti-tumor immune response in a patient at a specific point in the patient's treatment.
- Link heavy and light chain sequences, which are encoded by different cDNAs, from the same cell informationally and recreate native heavy and light chain pairings for individual B cells, further defining those B cells as unique entities.
- Allow for heavy and light chain sequence generation from many B cells simultaneously, creating significant increases in throughput with decreased costs.
- Correct sequence errors and bias generated by the process itself by allowing the use of multiple redundant heavy or light chain sequences known to be generated from the same cell and by allowing normalization of sequence counts on a cell-by-cell basis.
- Provide a means to detect contamination by other heavy and light chain sequences from other cells during the process.

Our process yields error- and bias-corrected, natively paired antibody heavy and light chain sequences that include the signal sequence of the proteins partially into the constant region of the antibody chains. Due to these properties, these sequences are already in a format that enables us to take them directly into antibody expression systems, saving us considerable time and expense. The technology allows us to isolate and identify the precise sequences necessary to ultimately generate B cell antibodies as they arose in a patient.

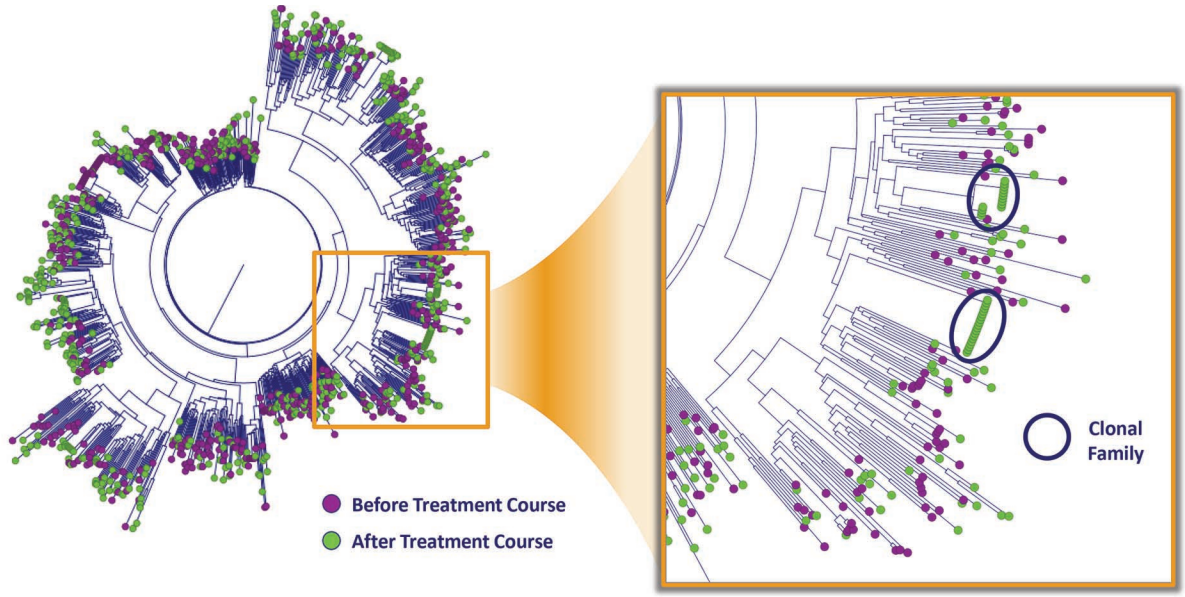
Repertoire analysis

During repertoire analysis, we analyze these collections of sequences to better understand how these antibody sequences relate to each other, both within a single patient sample and across samples. The high quality of our data enables us to perform such analyses.

As a first step, we determine the relatedness among these antibodies. In affinity maturation, lineages of B cells expressing related antibodies, or clonal families, are generated. Additionally, our barcoding technology allows us to track identical antibody sequences that are expressed by different plasmablasts. Using these data, we generate a phylogenetic or family tree in which we depict the relatedness among antibody sequences.

We use these relationships to identify the families of antibodies expressed by plasmablasts that are all related to one another via descent from a single B cell that started the maturation process; *i.e.,* clonal families. Changes in clonal families occur in large part due to the nature of the biological processes that generate antibody diversity in germinal centers. Clonal expansions during an active immune response against tumor tissue indicate the sequences of antibodies that have the potential to be directed toward the patient's tumor. We believe that longitudinal analysis of changes in clonal

families, especially when correlated with changes in disease status, provides information useful for selecting potentially valuable antibodies for further analysis in the laboratory.



Plasmablast Repertoires from Renal Cell Carcinoma Patient with Clinical Response

Clonal expansions contain antibodies that are related to one another by descent from a single B cell that initiated the affinity maturation process

Furthermore, we can determine the sequence relationships among antibodies in a family. We can use this information to sample the diversity of antibodies in a family generated by a common B cell ancestor. We can also use more sophisticated analyses of antibody sequences, beyond simple sequence alignments, to identify evidence of convergent antibody generation across different patients.

Hit generation

We refer to the process of identifying antibodies that bind to non-autologous tumor tissue preferentially over normal tissue as ‘‘hit generation’’. We select approximately one percent of all antibody sequences in the repertoires that we generate from patient samples for further evaluation.

We convert the sequence information we obtain into antibody protein molecules that can be assessed for their tumor tissue binding properties. We have observed that substantially all of our selected antibodies can be manufactured at laboratory scale. We have developed a robust histology infrastructure as part of our platform that enables us to perform at full capacity a primary screen of hundreds of expressed antibodies per month against human tumor tissue samples and objectively score binding intensity to both the tumor as well as adjacent normal tissue. We have found that out of all of the antibody sequences that we have chosen to test in this manner, approximately 45% bind to non-autologous tumor tissue selectively over normal adjacent tissue. We have, to date, identified over 1,400 distinct antibodies capable of targeting non-autologous tumors preferentially in this primary screen.

Lead generation

We then take these hit antibodies and analyze them in a series of *in vitro* and *in vivo* assays, including multiple animal models, to identify antibodies or antibody-derived entities that show relevant function as leads. In some cases, we, alone or with partners, may add, remove, or alter protein or other molecular components, as we analyze the antibodies to generate relevant function, such as T cell engagement or antibody-directed killing. We perform broader measurements of antibody binding in additional human tumor and normal tissue samples and tumor cell lines via histology and flow cytometry. These analyses, for example, enable us to distinguish whether the antibodies are directly binding to tumor cells or to other cells found in the tumor microenvironment such as stromal cells or immune cells. Because approximately 25% of our antibodies recognize and bind to the mouse version of their human target, we are often able to assess *in vivo* activity in syngeneic mouse tumor models without spending significant time and resources on generating antibodies with surrogate Fv domains.

Candidate generation

The targets for leads are identified via a variety of means, including multiple types of antigen arrays, immunoprecipitation followed by mass-spectrometry (as the target of ATRC-101 was identified), and other techniques under development, followed by validation via standard recombinant methods. Target identification is often a resource-intensive and time-consuming process, and may not be successful in all cases. Leads undergo various protein sequence modifications to eliminate potential liabilities in stability, immunogenicity and manufacturing, and to increase target binding and activity, before being selected as clinical candidates to be taken into preclinical development.

Collaborations

Historically, we have entered into a number of discovery collaborations as we developed our discovery platform. These collaborations have generally focused on identifying novel antibodies in areas of significant unmet medical need.

We are currently engaged in a multi-year research and preclinical collaboration with the Bill & Melinda Gates Foundation to optimize and advance human anti-CSP monoclonal antibodies identified by our proprietary Immune Repertoire Capture® technology with the potential to be developed as prophylactic/therapeutic antibodies for malaria. In addition, we are engaged in a three-year collaboration agreement with Bristol-Myers Squibb to perform research activities in the field of autoimmune diseases and to apply our proprietary Immune Repertoire Capture® technology to patient samples in order to compare the effects of different treatments on the humoral immune response.

While our current and past collaborations have provided support and validation as we have worked to develop our discovery platform, and while we may continue to enter into such collaborative research agreements in the future, we expect our primary focus for future collaborations will be on accelerating advancement of our product pipeline. To that end, we are focusing our business development efforts on potential partners that bring complementary technologies that may allow us to facilitate our generation of product candidates from our large pool of novel antibody-target pairs.

Manufacturing

We use a third-party manufacturer to produce our antibodies and reagents for use in preclinical assessment of product candidates. We do not have, and we do not currently plan to acquire or develop, the infrastructure, facilities or capabilities to manufacture current Good Manufacturing Practices, or cGMP, bulk drug substance or filled drug product for use in human clinical trials. We

intend to continue to utilize third-party manufacturers such as contract development manufacturing organizations, or CDMOs, to produce, test and release cGMP bulk drug substance and drug product for our planned clinical trials. We expect to continue to rely on such third parties to manufacture clinical trial material for the foreseeable future. We currently have a service agreement with a CDMO to develop and manufacture material in support of our IND application and clinical studies.

Our current and expected future contractual CDMOs have a long, successful track record of manufacturing clinical and commercial products for other companies under cGMP compliance and have previously been inspected by regulatory authorities for compliance with cGMP standards.

Competition

We are aware of a number of companies that are developing antibodies for the treatment of cancer. Many of these companies are well-capitalized and, in contrast to us, have significant clinical experience, and may include our potential future partners. In addition, these companies compete with us in recruiting scientific and managerial talent. Our success will partially depend on our ability to obtain, maintain, enforce and defend patents and other intellectual property rights with respect to antibodies that are safer and more effective than competing products. Our commercial opportunity and success will be reduced or eliminated if competing products that are safer, more effective, or less expensive than the antibodies we develop are or become available.

We expect to compete with antibody, biologics and other therapeutic platforms and development companies who are also pursuing a similar discovery approach, including, but not limited to, companies such as Adaptive Biotechnologies Corporation, AIMM Therapeutics B.V., Neurimmune Holding AG, OncoReponse, Inc., and Vir Biotechnology, Inc. In addition, we expect to compete with large, multinational pharmaceutical companies that discover, develop and commercialize antibodies and other therapeutics for use in treating cancer such as AstraZeneca plc, Bristol-Myers Squibb Company, Genentech, Inc. and Merck & Co., Inc. If ATRC-101 or potential future product candidates are eventually approved, they will compete with a range of treatments that are either in development or currently marketed. For example, we expect that ATRC-101 and our potential future product candidates may compete against traditional cancer therapies, such as chemotherapy, as well as cell-based treatments for cancer, such as CAR-T therapies.

Intellectual Property

Our success will significantly depend upon our ability to obtain and maintain patent and other intellectual property and proprietary protection for our novel antibody-based immunotherapeutics to treat a range of solid tumors, as well as patent and other intellectual property and proprietary protection for our discovery platform, novel discoveries, and other important technology inventions and know-how. We rely, for example, on patents, trademarks, trade secrets, confidentiality agreements, and invention assignment agreements to protect our intellectual property and proprietary innovations.

As set out in the ‘‘Risk Factors—Risks Related to Our Intellectual Property,’’ our intellectual property and proprietary rights may be challenged, invalidated, circumvented, infringed or misappropriated, or may be insufficient to permit us to preserve or improve our competitive position.

Our intellectual property includes a portfolio of in-licensed and Atreca-owned patents and patent applications, relating to our discovery platform and the novel immunotherapeutic product candidates developed using that platform, including compositions of matter, methods of use, methods of treatment, and kits. Our lead immunotherapeutic product candidate, ATRC-101, is a monoclonal antibody with preclinical anti-tumor activity and is a variant of an antibody identified using our discovery platform. We have filed multiple U.S. provisional patent applications relating to ATRC-101 and other variants and anticipate that we will convert to nonprovisional utility patent applications or PCT applications in the first quarter of 2020.

As of May 23, 2019, we own:

- 2 issued U.S. patents relating to our platform-related technology;
- 1 issued patent in Singapore relating to our platform-related technology;
- 20 pending non-provisional utility patent applications, including 1 allowed U.S. application and 16 foreign patent applications relating to our platform-related technology;
- 5 pending U.S. provisional patent applications relating to ATRC-101 and other variants; and
- 1 pending U.S. provisional patent application relating to our anti-malarial therapeutic antibodies.

As of May 23, 2019, we exclusively license from Stanford University relating to our platform-related technology:

- 44 pending utility patent applications, including 2 pending U.S. non-provisional patent applications, and 42 foreign patent applications inclusive of 1 allowed patent application in Israel; and
- 9 issued foreign patents, 1 in each of the following jurisdictions: Europe (validated in 18 territories), Japan, Korea, Australia, Mexico, New Zealand, Russia, Hong Kong and South Africa.

As of May 23, 2019, we co-own:

- 3 pending international utility patent applications with collaborators relating to anti-HIV antibodies; and
- 3 pending utility patent applications with a collaborator relating to anti-malarial antibodies, including 2 international patent applications and 1 U.S. non-provisional patent application.

Government Regulation

In the United States, biological products are subject to regulation under the Federal Food, Drug, and Cosmetic Act, and the Public Health Service Act, and other federal, state, local and foreign statutes and regulations. These laws and their corresponding regulations govern, among other things, the research, development, clinical trial, testing, manufacturing, safety, efficacy, labeling, packaging, storage, record keeping, distribution, reporting, advertising and other promotional practices involving biological products. FDA approval must be obtained before the marketing of biological products. The process of obtaining regulatory approvals and the subsequent compliance with appropriate federal, state, local and foreign statutes and regulations require the expenditure of substantial time and financial resources.

U.S. biological products development process

The process required by the FDA before a biological product may be marketed in the United States generally involves the following:

- completion of nonclinical laboratory tests and animal studies according to Good Laboratory Practices, or GLP, and applicable requirements for the humane use of laboratory animals or other applicable regulations;
- submission to the FDA of an application for an investigational new drug, or IND, which must become effective before human clinical trials may begin;
- approval of the protocol and related documentation by an independent institutional review board, or IRB, or ethics committee at each clinical trial site before each study may be initiated;
- performance of adequate and well-controlled human clinical trials according to the FDA's regulations commonly referred to as Good Clinical Practices, or GCPs, and any additional requirements for the protection of human research subjects and their health information, to establish the safety and efficacy of the proposed biological product for its intended use;
- submission to the FDA of a Biologics License Application, or BLA, for marketing approval that includes substantive evidence of safety, purity, and potency from results of nonclinical testing and clinical trials;
- payment of user fees for FDA review of the BLA (unless a fee waiver applies);
- a determination by the FDA within 60 days of its receipt of a BLA whether or not to accept the filing for review;
- satisfactory completion of an FDA inspection of the manufacturing facility or facilities where the biological product is produced to assess compliance with current Good Manufacturing Practices, or cGMP, to assure that the facilities, methods and controls are adequate to preserve the biological product'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, or licensure, including consideration of the views of any FDA advisory committee, of the BLA.

Before testing any biological product candidate in humans, the product candidate enters the preclinical testing stage. Preclinical tests, also referred to as nonclinical studies, include laboratory evaluations of product biological characteristics, chemistry, toxicity and formulation, as well as animal studies to assess the potential safety and activity of the product candidate. The conduct of the preclinical tests must comply with federal regulations and requirements including GLP.

The clinical trial sponsor must submit the results of the preclinical tests, together with manufacturing information, analytical data, any available clinical data or literature and a proposed clinical protocol, to the FDA as part of the IND. Some preclinical testing may continue even after the IND is submitted. An IND is a request for authorization from the FDA to ship an unapproved, investigational product in interstate commerce and to administer it to humans, and must become effective before clinical trials may begin. The IND automatically becomes effective 30 days after receipt by the FDA, unless the FDA places the clinical trial on a clinical hold within that 30-day time period. In such a case, the IND sponsor and the FDA must resolve any outstanding concerns before the clinical trial can begin. The FDA also may impose clinical holds on a biological product candidate at any time before or during clinical trials due to, among other considerations, unreasonable and significant safety risk, inability to assess safety risk, lack of qualified investigators, a misleading or materially incomplete investigator brochure, or study design deficiencies. If the FDA imposes a clinical hold, studies may not recommence without FDA authorization and then only under terms authorized by the FDA. Accordingly, we cannot be sure that submission of an IND will result in the

FDA allowing clinical trials to begin, or that, once begun, issues or circumstances will not arise that delay, suspend or terminate such studies.

Clinical trials involve the administration of the biological product candidate to healthy volunteers or patients under the supervision of qualified investigators, generally physicians not employed by or under the study sponsor's control. 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, including stopping rules that assure a clinical trial will be stopped if certain adverse events should occur. Each protocol and any amendments to the protocol must be submitted to the FDA as part of the IND. Clinical trials must be conducted and monitored in accordance with the FDA's regulations comprising the GCP requirements, including the requirement that all research subjects provide informed consent. Further, each clinical trial and its related documentation must be reviewed and approved by an IRB at or servicing each institution at which the clinical trial will be conducted. An IRB is charged with protecting the welfare and rights of study participants and considers such items as whether the risks to individuals participating in the clinical trials are minimized and are reasonable in relation to anticipated benefits. The IRB also approves the form and content of the informed consent that must be signed by each clinical trial subject or his or her legal representative and must monitor the clinical trial until completed.

Clinical trials typically are conducted in three sequential phases that may overlap or be combined:

- *Phase 1*. The biological product is initially introduced into healthy human subjects or patients and assessed for biological activity, side effect tolerability, safety and early signs of efficacy.
- *Phase 2*. The biological product is evaluated in a limited patient population to identify possible adverse effects and safety risks, to preliminarily evaluate the efficacy of the product for specific targeted diseases and to determine dosage tolerance, optimal dosage and dosing schedule.
- *Phase 3*. Clinical trials are undertaken to further evaluate dosage, clinical efficacy, potency, and safety in an expanded patient population at geographically dispersed clinical trial sites. These clinical trials are intended to establish the overall risk/benefit ratio of the product and provide an adequate basis for approval and physician labeling.

Post-approval clinical trials, sometimes referred to as Phase 4 clinical trials, may be conducted after initial marketing approval. These clinical trials are used to gain additional experience from the treatment of patients in the intended therapeutic indication, particularly for long-term safety follow-up.

During all phases of clinical development, the FDA requires extensive monitoring and auditing of all clinical activities, clinical data, and clinical trial investigators. Annual progress reports detailing the results of the clinical trials must be submitted to the FDA. Written IND safety reports must be promptly submitted to the FDA and the investigators for serious and unexpected adverse events, any findings from other studies, tests in laboratory animals or *in vitro* testing that suggest a significant risk for human subjects, or any clinically important increase in the rate of a serious suspected adverse reaction over that listed in the protocol or investigator brochure. The sponsor must submit an IND safety report within 15 calendar days after the sponsor determines that the information qualifies for reporting. The sponsor also must notify the FDA of any unexpected fatal or life-threatening suspected adverse reaction within seven calendar days after the sponsor's initial receipt of the information. 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, acting on its own or based on a recommendation from the sponsor's data safety monitoring board, may suspend 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 biological product has been associated with unexpected serious harm to patients.

Concurrent with clinical trials, companies usually complete additional animal studies and also must develop additional information about the physical characteristics of the biological product as well as finalize a process for manufacturing the product in commercial quantities in accordance with cGMP requirements. To help reduce the risk of the introduction of adventitious agents with use of biological products, emphasis is placed on the importance of manufacturing control for products whose attributes cannot be precisely defined. The manufacturing process must be capable of consistently producing quality batches of the product candidate and, among other things, the sponsor must develop methods for testing the identity, strength, quality, potency and purity of the final biological product. Additionally, appropriate packaging must be selected and tested and stability studies must be conducted to demonstrate that the biological product candidate does not undergo unacceptable deterioration over its shelf life.

U.S. review and approval processes

After the completion of clinical trials of a biological product, FDA approval of a BLA must be obtained before commercial marketing of the biological product. The BLA must include results of product development, laboratory and animal studies, human studies, information on the manufacture and composition of the product, proposed labeling and other relevant information.

Within 60 days following submission of the application, the FDA reviews a BLA submitted to determine if it is substantially complete before the FDA accepts it for filing. The FDA may refuse to file any BLA that it deems incomplete or not properly reviewable at the time of submission and may request additional information. In this event, the BLA must be resubmitted with the additional information. The resubmitted application also is subject to review before the FDA accepts it for filing. In most cases, the submission of a BLA is subject to a substantial application user fee, although the fee may be waived under certain circumstances. Under the performance goals and policies implemented by the FDA under the Prescription Drug User Fee Act, or PDUFA, for original BLAs, the FDA targets ten months from the filing date in which to complete its initial review of a standard application and respond to the applicant, and six months from the filing date for an application with priority review. The FDA does not always meet its PDUFA goal dates, and the review process is often significantly extended by FDA requests for additional information or clarification. This review in total typically takes twelve months from the date the BLA is submitted to the FDA because the FDA has approximately two months to make a filing decision. The review process and the PDUFA goal date may be extended by three months if the FDA requests or the BLA sponsor otherwise provides additional information or clarification regarding information already provided in the submission within the last three months before the PDUFA goal date.

Once the submission is accepted for filing, the FDA begins an in-depth substantive review of the BLA. The FDA reviews the BLA to determine, among other things, whether the proposed product is safe and potent, or effective, for its intended use, and has an acceptable purity profile, and whether the product is being manufactured in accordance with cGMP to assure and preserve the product's identity, safety, strength, quality, potency and purity. The FDA may refer applications for novel biological products or biological products that present difficult or novel 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. The FDA is not bound by the recommendations of an advisory committee, but it considers such recommendations carefully when making decisions. During the biological product

approval process, the FDA also will determine whether a Risk Evaluation and Mitigation Strategy, or REMS, is necessary to assure the safe use of the biological 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 a REMS, if required.

Before approving a BLA, the FDA typically will inspect the facilities at which the product is manufactured. 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. Additionally, before approving a BLA, the FDA will typically inspect one or more clinical sites to assure that the clinical trials were conducted in compliance with IND study requirements and GCP requirements. To assure cGMP and GCP compliance, an applicant must incur significant expenditure of time, money and effort in the areas of training, record keeping, production and quality control.

Under the Pediatric Research Equity Act, or PREA, as amended, a BLA or supplement to a BLA for a novel product (*e.g.*, new active ingredient, new indication, etc.) must contain data to assess the safety and effectiveness of the biological product 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 data or full or partial waivers.

Notwithstanding the submission of relevant data and information, the FDA may ultimately decide that the BLA does not satisfy its regulatory criteria for approval and deny approval. Data obtained from clinical trials are not always conclusive and the FDA may interpret data differently than we interpret the same data. If the FDA decides not to approve the BLA in its present form, the FDA will issue a complete response letter that usually describes all of the specific deficiencies in the BLA identified by the FDA. The deficiencies identified may be minor, for example, requiring labeling changes, or major, for example, requiring additional clinical trials. Additionally, the complete response letter may include recommended actions that the applicant might take to place the application in a condition for approval. 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.

If a product receives regulatory approval, the approval may be significantly limited to specific diseases and dosages or the indications for use may otherwise be limited, including to subpopulations of patients, which could restrict the commercial value of the product. Further, the FDA may require that certain contraindications, warnings, precautions or drug-drug interactions be included in the product labeling. The FDA may impose restrictions and conditions on product distribution, prescribing, or dispensing in the form of a REMS, or otherwise limit the scope of any approval. In addition, the FDA may require post marketing clinical trials, sometimes referred to as Phase 4 clinical trials, designed to further assess a biological product's safety and effectiveness, and testing and surveillance programs to monitor the safety of approved products that have been commercialized.

Expedited development and review programs

The FDA has various programs, including fast track designation, breakthrough therapy designation, accelerated approval and priority review, that are intended to expedite or simplify the process for the development and FDA review of drugs and biologics that are intended for the treatment of serious or life-threatening diseases or conditions. These programs do not change the standards for approval but may help expedite the development or approval process. To be eligible for fast track designation, new drugs and biological products must be intended to treat a serious or life-threatening condition and demonstrate the potential to address unmet medical needs for the

condition. Fast track designation applies to the combination of the product and the specific indication for which it is being studied. The sponsor of a new drug or biologic may request the FDA to designate the drug or biologic as a fast track product at any time during the clinical development of the product. One benefit of fast track designation, for example, is that the FDA may consider for review sections of the marketing application for a product that has received fast track designation on a rolling basis before the complete application is submitted.

Under the FDA's breakthrough therapy program, products may be eligible for designation as a breakthrough therapy if they are intended, alone or in combination with one or more other drugs or biologics, to treat a serious or life-threatening disease or condition and preliminary clinical evidence demonstrates that such product may have substantial improvement on one or more clinically significant endpoints over existing therapies. The benefits of breakthrough therapy designation include the same benefits as fast track designation plus the FDA will seek to ensure the sponsor of a breakthrough therapy product receives timely advice and interactive communications to help the sponsor design and conduct a development program as efficiently as possible.

Any product is eligible for priority review if it has the potential to provide safe and effective therapy where no satisfactory alternative therapy exists or a significant improvement in the treatment, diagnosis or prevention of a disease compared to marketed products. The FDA will attempt to direct additional resources to the evaluation of an application for a new drug or biological product designated for priority review in an effort to facilitate the review. Under priority review, the FDA's goal is to review an application in six months once it is filed, compared to ten months for a standard review.

Additionally, a product may be eligible for accelerated approval. Drug or biological products studied for their safety and effectiveness in treating serious or life-threatening illnesses and that provide meaningful therapeutic benefit over existing treatments may receive accelerated approval, which means that they may be approved on the basis of adequate and well-controlled clinical trials establishing that the product has an effect on a surrogate endpoint that is reasonably likely to predict a clinical benefit, or on the basis of an effect on an intermediate clinical endpoint other than survival or irreversible morbidity. As a condition of approval, the FDA may require that a sponsor of a drug or biological product receiving accelerated approval perform adequate and well-controlled post-marketing clinical trials. In addition, the FDA currently requires as a condition for accelerated approval pre-approval of promotional materials, which could adversely impact the timing of the commercial launch of the product.

Post-approval requirements

Maintaining substantial compliance with applicable federal, state, and local statutes and regulations requires the expenditure of substantial time and financial resources. Rigorous and extensive FDA regulation of biological products continues after approval, particularly with respect to cGMP. As the manufacturer of our products we are required to comply with applicable requirements in the cGMP regulations, including quality control and quality assurance and maintenance of records and documentation. Other post-approval requirements applicable to biological products include reporting of cGMP deviations that may affect the identity, potency, purity and overall safety of a distributed product, record-keeping requirements, reporting of adverse effects, reporting updated safety and efficacy information, and complying with electronic record and signature requirements. After a BLA is approved, the product also may be subject to official lot release. As part of the manufacturing process, we are required to perform certain tests on each lot of the product before it is released for distribution. If the product is subject to official release by the FDA, we shall submit samples of each lot of product to the FDA together with a release protocol showing a summary of the history of manufacture of the lot and the results of all of the tests performed on the lot. The FDA also may perform certain confirmatory tests on lots of some products, such as viral vaccines, before

releasing the lots for distribution. In addition, the FDA conducts laboratory research related to the regulatory standards on the safety, purity, potency, and effectiveness of biological products.

We also must comply with the FDA's advertising and promotion requirements, such as those related to direct-to-consumer advertising, the prohibition on promoting products for uses or in patient populations that are not described in the product's approved labeling (known as ''off-label use''), industry-sponsored scientific and educational activities, and promotional activities involving the internet. Discovery of previously unknown problems or the failure to comply with the applicable regulatory requirements may result in restrictions on the marketing of a product or withdrawal of the product from the market as well as possible civil or criminal sanctions. Failure to comply with the applicable U.S. requirements at any time during the product development process, approval process or after approval may subject an applicant or manufacturer to administrative or judicial actions, civil or criminal sanctions and adverse publicity. FDA sanctions could include refusal to approve pending applications, withdrawal of an approval, license revocation, clinical holds, warning or untitled letters, product recalls, product seizures, total or partial suspension of production or distribution, injunctions, fines, refusals of government contracts, mandated corrective advertising or communications with doctors or other stakeholders, debarment, restitution, disgorgement of profits, or civil or criminal penalties. Any agency or judicial enforcement action could have a material adverse effect on us.

Biological product manufacturers and other entities involved in the manufacture and distribution of approved biological products 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 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. Discovery of problems with a product after approval may result in restrictions on a product, manufacturer, or holder of an approved BLA, including withdrawal of the product from the market. In addition, changes to the manufacturing process or facility generally require prior FDA approval before being implemented and other types of changes to the approved product, such as adding new indications and additional labeling claims, are also subject to further FDA review and approval.

Government regulation outside of the United States

Whether or not we obtain FDA approval for a product, we must obtain the requisite approvals from regulatory authorities in foreign countries prior to the commencement of clinical trials or marketing of the product in those countries. Certain countries outside of the United States have a similar process that requires the submission of a clinical trial application, or CTA, much like the IND prior to the commencement of human clinical trials. In the European Union, for example, a CTA must be submitted for each clinical trial to each country's national health authority and an independent ethics committee, much like the FDA and an IRB, respectively. Once the CTA is approved in accordance with a country's requirements, the corresponding clinical trial may proceed.

The requirements and process governing the conduct of clinical trials, product licensing, pricing and reimbursement vary from country to country. In all cases, the clinical trials must be conducted in accordance with GCP and the applicable regulatory requirements and the ethical principles that have their origin in the Declaration of Helsinki.

Other Healthcare Laws

In addition to FDA restrictions on marketing of pharmaceutical and biological products, several other types of state and federal laws have been applied to restrict certain general business and marketing practices in the biopharmaceutical industry in recent years. These laws include, among

others, anti-kickback statutes, false claims statutes and other healthcare laws and regulations, some of which are described below.

The federal Anti-Kickback Statute prohibits, among other things, knowingly and willfully offering, paying, soliciting or receiving remuneration to induce, or in return for, purchasing, leasing, ordering or arranging for the purchase, lease or order of any healthcare item or service reimbursable under Medicare, Medicaid, or other federally financed healthcare programs. The Patient Protection and Affordable Care Act as amended by the Health Care and Education Reconciliation Act, collectively, the ACA, amended the intent element of the federal statute so that a person or entity no longer needs to have actual knowledge of the statute or specific intent to violate it in order to commit a violation. This statute has been interpreted to apply to arrangements between pharmaceutical manufacturers on the one hand and prescribers, purchasers and formulary managers, among others, on the other. Although there are a number of statutory exceptions and regulatory safe harbors protecting certain common activities from prosecution or other regulatory sanctions, the exceptions and safe harbors are drawn narrowly, and practices that involve remuneration intended to induce prescribing, purchases or recommendations may be subject to scrutiny if they do not qualify for an exception or safe harbor.

Federal civil and criminal false claims laws, including the federal civil False Claims Act, prohibit any person or entity from knowingly presenting, or causing to be presented, a false claim for payment to the federal government, or knowingly making, or causing to be made, a false statement to have a false claim paid. This includes claims made to programs where the federal government reimburses, such as Medicare and Medicaid, as well as programs where the federal government is a direct purchaser, such as when it purchases off the Federal Supply Schedule. Recently, several pharmaceutical and other healthcare companies have been prosecuted under these laws for allegedly inflating drug prices they report to pricing services, which in turn were used by the government to set Medicare and Medicaid reimbursement rates, and for allegedly providing free product to customers with the expectation that the customers would bill federal programs for the product. In addition, certain marketing practices, including off-label promotion, may also violate false claims laws. Additionally, the ACA amended the federal Anti-Kickback Statute such that a violation of that statute can serve as a basis for liability under the federal civil False Claims Act. Most states also have statutes or regulations similar to the federal Anti-Kickback Statute and civil False Claims Act, which apply to items and services reimbursed under Medicaid and other state programs, or, in several states, apply regardless of the payor.

Other federal statutes pertaining to healthcare fraud and abuse include the civil monetary penalties statute, which prohibits, among other things, the offer or payment of remuneration to a Medicaid or Medicare beneficiary that the offeror or payor knows or should know is likely to influence the beneficiary to order a receive a reimbursable item or service from a particular supplier, and the additional federal criminal statutes created by the Health Insurance Portability and Accountability Act of 1996, or HIPAA, which prohibits, among other things, 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 money or property owned by or under the control of any healthcare benefit program in connection with the delivery of or payment for healthcare benefits, items or services.

HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act of 2009, or HITECH, and their respective implementing regulations, including the Final Omnibus Rule published on January 25, 2013, impose obligations on certain healthcare providers, health plans, and healthcare clearinghouses, known as covered entities, as well as their business associates that perform certain services involving the storage, use or disclosure of individually identifiable health information, including mandatory contractual terms, with respect to safeguarding

the privacy, security, and transmission of individually identifiable health information, and require notification to affected individuals and regulatory authorities of certain breaches of security of individually identifiable health information. HITECH increased the civil and criminal penalties that may be imposed against covered entities, business associates and possibly other persons, 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. In addition, many state laws govern the privacy and security of health information in certain circumstances, many of which differ from each other in significant ways and may not have the same effect, and often are not pre-empted by HIPAA.

Further, pursuant to the federal Physician Payments Sunshine Act, created as part of the ACA, certain manufacturers of prescription drugs are required to collect and report annually to the Centers for Medicare & Medicaid Services, or CMS, information on certain payments or transfers of value to physicians and teaching hospitals, as well as investment interests held by physicians and their immediate family members. Failure to submit required information may result in civil monetary penalties. Effective January 1, 2022, reporting on transfers of value to physician assistants, nurse practitioners or clinical nurse specialists, certified registered nurse anesthetists, and certified nurse-midwives will also be required.

In addition, several states now require biopharmaceutical manufacturers to report certain expenses relating to the marketing and promotion of drug products and to report gifts and payments to individual healthcare practitioners in these states. Other states prohibit various marketing-related activities, such as the provision of certain kinds of gifts or meals. Still other states require the posting of information relating to clinical studies and their outcomes. Some states require the reporting of certain drug pricing information, including information pertaining to and justifying price increases, or prohibit prescription drug price gouging. In addition, some states require pharmaceutical companies to implement compliance programs or marketing codes. Certain states and local jurisdictions also require the registration of pharmaceutical sales representatives.

Efforts to ensure that business arrangements with third parties comply with applicable healthcare laws and regulations involve substantial costs. If a biopharmaceutical manufacturer's operations are found to be in violation of any such requirements, it may be subject to significant penalties, including civil, criminal and administrative penalties, damages, fines, disgorgement, imprisonment, the curtailment or restructuring of its operations, loss of eligibility to obtain approvals from the FDA, exclusion from participation in government contracting, healthcare reimbursement or other federal or state government healthcare programs, including Medicare and Medicaid, integrity oversight and reporting obligations, and reputational harm. Although effective compliance programs can mitigate the risk of investigation and prosecution for violations of these laws, these risks cannot be entirely eliminated. Any action for an alleged or suspected violation can cause a drug company to incur significant legal expenses and divert management's attention from the operation of the business, even if such action is successfully defended.

U.S. healthcare reform

In the United States there have been, and continue to be, proposals by the federal government, state governments, regulators and third party payors to control or manage the increased costs of healthcare and, more generally, to reform the U.S. healthcare system. The biopharmaceutical industry has been a particular focus of these efforts and has been significantly affected by major legislative initiatives For example, in March 2010, the ACA was enacted, which intended to broaden access to health insurance, reduce or constrain the growth of healthcare spending, enhance remedies against fraud and abuse, add new transparency requirements for the healthcare and health insurance industries, impose new taxes and fees on the health industry and impose additional health policy reforms, substantially changed the way healthcare is financed by both governmental and

private insurers, and significantly impacts the U.S. pharmaceutical industry. The ACA, among other things, (i) subjected therapeutic biologics to potential competition by lower-cost biosimilars by creating a licensure framework for follow-on biologic products, (ii) proscribed a new methodology by which rebates owed by manufacturers under the Medicaid Drug Rebate Program are calculated for drugs and therapeutic biologics that are inhaled, infused, instilled, implanted or injected, (iii) increased the minimum Medicaid rebates owed by manufacturers under the Medicaid Drug Rebate Program and extended the rebate program to individuals enrolled in Medicaid managed care organizations, (iv) established annual nondeductible fees and taxes on manufacturers of certain branded prescription drugs and therapeutic biologics, apportioned among these entities according to their market share in certain government healthcare programs (v) established a new Medicare Part D coverage gap discount program, in which manufacturers must agree to offer 50% (now 70%) point of-sale discounts off negotiated prices of applicable brand drugs and therapeutic biologics to eligible beneficiaries during their coverage gap period, as a condition for the manufacturer's outpatient drugs and therapeutic biologics to be covered under Medicare Part D, (vi) expanded eligibility criteria for Medicaid programs by, among other things, allowing states to offer Medicaid coverage to additional individuals and by adding new mandatory eligibility categories for individuals with income at or below 133% of the federal poverty level, thereby potentially increasing manufacturers' Medicaid rebate liability, (vii) expanded the entities eligible for discounts under the Public Health program (viii) created a new Patient-Centered Outcomes Research Institute to oversee, identify priorities in, and conduct comparative clinical effectiveness research, along with funding for such research, and (ix) established a Center for Medicare Innovation at CMS to test innovative payment and service delivery models to lower Medicare and Medicaid spending, potentially including prescription drug spending.

The Trump administration and Congress have, and we expect they will continue to, seek to modify, repeal, or otherwise invalidate all, or certain provisions of, the ACA. Since January 2017, the Trump administration has issued 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. For example, on October 12, 2017, the Trump administration issued an executive order that expands the use of association health plans and allows anyone to purchase short-term health plans that provide temporary, limited insurance. This executive order also calls for the halt of federal payments to health insurers for cost-sharing reductions previously available to lower-income Americans to afford coverage. There is still uncertainty with respect to the impact this executive order could have on coverage and reimbursement for healthcare items and services covered by plans that were authorized 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 the Tax Act, among other things, included a provision that repealed, 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, the current U.S. presidential administration 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 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, or the BBA, among other things, amended the ACA, effective January 1, 2019, to increase from 50% to 70% the point-of-sale discount that is owed by pharmaceutical manufacturers who participate in Medicare Part D and to close the coverage gap in most Medicare drug plans, commonly referred to as the ''donut hole''. More recently, in July 2018, CMS published a final rule permitting further collections and payments to and from certain ACA qualified health plans and health insurance issuers under the ACA risk adjustment program in

response to the outcome of federal district court litigation regarding the method CMS uses to determine this risk adjustment. On December 14, 2018, a Texas U.S. District Court Judge ruled that the ACA is unconstitutional in its entirety because the ''individual mandate'' was repealed by Congress as part of the Tax Act. While the Texas U.S. District Court Judge, as well as the Trump administration and CMS, have stated that the ruling will have no immediate effect pending appeal of the decision, it is unclear how this decision, subsequent appeals, and other efforts to repeal and replace the ACA will impact the ACA.

In addition, other legislative changes have been proposed and adopted in the United States since the ACA was enacted to reduce healthcare expenditures. 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, including the BBA, will remain in effect through 2027 unless additional Congressional action is taken. Moreover, 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, including hospitals, imaging centers and cancer treatment centers, and increased the statute of limitations period for the government to recover overpayments to providers from three to five years.

Payment methodologies also may be subject to changes in healthcare legislation and regulatory initiatives. For example, the Medicare Prescription Drug, Improvement, and Modernization Act of 2003, or MMA, changed the way Medicare covers and pays for pharmaceutical products. The legislation expanded Medicare coverage for drug purchases by the elderly and introduced a new reimbursement methodology based on average sales prices for physician-administered drugs. In addition, this legislation provided authority for limiting the number of drugs that will be covered in any therapeutic class. While the MMA only applies to drug benefits for Medicare beneficiaries, private payors often follow Medicare coverage policy and payment limitations in setting their own reimbursement rates. Therefore, any reduction in reimbursement that results from the MMA may result in a similar reduction in payments from private payors.

Recently there has been heightened governmental scrutiny over the manner in which biopharmaceutical manufacturers set prices for their marketed products, which has resulted in several Congressional inquiries and proposed and enacted federal and state legislation designed to, among other things, bring more transparency to product pricing, review the relationship between pricing and manufacturer patient programs, and reform government program reimbursement methodologies for drug products. At the federal level, the Trump administration's budget proposal for fiscal year 2019 contains further drug price control measures that could be enacted during the 2019 budget process or in other future legislation, including, for example, measures to permit Medicare Part D plans to negotiate the price of certain drugs under Medicare Part B, to allow some states to negotiate drug prices under Medicaid, and to eliminate cost sharing for generic drugs for low-income patients. Additionally, on May 11, 2018, the Trump administration laid out the administration's ''Blueprint'' to reduce the cost of prescription medications while preserving innovation and cures. While the Department of Health and Human Services, or HHS, is soliciting feedback on some of these measures, other actions may be immediately implemented by HHS under existing authority. Further, on January 31, 2019, the HHS Office of Inspector General, proposed modifications to the federal Anti-Kickback Statute discount safe harbor for the purpose of reducing the cost of drug products to consumers which, among other things, if finalized, will affect discounts paid by manufacturers to Medicare Part D plans, Medicaid managed care organizations and pharmacy benefit managers working with these organizations. Although a number of these, and other potential,

proposals will require additional authorization to become effective, Congress and the Trump administration have each indicated that it will continue to seek new legislative or administrative measures to control drug costs. At the state level, legislatures are increasingly passing legislation and implementing regulations designed to control pharmaceutical and biological product pricing, including price or patient reimbursement constraints, discounts, restrictions on certain product access and marketing cost disclosure and transparency measures, and, in some cases, designed to encourage importation from other countries and bulk purchasing.

Coverage, pricing and reimbursement

Significant uncertainty exists as to the coverage and reimbursement status of biopharmaceutical products approved by the FDA and other government authorities. Sales of any approved products will depend, in part, on the extent to which the costs of the products will be covered by third-party payors, including government health programs in the United States such as Medicare and Medicaid, commercial health insurers and managed care organizations. The process for determining whether a payor will provide coverage for a product may be separate from the process for setting the price or reimbursement rate that the payor will pay for the product once coverage is approved. Third-party payors are increasingly challenging the prices charged, examining the medical necessity and reviewing the cost-effectiveness of medical products and services and imposing controls to manage costs. Third-party payors may also limit coverage to specific products on an approved list, or formulary, which might not include all of the approved products for a particular indication.

In the United States, no uniform policy of coverage and reimbursement for products exists among third-party payors. Third-party payors often rely upon Medicare coverage policy and payment limitations in setting their reimbursement rates, but also have their own methods and approval process apart from Medicare determinations. Therefore, coverage and reimbursement for products in the United States can differ significantly from payor to payor. In order to secure coverage and reimbursement for any biological product that is approved for sale, a biopharmaceutical manufacturer may need to conduct expensive pharmacoeconomic studies in order to demonstrate the medical necessity and cost-effectiveness of the product. A payor's decision to provide coverage for a drug or biological product does not imply that an adequate reimbursement rate will be approved. Third-party reimbursement may not be sufficient to maintain price levels high enough to realize an appropriate return on investment in product development.

The containment of healthcare costs also has become a priority of federal, state and foreign governments and the prices of drugs have been a focus in this effort. Governments have shown significant interest in implementing cost-containment programs, including price controls, restrictions on reimbursement and requirements for substitution of generic products. Adoption of price controls and cost-containment measures, and adoption of more restrictive policies in jurisdictions with existing controls and measures, could further limit a company's revenue generated from the sale of any approved drug or biological product. Coverage policies and third-party reimbursement rates may change at any time. Even if favorable coverage and reimbursement status is attained for one or more drug or biological products for which a company or its collaborators receive marketing approval, less favorable coverage policies and reimbursement rates may be implemented in the future.

Employees

As of March 31, 2019, we had 85 full-time employees, 71 of whom were primarily engaged in research and development activities and 42 of whom had an M.D. or Ph.D. degree. None of our employees are represented by a labor union or covered by a collective bargaining agreement.

Facilities

We occupy approximately 41,124 square feet of office and laboratory space in Redwood City, California, under leases that expire in the first half of 2020, which we use for our corporate headquarters as well as certain of our research and development activities. In January 2019, we entered into a commercial lease agreement for an additional 33,000 square feet of office space in a separate facility in South San Francisco, California.

Legal Proceedings

From time to time, we may become involved in litigation relating to claims arising from the ordinary course of business. Our management believes that there are currently no claims or actions pending against us, the ultimate disposition of which would have a material adverse effect on our results of operations, financial condition or cash flows.

MANAGEMENT

Executive Officers and Directors

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

Name	Age	Position
Executive Officers		
John A. Orwin	54	President, Chief Executive Officer and Director
Herbert Cross	47	Chief Financial Officer
Tito A. Serafini, Ph.D.	55	Chief Strategy Officer and Director
Norman Michael Greenberg, Ph.D.	59	Chief Scientific Officer
Guy Cavet, Ph.D.	45	Chief Technical Officer
Non-Employee Directors		
Brian Atwood(1)(2)	66	Chairman of the Board and Director
Franklin Berger(1)(3)	69	Director
David Lacey, M.D.(2)(3)	66	Director
William H. Robinson, M.D., Ph.D.(1)	51	Director
Lawrence Steinman, M.D.(2)(3)	71	Director

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

Executive Officers

John A. Orwin. Mr. Orwin has served as our President and Chief Executive Officer and a member of our board of directors since April 2018. Prior to joining Atreca, from June 2013 through June 2017, Mr. Orwin served as Chief Executive Officer of Relypsa, Inc. and from June 2013 through March 2017 also served as President of Relypsa and served on its board of directors from June 2013 until Relypsa's acquisition by the Galenica Group in September 2016. Prior to Relypsa, Mr. Orwin served as President and Chief Operating Officer of Affymax, Inc., a biotechnology company, from April 2010 to January 2011, and as Affymax's Chief Executive Officer and a member of the board of directors from February 2011 to May 2013. From 2005 to April 2010, Mr. Orwin served as Vice President and then Senior Vice President of the BioOncology Business Unit at Genentech, Inc. (now a member of the Roche Group), a biotechnology company. From 2001 to 2005, Mr. Orwin served in various executive-level positions at Johnson & Johnson, a life sciences company. Prior to such roles, Mr. Orwin held senior marketing and sales positions at various life sciences and pharmaceutical companies, including Alza Corporation (acquired by Johnson & Johnson), Sangstat Medical Corporation (acquired by Genzyme), Rhone-Poulenc Rorer Pharmaceuticals, Inc. (merged with Sanofi-Aventis) and Schering-Plough Corporation (merged with Merck). Mr. Orwin currently serves as a member of the board of directors of Retrophin, Inc., Array BioPharma Inc., a biopharmaceutical company and Seattle Genetics, Inc., a biotechnology company. In addition to previously serving as a member of the board of directors of Relypsa and Affymax, Mr. Orwin also served on the board of directors of NeurogesX, Inc., a biopharmaceutical company, from November 2009 until July 2013. Mr. Orwin received a B.A. in Economics from Rutgers University and an M.B.A. from the New York University Leonard M. Stern School of Business. We believe that Mr. Orwin's perspective and deep experience in the biopharmaceutical industry qualifies him to serve on our board of directors.

Herbert Cross. Mr. Cross has served as our Chief Financial Officer since February 2019. Prior to joining Atreca, from November 2017 to June 2018, Mr. Cross served as Chief Financial Officer of ARMO Biosciences, Inc., a biotechnology company. From February 2016 to November 2017, Mr. Cross served as Chief Financial Officer of Balance Therapeutics, Inc., a biotechnology company, where he led all investor relations, strategic finance and administrative functions. From October 2013 to November 2015, Mr. Cross served as Chief Financial Officer of KaloBios Pharmaceuticals, Inc., a biotechnology company, and interim Chief Executive Officer from January 2015 to November 2015. In December 2015, KaloBios filed a voluntary petition for relief under Chapter 11 of the Bankruptcy Code. KaloBios emerged from Chapter 11 in July 2016. From November 2010 to June 2013, Mr. Cross served as Chief Financial Officer of Affymax, Inc., a biotechnology company. Mr. Cross received a B.S. in Business Administration from the University of California, Berkeley and is a certified public accountant, currently inactive, in the state of California.

Tito A Serafini, Ph.D. Dr. Serafini is one of our principal founders and has served as a member of our board of directors since June 2010 and as our Chief Strategy Officer, with responsibility for the non-clinical research, development and technical organization, since April 2018. From June 2010 to April 2018, Dr. Serafini served as our President and Chief Executive Officer. Dr. Serafini received a B.S. in biochemistry from Case Western Reserve University and a Ph.D. in biochemistry from Stanford University School of Medicine. Dr. Serafini performed postdoctoral research at the University of California, San Francisco, and he was afterward an award-winning faculty member in the Department of Molecular and Cell Biology at the University of California, Berkeley, where he co-founded the university's Functional Genomics Laboratory. Dr. Serafini left academia to co-found and serve as an executive officer of Renovis, Inc., eventually a publicly held company. He subsequently held the position of Chief Scientific Officer at Nuon Therapeutics, Inc., before founding Atreca. Dr. Serafini was selected to serve on our board of directors because of his scientific knowledge and acumen as well as the experience he brings as our founder and former Chief Executive Officer.

Norman Michael Greenberg, Ph.D. Dr. Greenberg has served as our Chief Scientific Officer since May 2016. Prior to joining Atreca, from February 2015 until May 2016, Dr. Greenberg served as Senior Vice President of Translational Medicine at Checkmate Pharmaceuticals, LLC. From April 2014 until May 2016, Dr. Greenberg served as Chief Executive Officer and President of NMG Scientific Consulting, USA. From August 2011 until March 2014, Dr. Greenberg was Vice President of Global Research, Oncology, at MedImmune (AstraZeneca), where he spearheaded global research activities for immune-mediated and tumor-targeted therapies. He previously has served as Senior Director of Research in Oncology, at Pfizer, as a Full Member of the Fred Hutchinson Cancer Research Center and as a tenured Associate Professor at Baylor College of Medicine. Dr. Greenberg is the inventor of the TRAMP prostate cancer research models and has authored over 130 peer-reviewed scientific research articles. He currently sits on the Scientific Advisory Board for Machavert Pharmaceuticals. Dr. Greenberg received a B.Sc. in microbiology and immunology from the University of Toronto and a Ph.D. in microbiology and immunology from the University of British Columbia. Dr. Greenberg performed postdoctoral research at Baylor College of Medicine in Houston.

Guy Cavet, Ph.D. Dr. Cavet is one of our co-founders and has served as our Chief Technical Officer since July 2014. Prior to joining Atreca, Dr. Cavet was Chief Information Officer and Head of Computational Sciences at Nodality Inc., a life sciences company, from March 2013 until July 2014. From June 2012 until February 2013, Dr. Cavet served as Vice President, Life Sciences at Kaggle, Inc., where he focused on application of machine learning in healthcare and biomedical research. From March 2008 until June 2012, Dr. Cavet built the computational and statistical teams at Crescendo Bioscience, Inc., most recently as Vice President, Informatics. From February 2005 until March 2008, Dr. Cavet served as Senior Scientist at Genentech, Inc., building and leading a

team applying computational biology to diagnostics and cancer genomics. From January 2002 until February 2005, Dr. Cavet served as Group Leader, Computational Genomics at Merck & Co., Inc. after that company acquired Rosetta Inpharmatics, Inc., where Dr. Cavet held positions of increasing responsibility in computational biology from December 1999. Dr. Cavet received B.S. and Ph.D. degrees in Biochemistry from Cambridge University, and he performed postdoctoral research at Stanford University.

Non-Employee Directors

Brian Atwood. Mr. Atwood has served as the Chairman of our Board since December 2013. From December 2015 until February 2018, he served as President and Chief Executive Officer and was a co-founder of Cell Design Labs, Inc., a biotechnology company focused on developing human cell engineering technology for the treatment of multiple diseases, including cancer. In 1999, he co-founded and currently serves as a Managing Director for Versant Ventures, a healthcare-focused venture capital firm. Mr. Atwood serves on the board of directors of Clovis Oncology, Inc. He also served on the board of directors of Immune Design Corp., from May 2008 until June 2016, Veracyte, Inc., from its founding until December 2016, OpGen Inc., from July 2007 until December 2017, Five Prime Therapeutics, from 2002 until March 2016, Cadence Pharmaceuticals, Inc. from March 2006 until its acquisition in March 2014, Helicos Biosciences from 2003 until September 2011, Pharmion Corporation from 2000 until its acquisition in March 2008 and Trius Therapeutics, Inc. from February 2007 until its acquisition in September 2013. Mr. Atwood holds a B.S. in biological sciences from the University of California, Irvine, a M.S. in ecology from the University of California, Davis, and an M.B.A. from Harvard Business School. Mr. Atwood was selected to serve on our board of directors because of his experience in the venture capital industry, his years of business and leadership experience and his financial sophistication and expertise.

Franklin Berger. Mr. Berger has served as a member of our board of directors since October 2014. Mr. Berger is a consultant to biotechnology industry participants, including major biopharmaceutical firms, mid-capitalization biotechnology companies, specialist asset managers and venture capital companies, providing business development, strategic, financing, partnering, and royalty acquisition advice. Mr. Berger is also a biotechnology industry analyst with over 25 years of experience in capital markets and financial analysis. Mr. Berger worked at Sectoral Asset Management Inc. as a founder of the small-cap focused NEMO Fund from 2007 through June 2008. From May 1998 to March 2003, he served at J.P. Morgan Securities LLC, most recently as Managing Director, Equity Research and Senior Biotechnology Analyst. Previously, Mr. Berger served in similar capacities at Salomon Smith Barney Inc. and Josephthal & Co. Mr. Berger also serves on the board of directors of BELLUS Health, Inc., ESSA Pharma Inc., Proteostasis Therapeutics, Inc., Tocagen, Inc. Kezar Life Sciences, Inc. and Five Prime Therapeutics, Inc., each of which is a public biotechnology company. Mr. Berger previously served as a member of the board of directors of BioTime, Inc., from May 2013 until March 2014, and Seattle Genetics, Inc., from June 2004 until May 2014, each of which was a public company during Mr. Berger's service as a director. Mr. Berger received a B.A. in International Relations and an M.A. in International Economics, both from Johns Hopkins University, and an M.B.A. from Harvard Business School. Mr. Berger was selected to serve on our board of directors because of his financial background and experience as an equity analyst in the biotechnology industry combined with his experience serving on the boards of directors of multiple public companies.

David Lacey, M.D. Dr. Lacey has served as a member of our board of directors since May 2016. Dr. Lacey is a biopharmaceutical consultant at David L. Lacey LLC, where he advises academic institutions, biotechnology companies and venture capital firms, a position he has held since July 2011. He currently serves as a director of Inbiomotion SL, Argenx SE, Nurix, Inc. and Unity Biotherapeutics and additionally as a scientific advisor to a number of early-stage

biotechnology companies. From 1994 until his retirement in 2011, he held various positions, including Senior Vice President of Discovery Research, at Amgen Inc., where he oversaw research encompassing oncology, inflammation, metabolic disorders and neuroscience, and he played a fundamental scientific role in the discovery of the OPG/RANKL/RANK pathway, which led to the development of the anti-RANKL human monoclonal antibody denosumab, for both osteoporosis (Prolia®) and cancer-related bone diseases (XGEVA®). Dr. Lacey received a B.A. degree in biology and an M.D. degree from the University of Colorado School of Medicine. Dr. Lacey was selected to serve on our board of directors because of his experience both in leading drug discovery and as an advisor to companies in the healthcare industry.

William H. Robinson, M.D., Ph.D. Dr. Robinson is one of our principal founders and has served as a member of our board of directors since March 2011. Dr. Robinson is a Professor of Medicine in the Division of Immunology and Rheumatology of the Department of Medicine at Stanford University. At Stanford, he is Director of the Stanford Osteoarthritis Initiative. He co-founded the Stanford Human Immune Monitoring Center, serves on the editorial boards of several journals, and serves on the Board of Directors of the American College of Rheumatology and the Federation of Clinical Immunology Societies (FOCiS). In 2010, Dr. Robinson was elected to the American Society of Clinical Investigation and the Henry Kunkel Society. He was a co-founder Bayhill Therapeutics. The foundational technology for Atreca's Immune Repertoire Capture® technology was developed in his academic laboratory. Dr. Robinson received his B.S., M.D. and Ph.D. degrees from Stanford University and completed his clinical training in internal medicine at the University of California, San Francisco. Dr. Robinson was selected to serve on our board of directors because of his expertise and his experience as a founder of and an advisor to various companies in the healthcare industry.

Lawrence Steinman, M.D. Dr. Steinman is one of our principal founders and has served as a member of our board of directors since June 2010. Dr. Steinman is the George A. Zimmermann Professor of Neurology and Neurological Sciences and Pediatrics in the Stanford University School of Medicine. From 2002 until 2011, he served as Chairman of Stanford University Program in Immunology. Dr. Steinman is an elected member of the National Academy of Sciences and the National Academy of Medicine, and he also chairs the Research Advisory Committee on Gulf War Veterans' Illnesses for the Veterans Administration. Dr. Steinman served as a director of and headed the scientific advisory board at Centocor, Inc. from 1991 until its acquisition in 1999. Dr. Steinman also co-founded and served as a director of Neurocrine Biosciences. Dr. Steinman co-founded and currently serves as a director of several privately held companies including Tolerion, Inc. and Katexco Pharmaceuticals Corp. Dr. Steinman received a B.A. from Dartmouth College and an M.D. from Harvard Medical School. Dr. Steinman was selected to serve on our board of directors because of his expertise and his experience as a founder of and advisor to various companies in the healthcare industry.

Family Relationships

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

Composition of Our Board of Directors

Our business and affairs are managed under the direction of our board of directors. We currently have ten authorized board seats with seven directors currently serving as members of our board of directors. No stockholders have any special rights regarding the election or designation of members of our board of directors. Our current directors will continue to serve as directors until their resignation, removal or successor is duly elected.

On September 5, 2018, we entered into a nominating agreement, or the Baker Brothers Nominating Agreement, with Baker Brothers Life Sciences L.P. and 667, L.P., or together, Baker Brothers. Pursuant to the Baker Brothers Nominating Agreement, during the period beginning at the closing of this offering until when Baker Brothers, together with its affiliates, no longer beneficially own at least 3,333,333 shares of our common stock (subject to adjustment for stock splits, combinations, recapitalizations and similar transactions), or the Nominating Agreement Period, we will have the obligation to support the nomination of, and to cause our board of directors to include in the slate of nominees recommended to our stockholders for election, two individuals designated by Baker Brothers, each a Baker Designee, unless a majority of our disinterested directors reasonably and in good faith determines that a Baker Designee would not be qualified to serve as our director under law, rules of the stock exchange on which our shares are listed, our amended and restated bylaws, or any of our company policies. If a Baker Designee resigns his or her seat on our board of directors or is removed or does not become a director for any reason, the vacancy will be filled by the election or appointment of another designee of Baker Brothers as soon as reasonably practicable, subject to compliance with applicable laws, rules and regulations. Furthermore, during the Nominating Agreement Period, if there is no Baker Designee on our board of directors, we will have the obligation to invite two board of directors observer designees of Baker Brothers, or the Baker Observers, to attend all meetings of our board of directors and all meetings of the committees of our board of directors as a nonvoting observer, subject to the Baker Observers' agreement to hold in confidence the information they receive as observers of our board of directors and committee meetings, as well as subject to their exclusion from our board of directors meetings to preserve our attorney-client privilege, to avoid conflicts of interest, if Bakers Brothers is determined by our board of directors to be a competitor, or other customary conditions. The Baker Brothers Nominating Agreement automatically terminates upon the earlier of when Baker Brothers together with its affiliates no longer beneficially own at least 3,333,333 shares of our common stock or the consummation of our acquisition in a change of control transaction as such terms are defined in our amended and restated certificate of incorporation.

Our amended and restated certificate of incorporation and amended and restated bylaws to become effective upon the closing of this offering will permit our board of directors to establish the authorized number of directors from time to time by resolution. Each director serves until the expiration of the term for which such director was elected or appointed, or until such director's earlier death, resignation or removal. In accordance with our amended and restated certificate of incorporation that will be in effect upon the closing of this offering, our board of directors will be divided into three classes with staggered three-year terms. At each annual general meeting of stockholders, the successors to directors whose terms then expire will be elected to serve from the time of election and qualification until the third annual meeting following election. Our directors will be divided among the three classes as follows:

- the Class I directors will be David Lacey and Lawrence Steinman, and their terms will expire at our first annual meeting of stockholders following this offering;
- the Class II directors will be Brian Atwood, William H. Robinson and Tito A. Serafini, and their terms will expire at our second annual meeting of stockholders following this offering; and
- the Class III directors will be Franklin Berger and John A. Orwin, and their terms will expire at our third annual meeting of stockholders following this offering.

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

Our board of directors meets on a regular basis and additionally as required. The members of our current board of directors were elected in compliance with the provisions of our amended and restated certificate of incorporation and an amended and restated voting agreement among certain of our stockholders. The amended and restated voting agreement will terminate on the date of the closing of this offering, and following the closing of this offering none of our stockholders will have any special rights regarding the election or designation of members of our board of directors.

Director Independence

Applicable Nasdaq 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, Nasdaq rules require that, subject to specified exceptions, each member of a listed company's audit, compensation and nominating and corporate governance committees be independent and that audit committee members also satisfy independence criteria set forth in Rule 10A-3 under the Exchange Act of 1934, as amended, or the Exchange Act. The Nasdaq independence definition includes a series of objective tests, such as that the director is not, and has not been for at least three years, one of our employees, that neither the director nor any of his family members has engaged in various types of business dealings with us and that the director is not associated with the holders of more than 5% of our common stock. In addition, under applicable Nasdaq 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.

Our board of directors has undertaken a review of the independence of each director. Based on information provided by each director concerning her or his background, employment and affiliations, our board of directors has determined that three of our directors, Mr. Atwood, Mr. Berger and Dr. Lacey, do not have relationships that would interfere with the exercise of independent judgment in carrying out the responsibilities of a director and that each of these directors is ''independent'' as that term is defined under the listing standards of Nasdaq. 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 independence, including the beneficial ownership of our capital stock by each non-employee director. We intend to rely on phase-in periods under Nasdaq rules with respect to director independence, which allow us to have less than a majority of independent directors upon the date of listing of our Class A common stock, so long as our board has a majority of independent directors within one year of the date of listing. Accordingly, we plan to have a board of directors comprised of a majority of independent directors within one year of the date of listing.

Board Leadership Structure and Board's Role in Risk Oversight

Brian Atwood is the current chairman of our board of directors and John A. Orwin is our current chief executive officer, hence the roles of chairman of our board of directors and chief executive officer are separated. We believe that separating these positions allows our chief executive officer to focus on our day-to-day business, while allowing the chairman of our 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 the chief executive officer is required to devote to his position in the current business environment, as well as the commitment required to serve as our chairman of our board of directors, particularly as the board of directors' oversight responsibilities continue to grow. While our amended and restated bylaws and corporate governance guidelines do not require that our chairman and chief executive officer positions be separate, 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.

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 risks relating to our financial condition, development and commercialization activities, operations, strategic direction and intellectual property as more fully discussed in the section titled ''Risk Factors'' appearing elsewhere in this prospectus. Management is responsible for the day-to-day management of risks we face, while our board of directors, as a whole and through its committees, has responsibility for the oversight of risk management. In its risk oversight role, our board of directors has the responsibility to satisfy itself that the risk management processes designed and implemented by management are adequate and functioning as designed.

The role of the board of directors in overseeing the management of our risks is conducted primarily through committees of the board of directors, as disclosed in the descriptions of each of the committees below and in the charters of each of the committees. The full board of directors (or the appropriate board committee in the case of risks that are under the purview of a particular committee) discusses with management our major risk exposures, their potential impact on us, and the steps we take to manage them. When a board committee is responsible for evaluating and overseeing the management of a particular risk or risks, the chairman of the relevant committee reports on the discussion to the full board of directors during the committee reports portion of the next board meeting. This enables the board of directors and its committees to coordinate the risk oversight role, particularly with respect to risk interrelationships.

Committees of Our Board of Directors

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

Audit Committee

Our audit committee consists of Mr. Atwood, Mr. Berger and Dr. Robinson. Our board of directors has determined that each of Mr. Atwood and Mr. Berger satisfy the independence requirements under the listing standards of Nasdaq and Rule 10A-3(b)(1) of the Exchange Act. We intend to comply with the listing requirement of Nasdaq regarding the composition of our audit committee within the transition period for newly public companies. The chair of our audit committee is Mr. Berger, who our board of directors has determined is an ''audit committee financial expert'' within the meaning of SEC regulations. Dr. Robinson is not ''independent'' due to his service and compensation received as a consultant to us within the past three years, and we are relying on the phase-in schedules set forth in Nasdaq listing rule 5615(b)(1) with respect to Dr. Robinson's service on the audit committee. Each member of our audit committee can read and understand fundamental financial statements in accordance with applicable requirements. In arriving at these determinations, our board of directors has examined each audit committee member's scope of experience and the nature of their employment in the corporate finance sector.

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

- helping our board of directors oversee our corporate accounting and financial reporting processes;

- managing the selection, engagement, qualifications, independence and performance of a qualified firm to serve as the independent registered public accounting firm to audit our financial statements;
- discussing the scope and results of the audit with the independent registered public accounting firm, and reviewing, with management and the independent accountants, our interim and year-end operating results;
- developing procedures for employees to submit concerns anonymously about questionable accounting or audit matters;
- reviewing related person transactions;
- establishing insurance coverage for the Company's officers and directors;
- overseeing the preparation of the Company's annual proxy statement, reviewing with management the Company's financial statements to be included the Company's quarterly reports to be filed with the SEC, and reviewing with management the ''Risk Factors'' and ''Management's Discussion and Analysis of Financial Condition and Results of Operations'' disclosures in the Company's periodic reports filed with the SEC;
- obtaining and reviewing a report by the independent registered public accounting firm at least annually that describes our internal quality control procedures, any material issues with such procedures and any steps taken to deal with such issues when required by applicable law; and
- approving or, as permitted, pre-approving, audit and permissible non-audit services to be performed by the independent registered public accounting firm.

Our audit committee will operate under a written charter, which will be effective upon the completion of this offering, that satisfies the applicable listing standards of Nasdaq.

Compensation Committee

Our compensation committee consists of Mr. Atwood, Dr. Lacey and Dr. Steinman. The chair of our compensation committee is Mr. Atwood. Our board of directors has determined that each of Mr. Atwood and Dr. Lacey is independent under the listing standards of Nasdaq, a ''non-employee director'' as defined in Rule 16b-3 promulgated under the Exchange Act and an ''outside director'' as defined in Section 162(m) of the Internal Revenue Code of 1986, as amended, or the Code. Dr. Steinman is not ''independent'' due to his service and compensation received as a consultant to us within the past three years and we are relying on the phase-in schedules set forth in Nasdaq listing rule 5615(b)(1) with respect to Dr. Steinman's service on the compensation committee. We are permitted to phase in our compliance with the independent compensation committee requirements set forth by Nasdaq listing standards as follows: (1) one independent member at the time of listing, (2) a majority of independent members within 90 days of listing and (3) all independent members within one year of listing. We intend to comply with the listing requirement of Nasdaq regarding the composition of our compensation committee within the transition period for newly public companies. Within one year of our listing on The Nasdaq Global Select Market, we expect that Dr. Steinman will have resigned from our compensation committee and that each new director added to the compensation committee will be independent under Nasdaq listing rules, a non-employee director, as defined in Rule 16b-3 promulgated under the Exchange Act, and an ''outside director,'' as defined pursuant to Section 162(m) of the Code.

The primary purpose of our compensation committee is to discharge the responsibilities of our board of directors in overseeing our compensation policies, plans and programs and to review and

determine the compensation to be paid to our executive officers, directors and other senior management, as appropriate. Specific responsibilities of our compensation committee include:

- reviewing and approving the compensation of our chief executive officer, other executive officers and senior management;
- reviewing and recommending to our board of directors the compensation paid to our directors;
- administering our equity incentive plans and other benefit programs;
- reviewing, adopting, amending and terminating incentive compensation and equity plans, severance agreements, profit sharing plans, bonus plans, change-of-control protections and any other compensatory arrangements for our executive officers and other senior management; and
- reviewing and establishing general policies relating to compensation and benefits of our employees, including our overall compensation philosophy.

Our compensation committee will operate under a written charter, which will be effective upon the completion of this offering, that satisfies the applicable listing standards of Nasdaq.

Nominating and Corporate Governance Committee

Our nominating and corporate governance committee consists of Mr. Berger, Dr. Lacey and Dr. Steinman. The chair of our nominating and corporate governance committee is Dr. Lacey. Our board of directors has determined that Mr. Berger and Dr. Lacey are ''independent'' as defined under the applicable Nasdaq listing standards and SEC rules and regulations. Dr. Steinman is not ''independent'' due to his service and compensation received as a consultant to us within the past three years and we are relying on the phase-in schedules set forth in Nasdaq listing rule 5615(b)(1) with respect to Dr. Steinman's service on the nominating and corporate governance committee. We are permitted to phase in our compliance with the independent nominating and corporate governance committee requirements set forth by the Nasdaq listing standards as follows: (1) one independent member at the time of listing, (2) a majority of independent members within 90 days of listing and (3) all independent members within one year of listing. Within one year of our listing on the Nasdaq Global Select Market, we expect that Dr. Steinman will have resigned from our nominating and corporate governance committee and that any new directors added to the nominating and corporate governance committee will be independent under Nasdaq listing rules.

Specific responsibilities of our nominating and corporate governance committee include:

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

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

Code of Business Conduct and Ethics

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

Compensation Committee Interlocks and Insider Participation

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

Non-Employee Director Compensation

We do not currently have a formal non-employee director compensation program, and non-employee directors are compensated for their service as non-employee directors as determined on an individual basis by our board of directors. In connection with this offering, we have adopted a non-employee director compensation policy, which will be effective upon the closing of this offering. Under this non-employee director compensation policy, our non-employee directors will be eligible to receive compensation for service on our board of directors and committees of our board of directors.

Pursuant to this non-employee director compensation policy, non-employee directors will be paid annual cash compensation of $35,000. In addition, non-employee directors will be paid $7,500 annually for serving on the audit committee ($15,000 annually for the chairperson), $5,000 annually for serving on the compensation committee ($10,000 annually for the chairperson), and $4,000 annually for serving on the nominating and governance committee ($8,000 annually for the chairman). Furthermore, our lead independent director, if any, will be paid an additional $35,000 annually for service as our lead independent director, and the chairperson of our board of directors will be paid an additional $35,000 annually for service as the chairperson of our board of directors. Non-employee directors will be reimbursed for their reasonable out-of-pocket expenses to cover attendance at and participation in meetings of our board of directors.

Our non-employee directors will be granted initial and/or annual option grants under our 2019 Equity Incentive Plan. Newly appointed or newly elected directors will be granted an option to purchase 24,000 shares of our Class A common stock. The initial option grant will vest in equal annual installments over three years from the date of grant, subject to the non-employee director's continuous service on each applicable vesting date. At the close of business on the date of each annual meeting of our stockholders, each individual who is then a non-employee director will be granted an option to purchase 12,000 shares of our Class A common stock. The annual option grant will vest upon the earlier of the one year anniversary of the date of grant or the day prior to our next annual meeting of our stockholders occurring after the grant date, subject to the non-employee director's continuous service on each applicable vesting date. All options granted under our director compensation policy will be granted with an exercise price equal to the fair market value of our Class A common stock on the grant date. The vesting of all options will cease upon a non-employee

director's cessation of service, unless otherwise determined pursuant to our 2019 Equity Incentive Plan or by agreement. All unvested options will vest in full immediately prior to a change in control (as defined in our 2019 Equity Incentive Plan Plan), subject to the non-employee director's continuous service as of immediately prior to the closing of such change in control.

The following table sets forth information regarding the compensation earned or paid to our non-employee directors during the year ended December 31, 2018. John A. Orwin, our President and Chief Executive Officer, and Tito A. Serafini, our Chief Strategy Officer, are also members of our board of directors, but did not receive any additional compensation for service as a director. The compensation of Mr. Orwin and Dr. Serafini as named executive officers is set forth below under ''Executive Compensation—Summary Compensation Table.''

Name	Fees Earned or Paid in Cash	All Other Compensation	Total
Brian Atwood	$ 35,000	$ —	$ 35,000
Franklin Berger	25,000	—	25,000
David Lacey, M.D.	25,000	—	25,000
William H. Robinson, M.D., Ph.D.(1)	—	250,000	250,000
Lawrence Steinman, M.D.(2)	—	150,000	150,000

(1) Dr. Robinson entered into an amended and restated consulting agreement with us, effective as of January 1, 2017, by which Dr. Robinson provides consulting services to us in the field of research and development of diagnostics, biologic therapeutics and paired diagnostics and biologic therapeutics and receives an annual consulting fee of $250,000, payable in quarterly installments.

(2) Dr. Steinman entered into an amended and restated consulting agreement with us on October 3, 2017, by which Dr. Steinman provides consulting services to us in the field of research and development of diagnostics, biologic therapeutics and paired diagnostics and biologic therapeutics and receives an annual consulting fee of $150,000, payable in quarterly installments. This amended and restated consulting agreement was amended and restated in January 2019 to increase the annual consulting fee to $175,000, among other things, and shall terminate on December 31, 2019.

EXECUTIVE COMPENSATION

Our named executive officers, as of December 31, 2018, were:

- John A. Orwin, who was appointed as our President and Chief Executive Officer in April 2018;
- Tito A. Serafini, Chief Strategy Officer, who previously served as our President and Chief Executive Officer until April 2018;
- Susan Berland, who served as our Chief Financial Officer until her retirement in March 2019; and
- Norman Michael Greenberg, our Chief Scientific Officer.

Summary Compensation Table

The following table sets forth information concerning the compensation of our named executive officers during the fiscal year ended December 31, 2018:

Name and Principal Position	Year	Salary ($)	Option Awards ($)	Non-Equity Incentive Plan Compensation ($)(1)	All Other Compensation ($)(2)	Total ($)
John A. Orwin *President and Chief Executive Officer*	2018	318,750	4,294,637	—	2,145	4,615,532
Tito A. Serafini *Chief Strategy Officer and Former President and Chief Executive Officer*	2018	413,170	2,019,627	158,000	5,658	2,596,455
Susan Berland *Chief Financial Officer*	2018	330,000	117,723	105,000	6,327	559,050
Norman Michael Greenberg *Chief Scientific Officer*	2018	393,225	177,421	128,625	101,418	800,689

(1) The amounts disclosed represent the applicable named executive officer's total performance bonus earned for the fiscal year ended December 31, 2018, as described below under "—Non-Equity Incentive Plan Compensation."

(2) The amounts disclosed for each of our named executive officers (other than Dr. Greenberg) represent the life insurance premiums paid by us for each such named executive officer. For Dr. Greenberg, the amounts disclosed represent (i) $76,802 of housing and other living expenses provided for the officer's residence, (ii) $18,965 for commuting expenses, and (iii) $5,651 for life insurance premiums paid by us.

Nonqualified Deferred Compensation

Our named executive officers did not participate in, or earn any benefits under, a non-qualified deferred compensation plan sponsored by us during 2018.

Non-Equity Incentive Plan Compensation

In addition to base salaries, our named executive officers are eligible to receive performance-based cash bonuses, which are designed to provide appropriate incentives to our executives to achieve defined performance goals and to reward our executives for individual achievement towards these goals. The performance-based cash bonus each executive officer is eligible to receive is generally based on the extent to which we achieve the corporate goals and the extent to which our

executives achieve their individual goals that our board or compensation committee establishes at the beginning of each year and is paid annually.

For the fiscal year ended December 31, 2018: (i) Mr. Orwin was eligible to receive a bonus at an annual target of 45% of his base salary based on our achievement of our 2018 corporate goals related to the generation of additional immuno-oncology pipeline assets, acquiring oncology patient samples and fundraising of $125 million pursuant to equity sales, and his bonus was also based on his personal goals of managing our business in terms of overall strategy, pipeline development, business and partnership development, leading our financing initiatives and initiatives related to this offering; (ii) Dr. Serafini was eligible to receive a bonus at an annual target of 40% of his base salary based on our achievement of our 2018 corporate goals described above and his personal goals of collecting and screening patient samples, advancing the development of ATRC-101 and recruiting a new chief executive officer; (iii) Ms. Berland was eligible to receive a bonus at an annual target of 35% of her base salary based on our achievement of our 2018 corporate goals described above and her personal goals of managing our facilities, operations, strategy and corporate development, positioning the company for a successful equity funding effort, increasing standards of company finance and administrative processes and delivering spending transparency and (iv) Dr. Greenberg was eligible to receive a bonus at an annual target of 35% of his base salary based on our achievement of our 2018 corporate goals described above and his personal goals of managing our therapeutic research and preclinical development, expanding our pipeline and value of antibody assets, support our IND filings, establishing scientific biomarkers and framework for protecting therapeutic-focused intellectual property. All bonuses for the fiscal year ended December 31, 2018 were paid in cash in 2019.

Agreements with our Named Executive Officers & Potential Payments Upon Termination or Change of Control

Below are descriptions of our employment agreements and offer letter agreements with our named executive officers. The agreements generally provide for at-will employment and set forth the named executive officer's initial base salary, eligibility for employee benefits and severance benefits upon a qualifying termination of employment. Furthermore, each of our named executive officers has executed a form of our standard proprietary information and inventions assignment agreement. The key terms of the employment agreements with our named executive officers, including potential payments upon termination or change of control, are described below. Following completion of our initial public offering, management expects to recommend to the compensation committee of our board of directors changes in compensation for certain of our named executive officers to better align their compensation with that of executives at a peer group of life-science public companies identified by the compensation committee. Based upon an analysis prepared by a third-party compensation consultant, management currently anticipates recommending changes for certain named executive officers including: (i) increases in base compensation by 5% to 10%, (ii) increases in incentive bonus target compensation by 5% to 10% and (iii) increases in severance payment periods by as much as 3 to 6 months in certain instances of termination without cause. Changes, if any, to executive officer compensation will be determined in the sole discretion of the compensation committee.

John A. Orwin

In March 2018, we entered into an executive employment agreement with John A. Orwin, or the Orwin Employment Agreement, which provides for his at-will employment as our President and Chief Executive Officer, with no specific term. The Orwin Employment Agreement provides for an annual base salary of $450,000 and an annual discretionary bonus of up to 45% of his base salary, the amount of which will be decided in the sole discretion of our board of directors based upon our and

Mr. Orwin's achievement of objectives and milestones determined on an annual basis by our board of directors. Pursuant to the Orwin Employment Agreement, Mr. Orwin was granted an initial option to purchase a number of shares representing 5.5% of our Class A common stock on a fully diluted basis, which share number represented 695,832 shares as of the grant date. This initial option grant vests over a four-year period during which 25% of the shares subject to this option grant vest on the one-year anniversary of Mr. Orwin's date of employment and the remaining shares subject to this option grant vest in 36 equal monthly installments thereafter, in each case, subject to Mr. Orwin's continued service with the Company. Mr. Orwin is also entitled to receive an additional option to purchase shares of our Class A common stock if his percentage owned of our capital stock drops below 4% (on a fully-diluted, as converted to Class A common stock basis) upon the earliest to occur of (A) the date of the first issuance of our capital stock to the public pursuant to a firmly underwritten public offering pursuant to an effective registration statement, (B) a change of control of our company, or (C) three years after March 21, 2018, such that after such grant Mr. Orwin's percentage owned of our capital stock will equal 4%. Mr. Orwin has also executed our standard form of employee confidential information and inventions assignment agreement, whereby he agrees to maintain confidentiality regarding any confidential information regarding the company and assigns to the Company all intellectual property pertaining to our company.

The Orwin Employment Agreement provides for payments to be made to Mr. Orwin upon certain qualifying terminations of his employment, including in connection with a Change of Control of the Company (as such term is defined in the Orwin Employment Agreement and summarized below). Pursuant to the Orwin Employment Agreement, if Mr. Orwin (i) is terminated without Cause (as such term is defined in the Orwin Employment Agreement and summarized below) and other than as a result of death or disability or (ii) resigns for Good Reason (as such term is defined in the Orwin Employment Agreement and summarized below), then, provided that Mr. Orwin signs, and does not subsequently revoke, a separation agreement and release of claims in favor of our company, Mr. Orwin will receive the following: (i) a severance payment equal to one year of his base salary to be paid in a lump sum on the 60th day following his termination of employment, (ii) subject to Mr. Orwin's timely election of continued coverage under the Consolidated Omnibus Budget Reconciliation Act of 1985, as amended, or COBRA, payment by us of Mr. Orwin's COBRA premiums for Mr. Orwin and eligible dependents for a period of up to 12 months following his termination of employment, or, if our company determines that it cannot pay these COBRA premiums without a substantial risk of violating applicable law, we may pay to Mr. Orwin a taxable monthly payment in an amount equal to the monthly COBRA premium that Mr. Orwin would be required to pay to continue his group health coverage in effect on the date of Mr. Orwin's termination of employment for a period of up to 12 months following his termination of employment, and (iii) only if such termination or resignation occurs within the 30-day period prior to or within the 12-month period following a Change of Control, the acceleration of vesting of all unvested equity awards held by Mr. Orwin. In addition, if Mr. Orwin's employment with the Company terminates as a result of death or disability, then the vesting on 50% of the outstanding unvested equity awards held by Mr. Orwin on his last day of employment will be accelerated.

For the purposes of the Orwin Employment Agreement, ''Cause'' means Mr. Orwin's (a) commission of any felony or crime involving dishonesty; (b) participation in any fraud against our company; (c) material breach of his duties to our company; (d) intentional damage to any property of our company; (e) misconduct, or other violation of our policy that causes harm; (f) breach of any written agreement with our company; and (g) conduct which in the good faith and reasonable determination of our board of directors demonstrates gross unfitness to serve.

For the purposes of the Orwin Employment Agreement, ''Good Reason'' means (a) a material reduction in Mr. Orwin's base salary, which the parties agree is a reduction of at least 10% of

Mr. Orwin's base salary (unless pursuant to a salary reduction program applicable generally to our company's similarly situated employees); (b) a material reduction in Mr. Orwin's duties (including responsibilities or authorities); provided, however, that, solely following a change of control, a change in job position (including a change in title) shall not be deemed a ''material reduction'' in and of itself unless Mr. Orwin's new duties are materially reduced from his prior duties; or (c) a relocation of Mr. Orwin's principal place of employment to a place that increases Mr. Orwin's one-way commute by more than 50 miles as compared to Mr. Orwin's then-current principal place of employment immediately prior to such relocation.

For the purposes of the Orwin Employment Agreement, ''Change of Control'' means (i) any consolidation or merger by us with or into any other entity other than any consolidation or merger in which the shares of our capital stock immediately prior the consolidation or merger continue to represent a majority of the voting power of the surviving entity immediately after the consolidation or merger or (ii) any transaction or series of related transactions to which we are a party and in which more than 50% of our voting power is transferred, provided that a Change of Control does not include any transaction or series of transactions principally for bona fide equity financing purposes where we receive cash or in which any of our indebtedness is cancelled.

Tito A. Serafini

In June 2018, we entered into an amended and restated executive employment agreement with Tito Serafini, or the Serafini Employment Agreement, which provides for his at-will employment as our Chief Strategy Officer and continued service on our board of directors, subject to the provisions of our amended and restated certificate of incorporation and our amended and restated voting agreement, each as amended from time to time. The Serafini Employment Agreement provides for an annual base salary of $413,170 and an annual discretionary bonus of up to 40% of his base salary, the amount of which will be decided in the sole discretion of our board of directors based upon our and Dr. Serafini's achievement of objectives and milestones determined on an annual basis by our board of directors. Pursuant to the Serafini Employment Agreement, Dr. Serafini was granted a new option to purchase 99,999 shares of our Class A common stock on April 28, 2018, of which 24,999 options were vested as of the grant date, and the remainder of the options are scheduled to vest monthly over the four-year period beginning on April 16, 2018, subject to Dr. Serafini's continued service with the Company. Dr. Serafini is also entitled to receive an additional option to purchase shares of our Class A common stock, or the Make-up Option, if his percentage owned of our capital stock drops below 3.4% (on a fully-diluted, as converted to Class A common stock basis) upon the earliest to occur of (A) the date of the first issuance of our capital stock to the public pursuant to a firmly underwritten public offering pursuant to an effective registration statement, (B) a change of control of our company, or (C) three years after June 26, 2018, such that after such grant Dr. Serafini's percentage owned of our capital stock will equal 3.4%. Dr. Serafini has also executed the Company's standard form of employee confidential information and inventions assignment agreement, whereby he agrees to maintain confidentiality regarding any confidential information regarding the company and assigns to the Company all intellectual property pertaining to the Company.

The Serafini Employment Agreement provides for payments to be made to Dr. Serafini upon certain qualifying terminations of his employment, including in connection with a Change of Control of the Company (as such term is defined in the Serafini Employment Agreement and summarized below). Pursuant to the Serafini Employment Agreement, if Dr. Serafini (A) is terminated without Cause (as such term is defined in the Serafini Employment Agreement and summarized below) and other than as a result of death or disability or (B) resigns for Good Reason (as such term is defined in the Serafini Employment Agreement and summarized below), in either case (1) prior to the 60-day period prior to or more than 12 months following a Change of Control or (2) on any date following

April 16, 2019, then, provided that Dr. Serafini signs, and does not subsequently revoke, a separation agreement and release of claims in favor of our company, Dr. Serafini will receive the following: (i) a severance payment equal to nine months of his base salary to be paid in a lump sum on the 60th day following his termination of employment and (ii) subject to Dr. Serafini's timely election of continued coverage under COBRA, payment by us of Dr. Serafini's COBRA premiums for Dr. Serafini and eligible dependents for a period of up to nine months following his termination of employment, or, if our company determines that it cannot pay these COBRA premiums without a substantial risk of violating applicable law, we may pay to Dr. Serafini a taxable monthly payment in an amount equal to the monthly COBRA premium that Dr. Serafini would be required to pay to continue his group health coverage in effect on the date of Dr. Serafini's termination of employment for a period of up to nine months following his termination of employment. If such termination or resignation occurs within the 60-day period prior to or within the 12-month period following a Change of Control, in addition to the above-described severance benefits, Dr. Serafini would also be entitled to the acceleration of vesting of all unvested equity awards held by Dr. Serafini.

If Dr. Serafini is (A) terminated without Cause (as such term is defined in the Serafini Employment Agreement and summarized below) and other than as a result of death or disability or (B) resigns for Good Reason (as such term is defined in the Serafini Employment Agreement and summarized below), in either case, on any date prior to April 16, 2019, then, provided that Dr. Serafini signs, and does not subsequently revoke, a separation agreement and release of claims in favor of the Company, Dr. Serafini will receive the following: (i) a severance payment equal to 15 months of his base salary, (ii) subject to Dr. Serafini's timely election of continued coverage under COBRA, payment by us of Dr. Serafini's COBRA premiums for Dr. Serafini and eligible dependents for a period of up to 15 months following his termination of employment, or, if our company determines that it cannot pay these COBRA premiums without a substantial risk of violating applicable law, we may pay to Dr. Serafini a taxable monthly payment to in an amount equal to the monthly COBRA premium that Dr. Serafini would be required to pay to continue his group health coverage in effect on the date of Dr. Serafini's termination of employment for a period up to 15 months following his termination of employment, (iii) the acceleration of vesting of all equity awards held by Dr. Serafini prior to April 1, 2018, and (iv) if Dr. Serafini is terminated without Cause (as such term is defined in the Serafini Employment Agreement and summarized below) or resigns without Good Reason (as such term is defined in the Serafini Employment Agreement and summarized below), the vesting on 25% of 99,999 shares of outstanding then-unvested new equity awards held by Dr. Serafini granted to him in connection with the Serafini Employment Agreement and on 25% of the unvested portion of the Make-up Option, if any are outstanding as of that time.

If Dr. Serafini is terminated due to his death or disability, then as of the termination date, (i) Dr. Serafini's then-unvested equity awards shall cease to vest, (ii) all unearned compensation payments to Dr. Serafini will terminate immediately and (iii) Dr. Serafini will not be entitled to any severance benefits, including any cash severance, payment by us of his COBRA premiums or special cash payments.

For the purposes of the Serafini Employment Agreement, ''Cause'' means Dr. Serafini's (a) commission of any felony or crime involving dishonesty; (b) willful participation in any fraud against our company; (c) willful breach of his material duties to our company; (d) willful and material damage to any property of our company; (e) willful misconduct or other violation of our policy that causes material harm to our company; (f) willful and material breach of any written agreement with our company; and (g) willful conduct which in the good faith and reasonable determination of our board of directors demonstrates gross unfitness to serve.

For the purposes of the Serafini Employment Agreement, ''Good Reason'' means (a) a material reduction in Dr. Serafini's base salary, which the parties agree is a reduction of at least 10% of Dr. Serafini's base salary (unless pursuant to a salary reduction program applicable generally to our company's similarly situated employees); (b) a material reduction in Dr. Serafini's duties (including responsibilities or authorities); provided, however, that a change in job position (including a change in title) shall not be deemed a ''material reduction'' in and of itself unless Dr. Serafini's new duties are materially reduced from his prior duties; (c) a material breach by our company of any written agreement between Dr. Serafini and our company; or (d) a relocation of Dr. Serafini's principal place of employment to a place that increases Dr. Serafini's one-way commute by more than 50 miles as compared to Dr. Serafini's then-current principal place of employment immediately prior to such relocation.

The Serafini Employment Agreement defines ''Change of Control'' in a manner similar to the Orwin Employment Agreement (as described above).

Susan Berland

In April 2016, we entered into an executive employment agreement with Susan Berland, or the Berland Employment Agreement, which provides for her at-will employment as our EVP and Chief Financial Officer. The Berland Employment Agreement provides for an annual base salary of $285,000 and an annual discretionary bonus of up to 35% of her base salary, the amount of which was decided in the sole discretion of our board of directors based upon our and Ms. Berland's achievement of objectives and milestones determined on an annual basis by our board of directors. Ms. Berland has also executed the Company's standard form of employee confidential information and inventions assignment agreement, whereby she agrees to maintain confidentiality regarding any confidential information regarding the company and assigns to the Company all intellectual property pertaining to the Company. Ms. Berland retired from all employment positions with us in March 2019.

The Berland Employment Agreement provides for payments to be made to Ms. Berland upon certain qualifying terminations of her employment, including in connection with a Change of Control of the Company (as such term is defined in the Berland Employment Agreement and summarized below). Pursuant to the Berland Employment Agreement, if Ms. Berland (i) is terminated without Cause (as such term is defined in the Berland Employment Agreement and summarized below) and other than as a result of death or disability or (ii) resigns for Good Reason (as such term is defined in the Berland Employment Agreement and summarized below), in either case prior to the 30-day period prior to the closing of a Change of Control or more than 12 months following the closing of a Change in Control, then, provided that Ms. Berland signs, and does not subsequently revoke, a separation agreement and release of claims in favor of our company, Ms. Berland will receive the following: (i) a severance payment equal to six months of her base salary to be paid in a lump sum on the 60th day following her termination of employment, (ii) subject to Ms. Berland's timely election of continued coverage under COBRA, payment by us of Ms. Berland's COBRA premiums for Ms. Berland and eligible dependents for a period of up to 6 months following her termination of employment, or, if our company determines that it cannot pay these COBRA premiums without a substantial risk of violating applicable law, we may pay to Ms. Berland a taxable monthly payment in an amount equal to the monthly COBRA premium that Ms. Berland would be required to pay to continue her group health coverage in effect on the date of Ms. Berland's termination of employment for a period of up to 6 months following her termination of employment, or the Berland COBRA Payments, and (iii) only if such termination or resignation occurs within the 30-day period prior to or within the 12-month period following a Change of Control, the acceleration of vesting of all unvested equity awards held by Ms. Berland.

If Ms. Berland was terminated due to her death or disability, then as of the termination date, (i) Ms. Berland's then-unvested equity awards shall cease to vest, (ii) all unearned compensation payments to Ms. Berland will terminate immediately and (iii) Ms. Berland will not be entitled to any severance benefits, including any cash severance, payment by us of her COBRA premiums or special cash payments.

For the purposes of the Berland Employment Agreement, ''Cause'' means Ms. Berland's (a) commission of any felony or crime involving dishonesty; (b) participation in any fraud against our company; (c) material breach of her duties to our company; (d) persistent unsatisfactory performance of job duties after written notice from our board of directors and a reasonable opportunity to cure (if curable), (e) intentional damage to any property of our company; (e) misconduct or other violation of our policy that causes harm to our company; (f) misconduct or other violation of Company policy that causes harm, (g) breach of any written agreement with our company; and (h) conduct which in the good faith and reasonable determination of our board of directors demonstrates gross unfitness to serve.

For the purposes of the Berland Employment Agreement, ''Good Reason'' means (a) a material reduction in Ms. Berland's base salary, which the parties agree is a reduction of at least 10% of Ms. Berland's base salary (unless pursuant to a salary reduction program applicable generally to our company's similarly situated employees); (b) a material reduction in Ms. Berland's duties (including responsibilities or authorities); provided, however, that a change in job position (including a change in title) shall not be deemed a ''material reduction'' in and of itself unless Ms. Berland's new duties are materially reduced from her prior duties; or (c) a relocation of Ms. Berland's principal place of employment to a place that increases Ms. Berland's one-way commute by more than 50 miles as compared to Ms. Berland's then-current principal place of employment immediately prior to such relocation.

The Berland Employment Agreement defines ''Change of Control'' in a manner similar to the Orwin Employment Agreement (as described above).

In April 2019, we entered into a separation agreement with Ms. Berland, or the Berland Separation Agreement, pursuant to which Ms. Berland will provide to us certain transition consulting services, including providing strategic advice and counseling, from March 31, 2019 until December 31, 2019. The Berland Separation Agreement provides for (i) severance pay, equivalent to six months of Ms. Berland's base salary in effect as of the separation date, (ii) the COBRA Payments, (iii) continued vesting of Ms. Berland's outstanding stock options on the same terms and conditions through December 31, 2019 and (v) payment of $350 per hour of work for us for a maximum of 170 hours per month.

Norman Michael Greenberg

In March 2016, we entered into an executive employment agreement with Norman Michael Greenberg, or the Greenberg Employment Agreement, which provides for his at-will employment as our Senior Vice President and Chief Scientific Officer. The Greenberg Employment Agreement provides for an annual base salary of $350,000 and an annual discretionary bonus of up to 35% of his base salary, the amount of which will be decided in the sole discretion of our board of directors based upon our and Dr. Greenberg's achievement of objectives and milestones determined on an annual basis by our board of directors. Pursuant to the Greenberg Employment Agreement, Dr. Greenberg was granted an initial option to purchase 122,201 shares of our Class A common stock. This initial option grant vests over a four-year period during which 25% of the options vested on the one-year anniversary of Dr. Greenberg's date of employment and the remaining options vest in 36 equal monthly installments thereafter, in each case, subject to Dr. Greenberg's continued

service with the Company. Pursuant to the Greenberg Employment Agreement, Dr. Greenberg also received a sign-on advance bonus of $50,000, which was considered earned in March 2017 following the completion of his one-year anniversary of continuous service with the Company. Additionally, pursuant to the Greenberg Employment Agreement, Dr. Greenberg was entitled to (A) the reimbursement of reasonable expenditures incurred by Dr. Greenberg during the first 12 months of his employment with us for temporary housing (up to $4,000 per month) and for up to two trips per month of travel between the San Francisco Bay Area and his then-primary residence (up to $1,300 per month), (B) the reimbursement of up to $50,000 for relocation expenses incurred not later than August 31, 2017 and (C) tax gross-up assistance with respect to any portion of the above-described relocation benefit amounts that were taxable to Dr. Greenberg without a full corresponding deduction. Dr. Greenberg has also executed the Company's standard form of employee confidential information and inventions assignment agreement, whereby he agrees to maintain confidentiality regarding any confidential information regarding the company and assigns to the Company all intellectual property pertaining to the Company.

The Greenberg Employment Agreement provides for payments to be made to Dr. Greenberg upon certain qualifying terminations of his employment, including in connection with a Change of Control of the Company (as such term is defined in the Greenberg Employment Agreement and summarized below). Pursuant to the Greenberg Employment Agreement, if Dr. Greenberg (i) is terminated without Cause (as such term is defined in the Greenberg Employment Agreement and summarized below) and other than as a result of death or disability or (ii) resigns for Good Reason (as such term is defined in the Greenberg Employment Agreement and summarized below), in either case prior to the 30-day period prior to the closing of a Change of Control or more than 12 months following the closing of a Change in Control, then, provided that Dr. Greenberg signs, and does not subsequently revoke, a separation agreement and release of claims in favor of our company, Dr. Greenberg will receive the following: (i) a severance payment equal to six months of his base salary to be paid in a lump sum on the 60th day following his termination of employment, (ii) subject to Dr. Greenberg's timely election of continued coverage under COBRA, payment by us of Dr. Greenberg's COBRA premiums for Dr. Greenberg and eligible dependents for a period of up to 6 months following her termination of employment, or, if our company determines that it cannot pay these COBRA premiums without a substantial risk of violating applicable law, we may pay to Dr. Greenberg a taxable monthly payment in an amount equal to the monthly COBRA premium that Dr. Greenberg would be required to pay to continue his group health coverage in effect on the date of Dr. Greenberg's termination of employment for a period of up to 6 months following her termination of employment, and (iii) only if such termination or resignation occurs within the 30-day period prior to or within the 12-month period following a Change of Control, the acceleration of vesting of all unvested equity awards held by Dr. Greenberg.

If Dr. Greenberg is terminated due to his death or disability, then as of the termination date, (i) Dr. Greenberg's then-unvested equity awards shall cease to vest, (ii) all unearned compensation payments to Dr. Greenberg will terminate immediately and (iii) Dr. Greenberg will not be entitled to any severance benefits, including any cash severance, payment by us of his COBRA premiums or special cash payments.

For the purposes of the Greenberg Employment Agreement, ''Cause'' means Dr. Greenberg's (a) commission of any felony or crime involving dishonesty; (b) participation in any fraud against our company; (c) material breach of his duties to our company; (d) persistent unsatisfactory performance of job duties after written notice from our board of directors and a reasonable opportunity to cure (if curable), (e) intentional damage to any property of our company; (e) misconduct or other violation of our policy that causes harm to our company; (f) misconduct or other violation of Company policy that causes harm, (g) breach of any written agreement with our company; and (g) conduct which in the good faith and reasonable determination of our board of directors demonstrates gross unfitness to serve.

For the purposes of the Greenberg Employment Agreement, ''Good Reason'' means (a) a material reduction in Dr. Greenberg's base salary, which the parties agree is a reduction of at least 10% of Dr. Greenberg's base salary (unless pursuant to a salary reduction program applicable generally to our company's similarly situated employees); (b) a material reduction in Dr. Greenberg's duties (including responsibilities or authorities); provided, however, that a change in job position (including a change in title) shall not be deemed a ''material reduction'' in and of itself unless in Dr. Greenberg's new duties are materially reduced from his prior duties; or (c) a relocation of Dr. Greenberg's principal place of employment to a place that increases Dr. Greenberg's one-way commute by more than 50 miles as compared to Dr. Greenberg's then-current principal place of employment immediately prior to such relocation.

The Greenberg Employment Agreement defines ''Change of Control'' in a manner similar to the Orwin Employment Agreement (as described above).

In the event that the severance and other benefits payable to Mr. Orwin, Dr. Serafini, Ms. Berland or Dr. Greenberg constitute ''parachute payments'' under Section 280G of the U.S. tax code and would be subject to the applicable excise tax under Section 4999 of the Code, such severance and other benefits will be either (A) delivered in full or (B) delivered to such lesser extent which would result in no portion of such severance and other benefits being subject to the excise tax, whichever results in the receipt on an after-tax basis of the greatest amount of benefits.

Outstanding Equity Awards as of December 31, 2018

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

		Option Awards			
		Number of securities underlying unexercised options		Option exercise price	Option expiration date
Name	Grant Date	(#) exercisable	(#) unexercisable	($)	
John A. Orwin	4/28/2018(1)	695,832	—	$ 5.16	4/27/2028
	10/30/2018(2)	6,197	142,556	$10.02	10/29/2028
	11/15/2018(2)	1,229	57,766	$10.02	11/14/2028
Tito A. Serafini	2/3/2016(3)	33,332	—	$ 4.56	2/2/2026
	4/28/2018(4)	99,999	—	$ 5.16	4/27/2028
	10/30/2018(2)	5,891	135,503	$10.02	10/29/2028
	11/15/2018(2)	1,044	49,101	$10.02	11/14/2028
Susan Berland	5/1/2015(5)	5,784	—	$ 0.66	4/30/2025
	2/3/2016(1)	40,347	—	$ 4.56	2/2/2026
	4/28/2018(3)	33,332	—	$ 5.16	4/27/2028
Norman Michael Greenberg	5/10/2016(1)	122,201	—	$ 4.56	5/9/2026
	4/28/2018(3)	49,999	—	$ 5.16	4/27/2028

(1) 25% of the total shares subject to this option will vest one year after the vesting commencement date and 1/48th of the shares subject to this option will vest monthly thereafter subject to continued service to us through the applicable vesting date. If applicable, vesting accelerates as provided in, and subject to the terms and conditions of, that executive employment agreement, as may be amended from time to time. The option is subject to an early exercise provision and is immediately exercisable for restricted shares subject to the same vesting provisions.

(2) 1/48th of the total shares subject to this option will vest monthly measured from the vesting commencement date subject to continued service to us through the applicable vesting date. If applicable, vesting accelerates as provided in, and subject to the terms and conditions of, that executive employment agreement, as may be amended from time to time.

(3) 1/48th of the total shares subject to this option will vest monthly measured from the vesting commencement date subject to continued service to us through the applicable vesting date. If applicable, vesting accelerates as provided in, and subject to the terms and conditions of, that executive employment agreement, as may be amended from time to time. The option is subject to an early exercise provision and is immediately exercisable for restricted shares subject to the same vesting provisions.
(4) 25% of the total shares subject to this option vested on the vesting commencement date and 1/48th of the unvested shares will vest monthly thereafter subject to continued service to us through the applicable vesting date. If applicable, vesting accelerates as provided in, and subject to the terms and conditions of, that executive employment agreement, as may be amended from time to time. The option is subject to an early exercise provision and is immediately exercisable for restricted shares subject to the same vesting provisions.
(5) 31.25% of the total shares subject to this option will vest on the 15 month anniversary of the vesting commencement date and 1/48th of the shares subject to this option will vest monthly thereafter subject to continued service to us through the applicable vesting date. If applicable, vesting accelerates as provided in, and subject to the terms and conditions of, that executive employment agreement, as may be amended from time to time. The option is subject to an early exercise provision and is immediately exercisable for restricted shares subject to the same vesting provisions.

Employee Benefit and Stock Plans

2019 Equity Incentive Plan

Our board of directors adopted and our stockholders approved our 2019 Equity Incentive Plan, or the 2019 Plan, on June 2, 2019, and June 7, 2019, respectively. The 2019 Plan became effective on June 19, 2019, and no further grants will be made under the 2010 Plan. The purpose of the 2019 Plan, through the grant of stock awards, is to help us secure and retain the services of eligible award recipients, provide incentives for such persons to exert maximum efforts for our success and that of our affiliates, and provide a means by which the eligible recipients may benefit from increases in value of our Class A common stock.

Awards. The 2019 Plan provides for the grant of incentive stock options, or ISOs, within the meaning of Section 422 of the Code, nonstatutory stock options, or NSOs, stock appreciation rights, restricted stock awards, restricted stock unit awards, performance-based stock awards, and other forms of equity compensation, which are collectively referred to as stock awards. ISOs may be granted only to our employees and to any of our parent or subsidiary corporation's employees. All other awards may be granted to employees, including officers, and to non-employee directors and consultants of ours and any of our affiliates.

Share Reserve. Initially, the aggregate number of shares of our Class A common stock that may be issued pursuant to stock awards under the 2019 Plan is the sum of (1) 2,416,666 shares plus (2) the number of shares remaining available for issuance under our 2010 Plan at the time our 2019 Plan becomes effective and (3) the number of shares subject to stock options or other stock awards granted under our 2010 Plan that would have otherwise returned to our 2010 Plan in accordance with its terms (such as upon the expiration or termination of a stock award prior to vesting or to cover the payment of any withholding tax or any applicable exercise price). The number of shares of our Class A common stock reserved for issuance under our 2019 Plan will automatically increase on January 1 of each year, beginning on January 1, 2020 and continuing through and including January 1, 2029, by 4% of the total number of shares of our capital stock outstanding on December 31 of the preceding calendar year, or a lesser number of shares determined by our board of directors. The maximum number of shares that may be issued upon the exercise of ISOs under our 2019 Plan is 6,141,842 shares.

If a stock award granted under the 2019 Plan expires or otherwise terminates without being exercised in full, or is settled in cash, the shares of our Class A common stock not acquired pursuant to the stock award again will become available for subsequent issuance under the 2019 Plan. In addition, the following types of shares under the 2019 Plan may become available for the grant of new stock awards under the 2019 Plan: (1) shares that are forfeited to or repurchased by us prior to becoming fully vested; (2) shares withheld to satisfy income or employment withholding taxes; or (3) shares used to pay the exercise or purchase price of a stock award. Shares issued under the 2019 Plan may be previously unissued shares or reacquired shares bought by us on the open market.

The maximum number of shares of Class A common stock subject to stock awards granted under the 2019 Plan or otherwise during any one calendar year to any non-employee director, taken together with any cash fees paid by us to such non-employee director during such calendar year for service on the board of directors, will not exceed $750,000 in total value (calculating the value of any such stock awards based on the grant date fair value of such stock awards for financial reporting purposes), or, with respect to the calendar year in which a non-employee director is first appointed or elected to our board of directors, $1,000,000.

Administration. Our board of directors, or a duly authorized committee thereof, has the authority to administer the 2019 Plan. Our board of directors may also delegate to one or more of our officers the authority to (1) designate employees (other than officers) to be recipients of certain stock awards, (2) determine the number of shares of Class A common stock to be subject to such stock awards and (3) to the extent permitted by applicable law, specify the other terms applicable to such awards. Subject to the terms of the 2019 Plan, our board of directors or the authorized committee, referred to as the plan administrator, determines recipients, dates of grant, the numbers and types of stock awards to be granted, and the terms and conditions of the stock awards, including the period of their exercisability and the vesting schedule applicable to a stock award. Subject to the limitations set forth below, the plan administrator will also determine the exercise price, strike price, or purchase price of stock awards granted and the types of consideration to be paid for the stock award.

The plan administrator has the authority to modify outstanding stock awards under our 2019 Plan. Subject to the terms of our 2019 Plan, the plan administrator has the authority, without stockholder approval, to reduce the exercise, purchase, or strike price of any outstanding stock award, cancel any outstanding stock award in exchange for new stock awards, cash, or other consideration, or take any other action that is treated as a repricing under generally accepted accounting principles, with the consent of any adversely affected participant.

Stock Options. ISOs and NSOs are evidenced by stock option agreements adopted by the plan administrator. The plan administrator determines the exercise price for a stock option, within the terms and conditions of the 2019 Plan, provided that the exercise price of a stock option generally cannot be less than 100% of the fair market value of our Class A common stock on the date of grant. Options granted under the 2019 Plan vest at the rate specified by the plan administrator.

The plan administrator determines the term of stock options granted under the 2019 Plan, up to a maximum of 10 years. Unless the terms of an option holder's stock option agreement provide otherwise, if an option holder's service relationship with us, or any of our affiliates, ceases for any reason other than disability, death, or cause, the option holder may generally exercise any vested options for a period of three months following the cessation of service. The option term will automatically be extended in the event that exercise of the option following such a termination of service is prohibited by applicable securities laws or our insider trading policy. If an option holder's service relationship with us or any of our affiliates ceases due to disability or death, or an option

holder dies within a certain period following cessation of service, the option holder or a beneficiary may generally exercise any vested options for a period of 12 months in the event of disability and 18 months in the event of death. In the event of a termination for cause, options generally terminate immediately. In no event may an option be exercised beyond the expiration of its term.

Acceptable consideration for the purchase of Class A common stock issued upon the exercise of a stock option will be determined by the plan administrator and may include (1) cash, check, bank draft or money order, (2) a broker-assisted cashless exercise, (3) a net exercise of the option if it is an NSO and (4) other legal consideration approved by the plan administrator.

Unless the plan administrator provides otherwise, options generally are not transferable except by will, the laws of descent and distribution, or pursuant to a domestic relations order. An option holder may designate a beneficiary, however, who may exercise the option following the option holder's death.

Tax Limitations on ISOs. The aggregate fair market value, determined at the time of grant, of our Class A common stock with respect to ISOs that are exercisable for the first time by an option holder during any calendar year under all of our stock plans may not exceed $100,000. Options or portions thereof that exceed such limit will be treated as NSOs. No ISOs may be granted to any person who, at the time of the grant, owns or is deemed to own stock possessing more than 10% of our total combined voting power or that of any of our parent or subsidiary corporations, unless (1) the option exercise price is at least 110% of the fair market value of the stock subject to the option on the date of grant and (2) the term of the ISO does not exceed five years from the date of grant.

Restricted Stock Awards. Restricted stock awards are evidenced by restricted stock award agreements adopted by the plan administrator. Restricted stock awards may be granted in consideration for (1) cash, check, bank draft, or money order, (2) services rendered to us or our affiliates, or (3) any other form of legal consideration. Class A common stock acquired under a restricted stock award may, but need not, be subject to a share repurchase option in our favor in accordance with a vesting schedule as determined by the plan administrator. Rights to acquire shares under a restricted stock award may be transferred only upon such terms and conditions as set by the plan administrator. Except as otherwise provided in the applicable award agreement, restricted stock awards that have not vested will be forfeited upon the participant's cessation of continuous service for any reason.

Restricted Stock Unit Awards. Restricted stock unit awards are evidenced by restricted stock unit award agreements adopted by the plan administrator. Restricted stock unit awards may be granted in consideration for any form of legal consideration or for no consideration. A restricted stock unit award may be settled by cash, delivery of stock, a combination of cash and stock as deemed appropriate by the plan administrator, or in any other form of consideration set forth in the restricted stock unit award agreement. Additionally, dividend equivalents may be credited in respect of shares covered by a restricted stock unit award. Rights under a restricted stock unit award may be transferred only upon such terms and conditions as set by the plan administrator. Restricted stock unit awards may be subject to vesting as determined by the plan administrator. Except as otherwise provided in the applicable award agreement, restricted stock units that have not vested will be forfeited upon the participant's cessation of continuous service for any reason.

Stock Appreciation Rights. Stock appreciation rights are evidenced by stock appreciation grant agreements adopted by the plan administrator. The plan administrator determines the strike price for a stock appreciation right, which generally cannot be less than 100% of the fair market value of our Class A common stock on the date of grant. Upon the exercise of a stock appreciation right, we will

pay the participant an amount in cash or stock equal to (1) the excess of the per share fair market value of our Class A common stock on the date of exercise over the strike price, multiplied by (2) the number of shares of Class A common stock with respect to which the stock appreciation right is exercised. A stock appreciation right granted under the 2019 Plan vests at the rate specified in the stock appreciation right agreement as determined by the plan administrator.

The plan administrator determines the term of stock appreciation rights granted under the 2019 Plan, up to a maximum of 10 years. Unless the terms of a participant's stock appreciation right agreement provides otherwise, if a participant's service relationship with us or any of our affiliates ceases for any reason other than cause, disability, or death, the participant may generally exercise any vested stock appreciation right for a period of three months following the cessation of service. The stock appreciation right term will be further extended in the event that exercise of the stock appreciation right following such a termination of service is prohibited by applicable securities laws. If a participant's service relationship with us, or any of our affiliates, ceases due to disability or death, or a participant dies within a certain period following cessation of service, the participant or a beneficiary may generally exercise any vested stock appreciation right for a period of 12 months in the event of disability and 18 months in the event of death. In the event of a termination for cause, stock appreciation rights generally terminate immediately upon the occurrence of the event giving rise to the termination of the individual for cause. In no event may a stock appreciation right be exercised beyond the expiration of its term.

Unless the plan administrator provides otherwise, stock appreciation rights generally are not transferable except by will, the laws of descent and distribution, or pursuant to a domestic relations order. A stock appreciation right holder may designate a beneficiary, however, who may exercise the stock appreciation right following the holder's death.

Performance Awards. Our 2019 Plan permits the grant of performance-based stock and cash awards. The performance goals that may be selected include one or more of the following: earnings (including earnings per share and net earnings); earnings before interest, taxes, and depreciation; earnings before interest, taxes, depreciation, and amortization; total stockholder return; return on equity or average stockholder's equity; return on assets, investment, or capital employed; stock price; margin (including gross margin); income (before or after taxes); operating income; operating income after taxes; pre-tax profit; operating cash flow; sales or revenue targets; increases in revenue or product revenue; expenses and cost reduction goals; improvement in or attainment of working capital levels; economic value added (or an equivalent metric); market share; cash flow; cash flow per share; share price performance; debt reduction; customer satisfaction; stockholders' equity; capital expenditures; debt levels; operating profit or net operating profit; workforce diversity; growth of net income or operating income; billings; implementation or completion of projects or processes; financing; regulatory milestones; stockholder liquidity; corporate governance and compliance; product commercialization; intellectual property; personnel matters; progress of internal research or clinical programs; progress of partnered programs; partner satisfaction; budget management; clinical achievements; completing phases of a clinical study (including the treatment phase); announcing or presenting preliminary or final data from clinical studies; in each case, whether on particular timelines or generally; timely completion of clinical trials; submission of Device Master File(s) and other regulatory achievements; partner or collaborator achievements; internal controls, including those related to the Sarbanes-Oxley Act of 2002; research progress, including the development of programs; investor relations, analysts and communication; manufacturing achievements (including obtaining particular yields from manufacturing runs and other measurable objectives related to process development activities); strategic partnerships or transactions (including in-licensing and out-licensing of intellectual property); establishing relationships with commercial entities with respect to the marketing, distribution and sale of our products and services (including with group purchasing

organizations, distributors and other vendors); supply chain achievements (including establishing relationships with manufacturers, suppliers and other services providers of the our products and services); co-development, co-marketing, profit sharing, joint venture, or other similar arrangements; individual performance goals; corporate development and planning goals; and other measures of performance selected by our board of directors or any committee thereof.

The performance goals may be based on company-wide performance or performance of one or more business units, divisions, affiliates, or business segments, and may be either absolute or relative to the performance of one or more comparable companies or the performance of one or more relevant indices. Unless specified otherwise in the award agreement at the time the award is granted or in such other document setting forth the performance goals at the time the goals are established, we will appropriately make adjustments in the method of calculating the attainment of performance goals as follows: to exclude restructuring or other nonrecurring charges; to exclude exchange rate effects; to exclude the effects of changes to generally accepted accounting principles; to exclude the effects of any statutory adjustments to corporate tax rates; to exclude the effects of any items that are unusual in nature or occur infrequently as determined under generally accepted accounting principles; to exclude the dilutive effects of acquisitions or joint ventures; to assume that any business divested by us achieved performance objectives at targeted levels during the balance of a performance period following such divestiture; to exclude the effect of any change in the outstanding shares of our Class A common stock by reason of any stock dividend or split, stock repurchase, reorganization, recapitalization, merger, consolidation, spin-off, combination or exchange of shares or other similar corporate change, or any distributions to common stockholders other than regular cash dividends; to exclude the effects of stock-based compensation and the award of bonuses under our bonus plans; to exclude costs incurred in connection with potential acquisitions or divestitures that are required to be expensed under generally accepted accounting principles; to exclude the goodwill and intangible asset impairment charges that are required to be recorded under generally accepted accounting principles; and to exclude the effect of any other unusual, nonrecurring gain or loss or other extraordinary item. In addition, we retain the discretion to adjust or eliminate the compensation or economic benefit due upon attainment of the goals. The performance goals may differ from participant to participant and from award to award.

Other Stock Awards. The plan administrator may grant other awards based in whole or in part by reference to our Class A common stock. The plan administrator will set the number of shares under the stock award and all other terms and conditions of such awards.

Changes to Capital Structure. In the event that there is a specified type of change in our capital structure, such as a stock split or recapitalization, appropriate adjustments will be made to (1) the class and maximum number of shares reserved for issuance under the 2019 Plan, (2) the class and maximum number of shares by which the share reserve may increase automatically each year, (3) the class and number of shares that may be issued upon the exercise of ISOs and (4) the class and number of shares and exercise price, strike price, or purchase price, if applicable, of all outstanding stock awards.

Corporate Transactions. In the event of certain specified significant corporate transactions, the plan administrator has the discretion to take any of the following actions with respect to stock awards:

- arrange for the assumption, continuation, or substitution of a stock award by a surviving or acquiring entity or parent company;
- arrange for the assignment of any reacquisition or repurchase rights held by us to the surviving or acquiring entity or parent company;

- accelerate the vesting of the stock award and provide for its termination prior to the effective time of the corporate transaction;
- arrange for the lapse of any reacquisition or repurchase right held by us;
- cancel or arrange for the cancellation of the stock award in exchange for such cash consideration, if any, as our board of directors may deem appropriate; or
- make a payment equal to the excess of (1) the value of the property the participant would have received upon exercise of the stock award over (2) the exercise price or strike price otherwise payable in connection with the stock award.

Our plan administrator is not obligated to treat all stock awards, even those that are of the same type, in the same manner.

Under the 2019 Plan, a significant corporate transaction is generally the consummation of (1) a sale or other disposition of all or substantially all of our consolidated assets, (2) a sale or other disposition of more than 50% of our outstanding securities, (3) a merger, consolidation or similar transaction following which we are not the surviving corporation or (4) a merger, consolidation, or similar transaction following which we are the surviving corporation but the shares of our Class A common stock outstanding immediately prior to such transaction are converted or exchanged into other property by virtue of the transaction.

Change in Control. The plan administrator may provide, in an individual award agreement or in any other written agreement between a participant and us, that the stock award will be subject to additional acceleration of vesting and exercisability or settlement in the event of a change in control. Under the 2019 Plan, a change in control is generally (1) the acquisition by a person or entity of more than 50% of our combined voting power other than by merger, consolidation or similar transaction, (2) a consummated merger, consolidation, or similar transaction immediately after which our stockholders do not own more than 50% of the combined voting power of the surviving entity (or its parent company), (3) a consummated sale, lease or exclusive license or other disposition of all or substantially all of our consolidated assets and (4) certain changes in the board of directors.

Amendment and Termination. Our board of directors has the authority to amend, suspend, or terminate our 2019 Plan, provided that such action does not materially impair the existing rights of any participant without such participant's written consent and provided further that certain types of amendments will require the approval of our stockholders. No ISOs may be granted after the tenth anniversary of the date our board of directors adopts our 2019 Plan.

2019 Employee Stock Purchase Plan

Our board of directors adopted the 2019 Employee Stock Purchase Plan, or the ESPP, on June 2, 2019, and our stockholders approved the ESPP on June 7, 2019. The ESPP became effective on June 19, 2019. The purpose of the ESPP is to secure the services of new employees, to retain the services of existing employees and to provide incentives for such individuals to exert maximum efforts toward our success and that of our affiliates. The ESPP is intended to qualify as an ''employee stock purchase plan'' within the meaning of Section 423 of the Code.

Share Reserve. Following this offering, the ESPP will authorize the issuance of 283,333 shares of our Class A common stock pursuant to purchase rights granted to our employees or to employees of any of our designated affiliates. The number of shares of our Class A common stock reserved for issuance will automatically increase on January 1 of each calendar year, from January 1, 2020 through January 1, 2029, by the lesser of (1) 1% of the total number of shares of our Class A common stock outstanding on December 31 of the preceding calendar year, and

(2) 416,666 shares; *provided*, that prior to the date of any such increase, our board of directors may determine that such increase will be less than the amount set forth in clauses (1) and (2).

Administration. Our board of directors intends to delegate concurrent authority to administer the ESPP to our compensation committee. The ESPP is implemented through a series of offerings under which eligible employees are granted purchase rights to purchase shares of our Class A common stock on specified dates during such offerings. Under the ESPP, we may specify offerings with durations of not more than 27 months, and may specify shorter purchase periods within each offering. Each offering will have one or more purchase dates on which shares of our Class A common stock will be purchased for employees participating in the offering. An offering under the ESPP may be terminated under certain circumstances.

Payroll Deductions. Generally, all regular employees, including executive officers, employed by us or by any of our designated affiliates, may participate in the ESPP and may contribute, normally through payroll deductions, up to 15% of their earnings (as defined in the ESPP) for the purchase of our Class A common stock under the ESPP. Unless otherwise determined by our board of directors, Class A common stock will be purchased for the accounts of employees participating in the ESPP at a price per share equal to the lower of (a) 85% of the fair market value of a share of our Class A common stock on the first date of an offering or (b) 85% of the fair market value of a share of our Class A common stock on the date of purchase.

Limitations. Employees may have to satisfy one or more of the following service requirements before participating in the ESPP, as determined by our board of directors, including: (1) being customarily employed for more than 20 hours per week; (2) being customarily employed for more than five months per calendar year; or (3) continuous employment with us or one of our affiliates for a period of time (which such period may not be equal to or greater than two years). No employee may purchase shares under the ESPP at a rate in excess of $25,000 worth of our Class A common stock based on the fair market value per share of our Class A common stock at the beginning of an offering for each year such a purchase right is outstanding. Finally, no employee will be eligible for the grant of any purchase rights under the ESPP if immediately after such rights are granted, such employee has voting power over 5% or more of our outstanding capital stock measured by vote or value pursuant to Section 424(d) of the Code.

Changes to Capital Structure. In the event that there occurs a change in our capital structure through such actions as a stock split, merger, consolidation, reorganization, recapitalization, reincorporation, stock dividend, dividend in property other than cash, large nonrecurring cash dividend, liquidating dividend, combination of shares, exchange of shares, change in corporate structure, or similar equity restructuring transaction, the board of directors will make appropriate adjustments to (1) the class and maximum number of shares reserved under the ESPP, (2) the class and maximum number of shares by which the share reserve may increase automatically each year, (3) the class and number of shares and purchase price of all outstanding purchase rights, and (4) the class and number of shares that are subject to purchase limits under ongoing offerings.

Corporate Transactions. In the event of certain significant corporate transactions, including (1) a sale of all or substantially all of our assets, (2) the sale or disposition of 50% of our outstanding securities, (3) the consummation of a merger or consolidation where we do not survive the transactions, and (4) the consummation of a merger or consolidation where we do survive the transaction but the shares of our Class A common stock outstanding immediately prior to such transaction are converted or exchanged into other property by virtue of the transaction, any then-outstanding rights to purchase our stock under the ESPP may be assumed, continued, or substituted for by any surviving or acquiring entity (or its parent company). If the surviving or acquiring entity (or its parent company) elects not to assume, continue, or substitute for such purchase rights, then the participants' accumulated payroll contributions will be used to purchase

shares of our Class A common stock within 10 business days prior to such corporate transaction, and such purchase rights will terminate immediately after such purchase.

ESPP Amendments, Termination. Our board of directors has the authority to amend, suspend, or terminate our ESPP, provided that except in certain circumstances such amendment or termination may not materially impair any outstanding purchase rights without the holder's consent. We will obtain stockholder approval of any amendment to our ESPP, as required by applicable law or listing requirements.

2010 Equity Incentive Plan

Our board of directors and certain of our stockholders approved in September 2010 the 2010 Plan, which became effective in September 2010. Our 2010 Plan has been periodically amended, most recently in May 2019 when the amendment was approved by our board of directors and certain of our stockholders. Our 2010 Plan terminated as of June 19, 2019, and we will not grant any additional awards under our 2010 Plan. However, our 2010 Plan will continue to govern the terms and conditions of the outstanding awards previously granted thereunder, which include options and restricted stock awards.

As of March 31, 2019, a total of 3,540,114 shares of our Class A common stock were reserved for issuance under the 2010 Plan. As of March 31, 2019, 2,587,996 shares of our Class A common stock were subject to outstanding option awards and 517,035 shares of our Class A common stock remained available for future issuance. Following the effectiveness of the 2019 Plan, no additional awards will be granted under the 2010 Plan.

Administration. The board of directors administers the 2010 Plan. Subject to the terms and conditions of the 2010 Plan, the board of directors has the authority to select the persons to whom awards are to be made, to determine the type or types of awards to be granted to each person, determine the number of awards to grant, determine the number of shares to be subject to such awards, determine the fair market value applicable to certain stock awards, and the terms and conditions of such awards, and make all other determinations and decisions and to take all other actions necessary or advisable for the administration of the 2010 Plan. The board of directors is also authorized to establish, adopt, amend or revise rules relating to administration of the 2010 Plan, subject to certain restrictions.

Eligibility. Options may be granted to individuals who are then our employees, consultants and members of our board of directors. Only employees may be granted ISOs.

Awards. The 2010 Plan permits the award of ISOs, NSOs, stock appreciation rights, restricted stock awards and restricted stock units. Only stock options have been granted under the 2010 Plan to date. Each award is set forth in a separate agreement with the person receiving the award and indicates the type, terms and conditions of the award.

- NSOs provide for the right to purchase shares of our Class A common stock at a specified price which may not be less than the fair market value of a share of stock on the date of grant, and usually will become exercisable (at the discretion of our board of directors) in one or more installments after the grant date, subject to the participant's continued employment or service with us or subject to the satisfaction of performance targets established by our compensation committee (or the board of directors, in the case of awards to non-employee directors). NSOs may be granted for any term specified by our compensation committee (or the board of directors, in the case of awards to non-employee directors), but the term may not exceed ten years.

- ISOs are designed to comply with the provisions of the Internal Revenue Code and are subject to specified restrictions contained in the Internal Revenue Code applicable to ISOs. Among such restrictions, ISOs must have an exercise price of not less than the fair market value of a share of Class A common stock on the date of grant, may only be granted to employees, must expire within a specified period of time following the optionee's termination of employment, and must be exercised within the ten years after the date of grant. In the case of an ISO granted to an individual who owns (or is deemed to own) more than 10% of the total combined voting power of all classes of our capital stock on the date of grant, the 2010 Plan provides that the exercise price must be at least 110% of the fair market value of a share of Class A common stock on the date of grant and the ISO must expire on the fifth anniversary of the date of its grant.

As of the date hereof, all of our non-employee directors, officers, other employees and certain current and former consultants participate in our 2010 Plan.

Corporate Transactions. In the event of certain specified significant corporate transactions, the plan administrator has the discretion to take any of the following actions with respect to stock awards:

- arrange for the assumption, continuation, or substitution of a stock award by a surviving or acquiring entity or parent company;
- arrange for the assignment of any reacquisition or repurchase rights held by us to the surviving or acquiring entity or parent company;
- accelerate the vesting of the stock award and provide for its termination prior to the effective time of the corporate transaction;
- arrange for the lapse of any reacquisition or repurchase right held by us;
- cancel or arrange for the cancellation of the stock award in exchange for such cash consideration, if any, as our board of directors may deem appropriate; or
- make a payment equal to the excess of (1) the value of the property the participant would have received upon exercise of the stock award over (2) the exercise price or strike price otherwise payable in connection with the stock award.

Our plan administrator is not obligated to treat all stock awards, even those that are of the same type, in the same manner.

Under the 2010 Plan, a significant corporate transaction is generally the consummation of (1) a sale or other disposition of all or substantially all of our consolidated assets, (2) a sale or other disposition of at least 90% of our outstanding securities, (3) a merger, consolidation or similar transaction following which we are not the surviving corporation or (4) a merger, consolidation, or similar transaction following which we are the surviving corporation but the shares of our Class A common stock outstanding immediately prior to such transaction are converted or exchanged into other property by virtue of the transaction.

Change in Control. The plan administrator may provide, in an individual award agreement or in any other written agreement between a participant and us, that the stock award will be subject to additional acceleration of vesting and exercisability or settlement in the event of a change in control. Under the 2010 Plan, a change in control is generally (1) the acquisition by a person or entity of more than 50% of our combined voting power other than by merger, consolidation or similar transaction, (2) a consummated merger, consolidation, or similar transaction immediately after which our stockholders do not own more than 50% of the combined voting power of the surviving entity (or its parent company), and (3) a consummated sale, lease or exclusive license or other disposition of all or substantially all of our consolidated assets.

Amendment or Termination of the 2010 Plan. Our board of directors may terminate, suspend, or amend the 2010 Plan, provided that such action does not materially impair the existing rights of any participant without such participant's written consent and provided further that certain types of amendments will require the approval of our stockholders. Unless sooner terminated by the board, the 2010 Plan automatically terminates on the day before the 10th anniversary of the earlier of (i) the date the 2010 Plan is adopted by the board, or (ii) the date the 2010 Plan is approved by our stockholders. The 2010 Plan was terminated by our board of directors as of June 19, 2019.

401(k) Plan

We maintain a safe harbor 401(k) plan that provides eligible U.S. employees with an opportunity to save for retirement on a tax advantaged basis. Eligible employees are able to defer eligible compensation up to certain limits of the Internal Revenue Code of 1986, as amended, or the Code, which are updated annually. We have the ability to make matching and discretionary contributions to the 401(k) plan. Currently, we do not make matching contributions or discretionary contributions to the 401(k) plan. The 401(k) plan is intended to be qualified under Section 401(a) of the Code, with the related trust intended to be tax exempt under Section 501(a) of the Code. As a tax-qualified retirement plan, contributions to the 401(k) plan are deductible by us when made, and contributions and earnings on those amounts are not generally taxable to the employees until withdrawn or distributed from the 401(k) plan.

Limitations of Liability and Indemnification Matters

On the completion of this offering, our amended and restated certificate of incorporation will contain provisions that limit the liability of our current and former directors for monetary damages to the fullest extent permitted by Delaware law. Delaware law provides that directors of a corporation will not be personally liable for monetary damages for any breach of fiduciary duties as directors, except liability for:

- any breach of the director's duty of loyalty to the corporation or its stockholders;
- any act or omission not in good faith or that involves intentional misconduct or a knowing violation of law;
- unlawful payments of dividends or unlawful stock repurchases or redemptions; or
- any transaction from which the director derived an improper personal benefit.

Such limitation of liability does not apply to liabilities arising under federal securities laws and does not affect the availability of equitable remedies such as injunctive relief or rescission.

Our amended and restated certificate of incorporation that will be in effect upon the closing of this offering will authorize us to indemnify our directors, officers, employees and other agents to the fullest extent permitted by Delaware law. Our amended and restated bylaws that will be in effect upon the closing of this offering will provide that we are required to indemnify our directors and officers to the fullest extent permitted by Delaware law and may indemnify our other employees and agents. Our amended and restated bylaws that will be in effect upon the closing of this offering will also provide that, on satisfaction of certain conditions, we will advance expenses incurred by a director or officer in advance of the final disposition of any action or proceeding, and permit us to secure insurance on behalf of any officer, director, employee or other agent for any liability arising out of his or her actions in that capacity regardless of whether we would otherwise be permitted to indemnify him or her under the provisions of Delaware law. We have entered and expect to continue to enter into agreements to indemnify our directors, executive officers and other employees as determined by the board of directors. With certain exceptions, these agreements provide for indemnification for related expenses including attorneys' fees, judgments, fines and settlement

amounts incurred by any of these individuals in any action or proceeding. We believe that these amended and restated certificate of incorporation and amended and restated bylaw provisions and indemnification agreements are necessary to attract and retain qualified persons as directors and officers. We also maintain customary directors' and officers' liability insurance.

The limitation of liability and indemnification provisions in our amended and restated certificate of incorporation and amended and restated bylaws may discourage stockholders from bringing a lawsuit against our directors for breach of their fiduciary duty. They may also reduce the likelihood of derivative litigation against our directors and officers, even though an action, if successful, might benefit us and other stockholders. Further, a stockholder's investment may be adversely affected to the extent that we pay the costs of settlement and damage awards against directors and officers as required by these indemnification provisions.

Insofar as indemnification for liabilities arising under the Securities Act may be permitted for directors, executive officers or persons controlling us, we have been informed that, in the opinion of the SEC, such indemnification is against public policy as expressed in the Securities Act and is therefore unenforceable.

CERTAIN RELATIONSHIPS AND RELATED PERSON TRANSACTIONS

Other than compensation arrangements for our directors and executive officers, which are described elsewhere in this prospectus, below we describe transactions since January 1, 2016 to which we were a party or will be a party, in which:

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

Preferred Stock Financings

In September 2018, we issued an aggregate of 5,007,134 shares of our Series C1 preferred stock at a purchase price of $13.98 per share for an aggregate purchase price of $70.0 million. In September 2018, we issued an aggregate of 3,934,191 shares of our Series C2 preferred stock at a purchase price of $13.98 per share for an aggregate purchase price of $55.0 million. In August 2017, we issued an aggregate of 3,001,421 shares of our Series B preferred stock at a purchase price of $11.661 per share for an aggregate purchase price of $35.0 million. The following table summarizes purchases of preferred stock by our directors and by holders of more than five percent of our capital stock and their affiliated entities. One of our executive officers purchased shares of preferred stock.

Name	Series B Preferred Stock(1)	Series C1 Preferred Stock(1)	Series C2 Preferred Stock(1)	Aggregate Purchase Price
Entities affiliated with Baker Brothers Life Sciences L.P.(2)	1,010,239	—	3,934,191	$66,780,400
Boxer Capital, LLC(3)	—	1,072,960	—	14,999,999
Hadley Harbor Master Investors (Cayman) II L.P.(4)	1,039,783	894,472	—	24,629,633
Brian Atwood(5)	4,287	—	—	49,998
Franklin Berger	26,115	13,164	—	488,570
Tito A. Serafini(6)	6,431	—	—	74,999
William H. Robinson	4,287	—	—	49,998

(1) Immediately upon the closing of this offering, each share of our Series B preferred stock and Series C1 preferred stock will convert into one share of Class A common stock and each share of our Series C2 preferred stock will convert into one share of Class B common stock. For a description of the material rights and privileges of the preferred stock, see Note 9 to our audited consolidated financial statements included elsewhere in this prospectus.
(2) Includes shares of preferred stock purchased by 667 L.P.
(3) Includes shares of preferred stock purchased by MVA Investors, LLC.
(4) All shares registered in the name of Waveform, Inc. Wellington Management Company LLP is the investment adviser to this entity. Wellington Management Company LLP is an investment adviser registered under the Investment Advisers Act of 1940, as amended, and is an indirect subsidiary of Wellington Management Group LLP. Wellington Management Company LLP and Wellington Management Group LLP may each be deemed to share beneficial ownership (within the meaning of Rule 13d-3 promulgated under the Exchange Act) of the shares indicated in the table, all of which are held of record by the entity named in the table or a nominee on its behalf. The business address of the entity named in the table is c/o Wellington Management Company LLP, 280 Congress Street, Boston, Massachusetts 02210. The business address of Wellington Management Company LLP and Wellington Management Group LLP is 280 Congress Street, Boston, Massachusetts 02210.
(5) Includes shares of preferred stock purchased by Atwood-Edminster Trust dtd 4/2/00.
(6) Includes shares of preferred stock purchased by Tito A. Serafini and Marya A. Postner Trustees of Successor Trustee, of the Serafini/Postner Revocable Trust U/A/D 2/8/98.

Baker Brothers Nominating Agreement

On September 5, 2018, we entered into a nominating agreement, or the Baker Brothers. Nominating Agreement, with Baker Brothers Life Sciences L.P. and 667, L.P., or together, the Baker Brothers. Pursuant to the Baker Brothers Nominating Agreement, during the period beginning at the closing of this offering until when Baker Brothers no longer beneficially own at least 3,333,333 shares of our common stock (subject to adjustment for stock splits, combinations, recapitalizations and similar transactions), or the Nominating Agreement Period, we will have the obligation to support the nomination of, and to cause our board of directors to include in the slate of nominees recommended to our stockholders for election, two individuals designated by Baker Brothers, each a Baker Brothers Designee, unless a majority of our disinterested directors reasonably and in good faith determines that a Baker Designee would not be qualified to serve as our director under law, rules of the stock exchange on which our shares are listed, our amended and restated bylaws, or any of our company policies. If a Baker Designee resigns his or her seat on our board of directors or is removed or does not become a director for any reason, the vacancy will be filled by the election or appointment of another designee of Baker Brothers as soon as reasonably practicable, subject to compliance with applicable laws, rules and regulations. Furthermore, during the Nominating Agreement Period, if there is no Baker Designee on our board of directors, we will have the obligation to invite two board of directors observer designees of Baker Brothers, or the Baker Observers, to attend all meetings of our board of directors and all meetings of the committees of our board of directors as a nonvoting observer, subject to Baker Observers' agreement to hold in confidence the information they receive as observers of our board of directors and committee meetings, as well as subject to their exclusion from our board of directors' meetings to preserve our attorney-client privilege, to avoid conflicts of interest, if Baker Brothers is determined by our board of directors to be a competitor or other customary conditions. The Baker Brothers Nominating Agreement automatically terminates upon the earlier of when Baker Brothers, together with its affiliates, no longer beneficially owns at least 3,333,333 shares of our common stock or the consummation of our acquisition in a change of control transaction, as such terms are defined in our amended and restated certificate of incorporation.

Bill & Melinda Gates Foundation Master Services Agreement

On February 1, 2013, we entered into a master services agreement, or the Gates Foundation Services Agreement, with the Bill & Melinda Gates Foundation, or the Gates Foundation. Pursuant to the Gates Foundation Services Agreement, we are currently engaged in a multi-year agreement to optimize and advance human anti-CSP monoclonal antibodies with the potential to be developed as prophylactic/therapeutic antibodies. We received income of approximately $2.8 million, $1.0 million, $892,000 and $165,000 under the Gates Foundation Service Agreement in 2016, 2017, 2018 and the three months ended March 31, 2019, respectively.

Director Consulting Agreements

We entered into an amended and restated consulting agreement, effective as of January 1, 2017, with Dr. William H. Robinson, who is a member of our board of directors, by which Dr. Robinson provides consulting services to us in the field of research and development of diagnostics, biologic therapeutics and paired diagnostics and biologic therapeutics and receives an annual consulting fee of $250,000, payable in quarterly installments. Dr. Robinson received approximately $250,000 from us in both 2017 and 2018 and $62,500 in the three months ended March 31, 2019.

We entered into an amended and restated consulting agreement as of October 3, 2017, with Dr. Lawrence Steinman, who is a member of our board of directors, by which Dr. Steinman provides consulting services to us in the field of research and development of diagnostics, biologic

therapeutics and paired diagnostics and biologic therapeutics and received an annual consulting fee of $150,000, payable in quarterly installments. This amended and restated consulting agreement was amended and restated in January 2019 to increase the annual consulting fee to $175,000, among other things, and shall terminate on December 31, 2019. Dr. Steinman received approximately $150,000 from us in both 2017 and 2018 and $43,750 in the three months ended March 31, 2019.

Investors' Rights Agreement

We are party to an amended and restated investors' rights agreement, or IRA, with certain holders of our preferred stock, including entities affiliated with Baker Brothers Life Sciences L.P., entities affiliated with Boxer Capital, LLC, Hadley Harbor Master Investors (Cayman) I L.P. and the Bill & Melinda Gates Foundation. The IRA provides the holders of our preferred stock with certain registration rights, including the right to demand that we file a registration statement or request that their shares be covered by a registration statement that we are otherwise filing, and also the right to obligate us to an agreement to provide for additional rights to demand that we file a registration statement or request that their shares be covered by a registration statement that we have filed and maintain as effective. The IRA also provides these stockholders with information rights, which will terminate on the completion of this offering, and a right of first refusal with regard to certain issuances of our capital stock, which will not apply to, and will terminate on, the completion of, this offering. In connection with this offering, the holders of 17,248,259 shares of our Class A common stock issuable on conversion of outstanding shares of our preferred stock (including Class A common stock issuable upon conversion of Class B common stock) will be entitled to rights with respect to the registration of their shares of Class A common stock (including Class A common stock issuable upon conversion of Class B common stock) under the Securities Act under this agreement. For a description of these registration rights, see the section titled ''Description of Capital Stock—Registration Rights''.

Indemnification Agreements

Our amended and restated certificate of incorporation that will be in effect upon the closing of this offering will contain provisions limiting the liability of directors, and our amended and restated bylaws that will be in effect upon the closing of this offering will provide that we will indemnify each of our directors and officers to the fullest extent permitted under Delaware law. Our amended and restated certificate of incorporation and amended and restated bylaws that will be in effect upon the closing of this offering will also provide our board of directors with discretion to indemnify our employees and other agents when determined appropriate by the board. In addition, we have entered into an indemnification agreement with each of our directors and executive officers, which requires us to indemnify them. For more information regarding these agreements, see the section titled ''Executive Compensation—Limitations of Liability and Indemnification Matters.''

Participation in This Offering

In addition, certain existing stockholders known to us to beneficially own more than 5% of our capital stock prior to this offering have agreed to purchase approximately $63 million of shares of our common stock in this offering at the initial public offering price. All shares of common stock purchased by entities affiliated with Baker Brothers Life Sciences L.P. will initially be issued in the form of Class B common stock that will be convertible into an equivalent number of shares of our Class A common stock. No other purchasers will be issued Class B common stock in this offering. The public offering price of and underwriting discount on such shares of Class B common stock will be identical to the shares of Class A common stock otherwise offered hereby. Unless otherwise indicated or as the context otherwise requires, references to Class A common stock being offered

hereby include the shares of Class A common stock into which shares of our Class B common stock purchased in this offering are convertible.

Other Transactions

We have engaged the law firm Cooley LLP, or Cooley, to provide legal services to the Company. An immediate family member of Tito A. Serafini, one of our directors and our Chief Strategy Officer, is a partner of Cooley. During the years ended December 31, 2016, 2017 and 2018, we incurred and recorded approximately $231,000, $407,000 and $541,000, respectively, of legal expenses for services performed by Cooley. We anticipate that the value of services to be performed by Cooley during the current fiscal year will exceed $900,000 and we incurred and recorded $370,000 of legal expenses for services performed by Cooley in the three months ended March 31, 2019. In August 2015, we issued to Cooley a warrant to purchase 62,936 shares of our Class A common stock, which will be exercised as of June 20, 2019.

We have engaged the law firm Kilpatrick Townsend & Stockton LLP, or Kilpatrick Townsend, to provide legal services to the Company. An immediate family member of Tito A. Serafini, one of our directors and our Chief Strategy Officer, is a partner of Kilpatrick Townsend. During the years ended December 31, 2016, 2017 and 2018, we incurred and recorded approximately $432,000, $487,000 and approximately $1.1 million, respectively, of legal expenses for services performed by Kilpatrick Townsend. We anticipate that the value of services to be performed by Kilpatrick Townsend during the current fiscal year will exceed $1.4 million and we incurred and recorded $381,000 of legal expenses for services performed by Kilpatrick Townsend in the three months ended March 31, 2019.

Policies and Procedures for Related Person Transactions

Our board of directors has adopted a written related person transaction policy, to be effective upon the closing of this offering, setting forth the policies and procedures for the review and approval or ratification of related-person transactions. This policy covers, with certain exceptions set forth in Item 404 of Regulation S-K under the Securities Act, any transaction, arrangement or relationship, or any series of similar transactions, arrangements or relationships in which we were or are to be a participant, where the amount involved exceeds $120,000 and a related person had or will have a direct or indirect material interest, including, without limitation, purchases of goods or services by or from the related person or entities in which the related person has a material interest, indebtedness, guarantees of indebtedness and employment by us of a related person. In reviewing and approving any such transactions, our audit committee is tasked to consider all relevant facts and circumstances, including, but not limited to, whether the transaction is on terms comparable to those that could be obtained in an arm's length transaction and the extent of the related person's interest in the transaction. All of the transactions described in this section occurred prior to the adoption of this policy.

PRINCIPAL STOCKHOLDERS

The following table sets forth information with respect to the beneficial ownership of our capital stock as of March 31, 2019 by:

- each of our named executive officers;
- each of our directors;
- all of our executive officers and directors as a group; and
- each person or group of affiliated persons known by us to beneficially own more than 5% of our Class A common stock or Class B common stock.

We have determined beneficial ownership in accordance with the rules and regulations of the SEC, and the information is not necessarily indicative of beneficial ownership for any other purpose. Except as indicated by the footnotes below, we believe, based on information furnished to us, that the persons and entities named in the table below have sole voting and sole investment power with respect to all shares that they beneficially own, subject to applicable community property laws.

Certain existing stockholders known to us to beneficially own more than 5% of our capital stock prior to this offering have agreed to purchase approximately $63 million of shares of our common stock in this offering at the initial public offering price. The following table reflects purchases by these stockholders. The underwriters will receive the same underwriting discount on any shares purchased by these entities as they will on any other shares sold to the public in this offering. All shares of common stock purchased by entities affiliated with Baker Brothers Life Sciences L.P. will initially be issued in the form of Class B common stock that will be convertible into an equivalent number of shares of our Class A common stock. No other purchasers will be issued Class B common stock in this offering. The public offering price of and underwriting discount on such shares of Class B common stock will be identical to the shares of Class A common stock otherwise offered hereby.

Applicable percentage ownership before the offering is based on 15,500,261 shares of Class A common stock and 3,934,191 shares of Class B common stock outstanding as of March 31, 2019, assuming (i) the automatic conversion of all outstanding shares of our convertible Series A preferred stock, convertible Series B preferred stock and convertible Series C1 preferred stock into shares of Class A common stock, (ii) the automatic conversion of all outstanding shares of our convertible Series C2 preferred stock into shares of Class B common stock and (iii) the issuance of 62,936 shares of Class A common stock upon the exercise of an outstanding warrant. Applicable percentage ownership after the offering is based on 20,850,261 shares of Class A common stock and 5,934,191 shares of Class B common stock outstanding immediately after the completion of this offering, assuming no exercise by the underwriters of their option to purchase additional shares of Class A common stock from us. In computing the number of shares beneficially owned by a person and the percentage ownership of such person, we deemed to be outstanding all shares subject to options held by the person that are currently exercisable, or exercisable or would vest based on service-based vesting conditions within 60 days of March 31, 2019. However, except as described above, we did not deem such shares outstanding for the purpose of computing the percentage ownership of any other person.

Unless otherwise indicated, the address of each beneficial owner listed below is c/o Atreca, Inc., 500 Saginaw Drive, Redwood City, CA 94063. We believe, based on information provided to us, that each of the stockholders listed below has sole voting and investment power with respect to the shares beneficially owned by the stockholder unless noted otherwise, subject to community property laws where applicable.

Name of Beneficial Owner	Number of Shares Beneficially Owned		Percentage of Shares Beneficially Owned Before the Offering		Percentage of Shares Beneficially Owned After the Offering	
	Class A Common Stock	Class B Common Stock	Class A Common Stock	Class B Common Stock	Class A Common Stock	Class B Common Stock
5% Stockholders						
Entities affiliated with Baker Brothers Life Sciences L.P.(1)	3,532,760	3,934,191	22.8%	100.0%	16.9%	100.0%
Boxer Capital, LLC(2)	1,072,960	—	6.9	—	8.5	
Hadley Harbor Master Investors (Cayman) II L.P.(3)	1,934,255	—	12.5	—	14.1	
Bill & Melinda Gates Foundation	1,396,644	—	9.0	—	6.7	
Directors and Named Executive Officers						
John A. Orwin(4)	724,898	—	4.5	—	3.4	
Herbert Cross	—	—	—	—	—	
Tito A. Serafini, Ph.D.(5)	603,385	—	3.9	—	2.9	
Susan Berland(6)	98,503	—	*	—	*	
Norman Michael Greenberg(7)	175,325	—	1.1	—	*	
Brian Atwood(8)	62,154	—	*	—	*	
Franklin Berger	97,808	—	*	—	*	
David Lacey, M.D.(9)	20,366	—	*	—	*	
William H. Robinson, M.D., Ph.D.(10)	461,214	—	3.0	—	2.2	
Lawrence Steinman, M.D.(11)	266,738	—	1.7	—	1.3	
All directors and executive officers as a group (10 persons)(12)	2,588,394	—	15.5		11.7	

* Represents beneficial ownership of less than 1%.

(1) Consists of 3,223,030 shares of Class A common stock and 3,540,107 shares of Class B common stock held of record by Baker Brothers Life Sciences L.P. and 309,730 shares of Class A common stock and 394,084 shares of Class B common stock held of record by 667, L.P.

(2) Consists of 1,033,583 shares held of record by Boxer Capital, LLC and 39,377 shares held of record by MVA Investors, LLC.

(3) All shares registered in the name of Waveform, Inc. Wellington Management Company LLP is the investment adviser to this entity. Wellington Management Company LLP is an investment adviser registered under the Investment Advisers Act of 1940, as amended, and is an indirect subsidiary of Wellington Management Group LLP. Wellington Management Company LLP and Wellington Management Group LLP may each be deemed to share beneficial ownership (within the meaning of Rule 13d-3 promulgated under the Exchange Act) of the shares indicated in the table, all of which are held of record by the entity named in the table or a nominee on its behalf. The business address of the entity named in the table is c/o Wellington Management Company LLP, 280 Congress Street, Boston, Massachusetts 02210. The business address of Wellington Management Company LLP and Wellington Management Group LLP is 280 Congress Street, Boston, Massachusetts 02210.

(4) All 724,898 shares are issuable pursuant to stock options exercisable within 60 days after March 31, 2019.

(5) Includes (a) 443,167 shares held of record by Tito A. Serafini and Marya A. Postner Trustees or Successor Trustee, of the Serafini/Postner Revocable Trust U/A/D 2/8/98 and (b) 160,218 shares issuable pursuant to stock options exercisable within 60 days after March 31, 2019.

(6) Includes (a) 19,040 shares held of record by Susan D. Berland Trust and (b) 79,463 shares issuable pursuant to a stock option exercisable within 60 days after March 31, 2019.

(7) All 175,325 shares are issuable pursuant to stock options exercisable within 60 days after March 31, 2019.

(8) Includes (a) 49,654 shares held of record by Atwood-Edminster Trust dtd 4/2/00 and (b) 12,500 shares issuable pursuant to a stock option exercisable within 60 days after March 31, 2019.

(9) All 20,366 shares are issuable pursuant to a stock option exercisable within 60 days after March 31, 2019.

(10) Includes (a) 444,548 shares and (b) 16,666 shares issuable pursuant to a stock option exercisable within 60 days after March 31, 2019.

(11) Includes (a) 258,405 shares and (b) 8,333 shares issuable pursuant to a stock option exercisable within 60 days after March 31, 2019.

(12) Includes (a) 1,401,340 shares and (b) 1,187,054 shares issuable pursuant to stock options exercisable within 60 days after March 31, 2019.

DESCRIPTION OF CAPITAL STOCK

General

Following the completion of this offering, our authorized capital stock will consist of 650,000,000 shares of Class A common stock, $0.0001 par value per share, 50,000,000 shares of Class B common stock, $0.0001 par value per share and 300,000,000 shares of preferred stock, $0.0001 par value per share. Our outstanding capital stock was held by 191 stockholders of record as of March 31, 2019.

The following is a summary of the rights of our Class A common stock, Class B common stock and preferred stock and some of the provisions of our amended and restated certificate of incorporation and amended and restated bylaws, which will each become effective upon the closing of this offering, the investors' rights agreement and relevant provisions of Delaware General Corporation Law. Because it is only a summary, it does not contain all the information that may be important to you. For a complete description you should refer to our amended and restated certificate of incorporation, amended and restated bylaws and investors' rights agreement, copies of which have been filed as exhibits to the registration statement of which this prospectus is a part, as well as the relevant provisions of Delaware General Corporation Law.

Class A Common Stock and Class B Common Stock

As of March 31, 2019, there were 15,500,261 shares of our Class A common stock outstanding and held of record by 192 stockholders and 3,934,191 shares of our Class B common stock outstanding, presuming (i) the automatic conversion of all outstanding shares of our convertible Series A preferred stock, convertible Series B preferred stock and convertible Series C1 preferred stock into shares of Class A common stock, (ii) the automatic conversion of all outstanding shares of our convertible Series C2 preferred stock into shares of Class B common stock and (iii) the issuance of 62,936 shares of Class A common stock upon the exercise of an outstanding warrant to purchase 62,936 shares of our Class A common stock, which warrant will be exercised as of June 20, 2019.

Holders of our Class A common stock and our Class B common stock have identical rights, provided that, (i) except as otherwise expressly provided in our amended and restated certificate of incorporation or as required by applicable law, on any matter that is submitted to a vote by our stockholders, holders of our Class A common stock are entitled to one vote per share of Class A common stock, and holders of our Class B common stock are not entitled to any votes per share of Class B common stock, including for the election of directors, and (ii) holders of our Class A common stock have no conversion rights, while holders of our Class B common stock shall have the right to convert each share of our Class B common stock into one share of Class A common stock at such holder's election, provided that as a result of such conversion, such holder would not beneficially own in excess of 4.99% of any class of our securities registered under the Exchange Act, unless otherwise as expressly provided for in our amended and restated certificate of incorporation. However, this ownership limitation may be increased or decreased to any other percentage designated by such holder of Class B common stock upon 61 days' notice to us. Our Class A common stock and Class B common stock do not have cumulative voting rights. Accordingly, the holders of a majority of the outstanding shares of Class A common stock entitled to vote in any election of directors can elect all of the directors standing for election, if they so choose, other than any directors that holders of any preferred stock we may issue may be entitled to elect. Subject to preferences that may be applicable to any then outstanding preferred stock, holders of our Class A common stock and Class B common stock are entitled to receive ratably those dividends, if any, as may be declared by the board of directors out of legally available funds. In the event of our liquidation, dissolution or winding up, the holders of our Class A common stock and

Class B common stock will be entitled to share ratably in the assets legally available for distribution to stockholders after the payment of or provision for all of our debts and other liabilities, subject to the prior rights of any preferred stock then outstanding. Holders of our Class A common stock and Class B common stock have no preemptive rights or other subscription rights and there are no redemption or sinking funds provisions applicable to our Class A common stock and Class B common stock. All outstanding shares of our Class A common stock and Class B common stock are, and the Class A common stock and Class B common stock to be outstanding immediately prior to the closing of this offering will be, duly authorized, validly issued, fully paid and nonassessable. The rights, preferences and privileges of holders of our Class A common stock and Class B common stock are subject to and may be adversely affected by the rights of the holders of shares of any series of preferred stock that we may designate and issue in the future.

Preferred Stock

As of March 31, 2019, there were 13,314,068 shares of our convertible Series A preferred stock, Series B preferred stock and Series C1 preferred stock outstanding, and 3,934,191 shares of our Series C2 preferred stock outstanding. Upon completion of this offering, all of our previously outstanding shares of convertible Series A preferred stock, Series B preferred stock and Series C1 preferred stock will have been converted into Class A common stock, all of our previously outstanding shares of convertible Series C2 preferred stock will have been converted into Class B common stock, there will be no authorized shares of our previously convertible preferred stock and we will have no shares of preferred stock outstanding. Under the terms of our amended and restated certificate of incorporation, which will become effective upon the closing of this offering, our board of directors has the authority, without further action by our stockholders, to issue up to shares of preferred stock in one or more series, to establish from time to time the number of shares to be included in each such series, to fix the dividend, voting and other rights, preferences and privileges of the shares of each wholly unissued series and any qualifications, limitations or restrictions thereon, and to increase or decrease the number of shares of any such series, but not below the number of shares of such series then outstanding.

Our board of directors may authorize the issuance of preferred stock with voting or conversion rights that could adversely affect the voting power or other rights of the holders of the Class A common stock. The issuance of preferred stock, while providing flexibility in connection with possible acquisitions and other corporate purposes, could, among other things, have the effect of delaying, deferring or preventing a change in our control and may adversely affect the market price of the Class A common stock and the voting and other rights of the holders of Class A common stock. We have no current plans to issue any shares of preferred stock.

Options

As of March 31, 2019, options to purchase 2,587,996 shares of our Class A common stock were outstanding under our 2010 Plan, of which 552,256 were vested and exercisable as of that date.

Warrants

As of March 31, 2019, 62,936 shares of our Class A common stock were issuable upon exercise of an outstanding warrant to purchase Class A common stock with an exercise price of $0.0006 per share. This warrant to purchase shares of Class A common stock will be exercised as of June 20, 2019.

As of March 31, 2019, 49,997 shares of our Series A preferred stock were issuable upon exercise of outstanding warrants to purchase our Series A preferred stock, all with an exercise price of $14.46 per share.

Registration Rights

We are party to an amended and restated investors' rights agreement that provides that certain holders of our convertible preferred stock, including certain holders of at least 5% of our capital stock, have certain registration rights as set forth below. The registration of shares of our Class A common stock by the exercise of registration rights described below would enable the holders to sell these shares without restriction under the Securities Act when the applicable registration statement is declared effective. We will pay the registration expenses, other than underwriting discounts and commissions, of the shares registered by the demand, piggyback and Form S-3 registrations described below.

Generally, in an underwritten offering, the managing underwriter, if any, has the right, subject to specified conditions, to limit the number of shares such holders may include. The demand, piggyback and Form S-3 registration rights described below will expire three years after the closing of this offering, of which this prospectus is a part, or with respect to any particular stockholder, such time after the closing of this offering that such stockholder can sell all of its shares entitled to registration rights under Rule 144 of the Securities Act during any 90-day period.

Demand Registration Rights

After this offering, the holders of an aggregate of 17,248,259 shares of our Class A common stock (including Class A common stock issuable upon conversion of Class B common stock) will be entitled to certain demand registration rights. At any time beginning 180 days after the completion of this offering, the holders of a majority of these shares may, on not more than one occasion, request that we register all or a portion of their shares. Such request for registration must cover shares with an anticipated aggregate offering price, net of underwriting discounts and commissions, of at least $15.0 million.

Piggyback Registration Rights

In connection with this offering, the holders of an aggregate of 17,248,259 shares of our Class A common stock including Class A common stock issuable upon conversion of Class B common stock were entitled to, and the necessary percentage of holders waived, their rights to notice of this offering and to include their shares of registrable securities in this offering. After this offering, in the event that we propose to register any of our securities under the Securities Act, either for our own account or for the account of other security holders, the holders of these shares will be entitled to certain piggyback registration rights allowing the holder to include their shares in such registration, subject to certain marketing and other limitations. As a result, whenever we propose to file a registration statement under the Securities Act, other than with respect to a demand registration or a registration statement on Forms S-4 or S-8, the holders of these shares are entitled to notice of the registration and have the right to include their shares in the registration, subject to limitations that the underwriters may impose on the number of shares included in the offering.

Form S-3 Registration Rights

After this offering, the holders of an aggregate of 17,248,259 shares of Class A common stock (including Class A common stock issuable upon conversion of Class B common stock), will be entitled to certain Form S-3 registration rights. The holders of these shares can make a request that we register their shares on Form S-3 if we are qualified to file a registration statement on Form S-3 and if the reasonably anticipated aggregate gross proceeds of the shares offered would equal or

exceed $3.0 million. We will not be required to effect more than two registrations on Form S-3 within any 12-month period.

Registration Rights Agreement

After this offering, any holder who holds at least 85,900 shares of our Class A common stock issued upon conversion of our Series B preferred stock and any holder who holds at least 321,883 shares of our Class A common stock or our Class B common stock issued upon conversion of our Series C1 preferred stock or our Series C2 preferred stock, respectively, will be entitled to bind us into entering into a registration rights agreement, through which, following the expiration of the 180-day-lockup period related to this offering, these holders who enter into the agreement with us would be, subject to certain limitations, entitled to certain registration rights. These registration rights include the right to demand that we file with the SEC a Form S-3 registration statement covering the registration of their Class A common stock for resale, subject to certain conditions, as well as rights to be permitted one underwritten public offering per calendar year, but no more than three underwritten public offering in total, to effect the sale of their Class A common stock for sale. This registration rights agreement requires us to pay expenses relating to such registrations and indemnify these holders against certain liabilities. Our registration obligations under this registration rights agreement would continue in effect until the earliest of (i) up to ten years after the date we enter into the agreement, (ii) when the applicable registrable securities have been resold by the holders pursuant to an effective registration statement, (iii) when the applicable registrable securities have been resold pursuant to Rule 144 or (iv) when the applicable registrable securities may be resold pursuant to Rule 144 without limitations as to volume or manner of sale.

Anti-Takeover Effects of Delaware Law and Our Certificate of Incorporation and Bylaws

Some provisions of Delaware law, our amended and restated certificate of incorporation and our amended and restated bylaws contain provisions that could make the following transactions more difficult: an acquisition of us by means of a tender offer; an acquisition of us by means of a proxy contest or otherwise; or the removal of our incumbent officers and directors. It is possible that these provisions could make it more difficult to accomplish or could deter transactions that stockholders may otherwise consider to be in their best interest or in our best interests, including transactions which provide for payment of a premium over the market price for our shares.

These provisions, summarized below, are intended to discourage coercive takeover practices and inadequate takeover bids. These provisions are also designed to encourage persons seeking to acquire control of us to first negotiate with our board of directors. We believe that the benefits of the increased protection of our potential ability to negotiate with the proponent of an unfriendly or unsolicited proposal to acquire or restructure us outweigh the disadvantages of discouraging these proposals because negotiation of these proposals could result in an improvement of their terms.

Stockholder Meetings

Our amended and restated bylaws provide that a special meeting of stockholders may be called only by our chairman of the board, chief executive officer or president, or by a resolution adopted by a majority of our board of directors.

Requirements for Advance Notification of Stockholder Nominations and Proposals

Our amended and restated bylaws establish advance notice procedures with respect to stockholder proposals to be brought before a stockholder meeting and the nomination of candidates for election as directors, other than nominations made by or at the direction of the board of directors or a committee of the board of directors.

Elimination of Stockholder Action by Written Consent

Our amended and restated certificate of incorporation and amended and restated bylaws eliminate the right of stockholders to act by written consent without a meeting.

Staggered Board

Our board of directors is divided into three classes. The directors in each class will serve for a three-year term, one class being elected each year by our stockholders. For more information on the classified board, see ''Management—Board Composition and Election of Directors.'' This system of electing and removing directors may tend to discourage a third party from making a tender offer or otherwise attempting to obtain control of us, because it generally makes it more difficult for stockholders to replace a majority of the directors.

Removal of Directors

Our amended and restated certificate of incorporation provides that no member of our board of directors may be removed from office by our stockholders except for cause and, in addition to any other vote required by law, upon the approval of not less than two thirds of the total voting power of all of our outstanding voting stock then entitled to vote in the election of directors.

Stockholders Not Entitled to Cumulative Voting

Our amended and restated certificate of incorporation does not permit stockholders to cumulate their votes in the election of directors. Accordingly, the holders of a majority of the outstanding shares of our Class A common stock entitled to vote in any election of directors can elect all of the directors standing for election, if they choose, other than any directors that holders of our preferred stock may be entitled to elect.

Delaware Anti-Takeover Statute

We are subject to Section 203 of the Delaware General Corporation Law, which prohibits persons deemed to be ''interested stockholders'' from engaging in a ''business combination'' with a publicly held Delaware corporation for three years following the date these persons become interested stockholders unless the business combination is, or the transaction in which the person became an interested stockholder was, approved in a prescribed manner or another prescribed exception applies. Generally, an ''interested stockholder'' is a person who, together with affiliates and associates, owns, or within three years prior to the determination of interested stockholder status did own, 15% or more of a corporation's voting stock. Generally, a ''business combination'' includes a merger, asset or stock sale, or other transaction resulting in a financial benefit to the interested stockholder. The existence of this provision may have an anti-takeover effect with respect to transactions not approved in advance by the board of directors.

Choice of Forum

Our amended and restated certificate of incorporation provides that the Court of Chancery of the State of Delaware will be the exclusive forum for the following types of actions or proceedings under Delaware statutory or common law: (i) any derivative action or proceeding brought on our behalf; (ii) any action asserting a breach of fiduciary duty; (iii) any action asserting a claim against us or our directors, officers, or employees arising under the Delaware General Corporation Law, our amended and restated certificate of incorporation or our amended and restated bylaws; and (iv) any action asserting a claim against us that is governed by the internal affairs doctrine. The provisions would not apply to suits brought to enforce a duty or liability created by the Exchange Act. Our amended and restated certificate of incorporation further provides that the federal district courts of the United States of America will be the exclusive forum for resolving any complaint asserting a cause of action

arising under the Securities Act, subject to and contingent upon a final adjudication in the State of Delaware of the enforceability of such exclusive forum provision.

Amendment of Charter Provisions

The amendment of any of the above provisions, except for the provision making it possible for our board of directors to issue preferred stock, would require approval by holders of at least two thirds of the total voting power of all of our outstanding voting stock.

The provisions of Delaware law, our amended and restated certificate of incorporation and our amended and restated bylaws could have the effect of discouraging others from attempting hostile takeovers and, as a consequence, they may also inhibit temporary fluctuations in the market price of our Class A common stock that often result from actual or rumored hostile takeover attempts. These provisions may also have the effect of preventing changes in the composition of our board and management. It is possible that these provisions could make it more difficult to accomplish transactions that stockholders may otherwise deem to be in their best interests.

Transfer Agent and Registrar

The transfer agent and registrar for our Class A common stock and Class B common stock will be Computershare Trust Company, N.A.. The transfer agent's address is 250 Royall Street, Canton, Massachusetts 02021-1011.

Exchange Listing

Our Class A common stock is listed on The Nasdaq Global Select Market under the symbol ''BCEL''.

SHARES ELIGIBLE FOR FUTURE SALE

Immediately prior to this offering, there was no public market for our Class A common stock. Future sales of substantial amounts of Class A common stock in the public market, or the perception that such sales may occur, could adversely affect the market price of our Class A common stock. Although we have listed our Class A common stock on The Nasdaq Global Select Market, we cannot assure you that there will be an active public market for our Class A common stock.

Following the closing of this offering, based on the number of shares of our Class A common stock outstanding as of March 31, 2019 and assuming: (i) the issuance of shares in this offering; (ii) the automatic conversion of all outstanding shares of our convertible Series A preferred stock, convertible Series B preferred stock and convertible Series C1 preferred stock into shares of Class A common stock; (iii) the automatic conversion of all outstanding shares of our convertible Series C2 preferred stock into shares of Class B common stock; (iv) the issuance of 62,936 shares of Class A common stock upon the exercise of an outstanding warrant, which will be exercised as of June 20, 2019; (v) the automatic reclassification of all of our outstanding warrants to purchase Series A preferred stock into warrants to purchase 49,997 shares of Class A common stock, each with an exercise price of $14.46 per share, immediately upon the closing of this offering and no exercise of these warrants; (vi) no exercise of outstanding options to purchase our Class A common stock; and (vii) no exercise of the underwriters' option to purchase additional shares of Class A common stock, we will have outstanding an aggregate of approximately 20,850,261 shares of Class A common stock.

Of these shares, all shares of Class A common stock sold in this offering will be freely tradable without restriction or further registration under the Securities Act, except for any shares purchased by our ''affiliates,'' as that term is defined in Rule 144 under the Securities Act. Shares purchased by our affiliates would be subject to the Rule 144 resale restrictions described below, other than the holding period requirement.

The remaining shares of our Class A common stock and all shares of our Class B common stock outstanding after this offering will be ''restricted securities,'' as that term is defined in Rule 144 under the Securities Act. These restricted securities are eligible for public sale only if they are registered under the Securities Act or if they qualify for an exemption from registration under Rule 144 or 701 under the Securities Act, each of which is summarized below. We expect that substantially all of these shares will be subject to the 180-day lock-up period under the lock-up agreements described below.

Additionally, shares of common stock that are either subject to outstanding options or warrants or reserved for future issuance under our equity incentive plans will become eligible for sale in the public market to the extent permitted by the provisions of various vesting schedules, the lock-up agreements described below and Rules 144 and 701 under the Securities Act.

Lock-Up Agreements

We, along with our directors, executive officers and substantially all of our other stockholders, optionholders and warrantholders, have agreed with the underwriters that for a period of 180 days, after the date of this prospectus, subject to specified exceptions, we or they will not offer, pledge, sell, contract to sell, sell any option or contract to purchase, purchase any option or contract to sell, grant any option, right or warrant to sale of, or otherwise dispose of or transfer any shares of Class A common stock or any securities convertible into or exercisable or exchangeable for shares of Class A common stock (including shares of our Class B common stock), request or demand that

we file a registration statement related to our Class A common stock or enter into any swap or other agreement that transfers to another, in whole or in part, directly or indirectly, the economic consequence of ownership of the Class A common stock or any securities convertible into or exercisable or exchangeable for shares of Class A common stock (including shares of our Class B common stock). Upon expiration of the lock-up period, certain of our stockholders and warrantholders will have the right to require us to register their shares under the Securities Act. See ''—Registration Rights'' below and ''Description of Capital Stock—Registration Rights.''

Upon the expiration of the lock-up period, substantially all of the shares subject to such lock-up restrictions will become eligible for sale, subject to the limitations discussed above.

Rule 144

Affiliate Resales of Restricted Securities

In general, beginning 90 days after the effective date of the registration statement of which this prospectus is a part, a person who is an affiliate of ours, or who was an affiliate at any time during the 90 days before a sale, who has beneficially owned shares of our Class A common stock for at least six months would be entitled to sell in ''broker's transactions'' or certain ''riskless principal transactions'' or to market makers, a number of shares within any three-month period that does not exceed the greater of:

- 1% of the number of shares of our Class A common stock then outstanding, which will equal approximately 208,502 shares immediately after this offering; or
- the average weekly trading volume in our Class A common stock on The Nasdaq Global Select Market during the four calendar weeks preceding the filing of a notice on Form 144 with respect to such sale.

Affiliate resales under Rule 144 are also subject to the availability of current public information about us. In addition, if the number of shares being sold under Rule 144 by an affiliate during any three-month period exceeds 5,000 shares or has an aggregate sale price in excess of $50,000, the seller must file a notice on Form 144 with the Securities and Exchange Commission and The Nasdaq Global Select Market concurrently with either the placing of a sale order with the broker or the execution of a sale directly with a market maker.

Non-Affiliate Resales of Restricted Securities

In general, beginning 90 days after the effective date of the registration statement of which this prospectus is a part, a person who is not an affiliate of ours at the time of sale, and has not been an affiliate at any time during the three months preceding a sale, and who has beneficially owned shares of our Class A common stock for at least six months but less than a year, is entitled to sell such shares subject only to the availability of current public information about us. If such person has held our shares for at least one year, such person can resell under Rule 144(b)(1) without regard to any Rule 144 restrictions, including the 90-day public company requirement and the current public information requirement.

Non-affiliate resales are not subject to the manner of sale, volume limitation or notice filing provisions of Rule 144.

Rule 701

In general, under Rule 701 of the Securities Act, any of our employees, directors, officers, consultants or advisors who purchases shares from us in connection with a compensatory stock or option plan or other written agreement before the effective date of a registration statement under the

Securities Act is entitled to sell such shares 90 days after such effective date in reliance on Rule 144. Securities issued in reliance on Rule 701 are restricted securities and, subject to the contractual restrictions described above, beginning 90 days after the date of this prospectus, may be sold by persons other than ''affiliates,'' as defined in Rule 144, subject only to the manner of sale provisions of Rule 144 and by ''affiliates'' under Rule 144 without compliance with its one-year minimum holding period requirement. However, substantially all Rule 701 shares are subject to lock-up agreements as described above and will become eligible for sale upon the expiration of the restrictions set forth in those agreements.

Equity Plans

We intend to file one or more registration statements on Form S-8 under the Securities Act to register all shares of Class A common stock subject to outstanding stock options and Class A common stock issued or issuable under the 2010 Plan, the 2019 Plan and the ESPP. We expect to file the registration statement covering shares offered pursuant to these stock plans shortly after the date of this prospectus, permitting the resale of such shares by non-affiliates in the public market without restriction under the Securities Act and the sale by affiliates in the public market subject to compliance with the resale provisions of Rule 144.

Registration Rights

As of March 31, 2019, certain holders of shares of our Class A common stock, which includes all of the shares of Class A common stock issuable upon the automatic conversion of our convertible preferred stock (including Class A common stock issuable upon conversion of our Class B common stock) immediately upon the closing of this offering, or their transferees will be entitled to various rights with respect to the registration of these shares under the Securities Act upon the completion of this offering. Registration of these shares under the Securities Act would result in these shares becoming fully tradable without restriction under the Securities Act immediately upon the effectiveness of the registration, except for shares purchased by affiliates. See ''Description of Capital Stock—Registration Rights'' for additional information. Shares covered by a registration statement will be eligible for sale in the public market upon the expiration or release from the terms of the lock-up agreement.

MATERIAL U.S. FEDERAL INCOME TAX CONSEQUENCES TO NON-U.S. HOLDERS OF OUR CLASS A COMMON STOCK

The following summary describes the material U.S. federal income tax consequences of the acquisition, ownership and disposition of our Class A common stock acquired in this offering by Non-U.S. Holders (as defined below). This discussion is not a complete analysis of all potential U.S. federal income tax consequences relating thereto, and does not deal with foreign, state and local consequences that may be relevant to Non-U.S. Holders in light of their particular circumstances, nor does it address U.S. federal tax consequences (such as gift and estate taxes) other than income taxes. Special rules different from those described below may apply to certain Non-U.S. Holders that are subject to special treatment under the Internal Revenue Code of 1986, as amended, or the Code, such as financial institutions, insurance companies, tax-exempt organizations, broker-dealers and traders in securities, U.S. expatriates, ''controlled foreign corporations,'' ''passive foreign investment companies,'' corporations that accumulate earnings to avoid U.S. federal income tax, corporations organized outside of the United States, any state thereof or the District of Columbia that are nonetheless treated as U.S. taxpayers for U.S. federal income tax purposes, persons that hold our Class A common stock as part of a ''straddle,'' ''hedge,'' ''conversion transaction,'' ''synthetic security'' or integrated investment or other risk reduction strategy, persons who acquire our Class A common stock through the exercise of an option or otherwise as compensation, persons subject to the alternative minimum tax or federal Medicare contribution tax on net investment income, persons subject to special tax accounting rules under Section 451(b) of the Code, ''qualified foreign pension funds'' as defined in Section 897(l)(2) of the Code and entities all of the interests of which are held by qualified foreign pension funds, partnerships and other pass-through entities or arrangements, and investors in such pass-through entities or arrangements. Such Non-U.S. Holders are urged to consult their own tax advisors to determine the U.S. federal, state, local and other tax consequences that may be relevant to them. Furthermore, the discussion below is based upon the provisions of the Code, and Treasury Regulations, rulings and judicial decisions thereunder as of the date hereof, and such authorities may be repealed, revoked or modified, perhaps retroactively, so as to result in U.S. federal income tax consequences different from those discussed below. We have not requested a ruling from the U.S. Internal Revenue Service, or IRS, with respect to the statements made and the conclusions reached in the following summary, and there can be no assurance that the IRS will agree with such statements and conclusions. This discussion assumes that the Non-U.S. Holder holds our Class A common stock as a ''capital asset'' within the meaning of Section 1221 of the Code (generally, property held for investment).

This discussion is for informational purposes only and is not tax advice. Persons considering the purchase of our Class A common stock pursuant to this offering should consult their own tax advisors concerning the U.S. federal income, estate and other tax consequences of acquiring, owning and disposing of our Class A common stock in light of their particular situations as well as any consequences arising under the laws of any other taxing jurisdiction, including any state, local or foreign tax consequences.

For the purposes of this discussion, a ''Non-U.S. Holder'' is, for U.S. federal income tax purposes, a beneficial owner of Class A common stock that is neither a U.S. Holder, nor a partnership (or other entity treated as a partnership for U.S. federal income tax purposes regardless of its place of organization or formation). A ''U.S. Holder'' means a beneficial owner of our Class A common stock that is for U.S. federal income tax purposes any of the following:

- an individual who is a citizen or resident of the United States;
- a corporation or other entity treated as a corporation for U.S. federal income tax purposes created or organized in or under the laws of the United States, any state thereof or the District of Columbia;

- an estate the income of which is subject to U.S. federal income taxation regardless of its source; or
- a trust if it (1) is subject to the primary supervision of a court within the United States and one or more U.S. persons have the authority to control all substantial decisions of the trust or (2) has a valid election in effect under applicable U.S. Treasury Regulations to be treated as a U.S. person.

Distributions

Distributions, if any, made on our Class A common stock to a Non-U.S. Holder to the extent made out of our current or accumulated earnings and profits (as determined under U.S. federal income tax principles) generally will constitute dividends for U.S. tax purposes and will be subject to withholding tax at a 30% rate or such lower rate as may be specified by an applicable income tax treaty, subject to the discussions below regarding effectively connected income, backup withholding and foreign accounts. To obtain a reduced rate of withholding under a treaty, a Non-U.S. Holder generally will be required to provide us with a properly executed IRS Form W-8BEN (in the case of individuals) or IRS Form W-8BEN-E (in the case of entities), or other appropriate form, certifying the Non-U.S. Holder's entitlement to benefits under that treaty. This certification must be provided to us or our paying agent prior to the payment of dividends and must be updated periodically. In the case of a Non-U.S. Holder that is an entity, Treasury Regulations and the relevant tax treaty provide rules to determine whether, for purposes of determining the applicability of a tax treaty, dividends will be treated as paid to the entity or to those holding an interest in that entity. If a Non-U.S. Holder holds stock through a financial institution or other agent acting on the holder's behalf, the holder will be required to provide appropriate documentation to such agent. The holder's agent will then be required to provide certification to us or our paying agent, either directly or through other intermediaries. If you are eligible for a reduced rate of U.S. federal withholding tax under an income tax treaty and you do not timely file the required certification, you may be able to obtain a refund or credit of any excess amounts withheld by timely filing an appropriate claim for a refund with the IRS.

We generally are not required to withhold tax on dividends paid to a Non-U.S. Holder that are effectively connected with the Non-U.S. Holder's conduct of a trade or business within the United States (and, if required by an applicable income tax treaty, are attributable to a permanent establishment or fixed base that such holder maintains in the United States) if a properly executed IRS Form W-8ECI, stating that the dividends are so connected, is furnished to us (or, if stock is held through a financial institution or other agent, to such agent). In general, such effectively connected dividends will be subject to U.S. federal income tax, on a net income basis at the regular rates applicable to U.S. residents. A corporate Non-U.S. Holder receiving effectively connected dividends may also be subject to an additional ''branch profits tax,'' which is imposed, under certain circumstances, at a rate of 30% (or such lower rate as may be specified by an applicable treaty) on the corporate Non-U.S. Holder's effectively connected earnings and profits, subject to certain adjustments. Non-U.S. Holders should consult their tax advisors regarding any applicable income tax treaties that may provide for different rules.

To the extent distributions on our Class A common stock, if any, exceed our current and accumulated earnings and profits, they will first reduce the Non-U.S. Holder's adjusted basis in our Class A common stock, but not below zero, and then will be treated as gain to the extent of any excess amount distributed, and taxed in the same manner as gain realized from a sale or other disposition of Class A common stock as described in the next section.

Gain on Disposition of Our Class A Common Stock

Subject to the discussions below regarding backup withholding and foreign accounts, a Non-U.S. Holder generally will not be subject to U.S. federal income tax with respect to gain realized on a sale or other disposition of our Class A common stock unless (a) the gain is effectively connected with a trade or business of such holder in the United States (and, if required by an applicable income tax treaty, is attributable to a permanent establishment or fixed base that such holder maintains in the United States), (b) the Non-U.S. Holder is a nonresident alien individual and is present in the United States for 183 or more days in the taxable year of the disposition and certain other conditions are met or (c) we are or have been a ''United States real property holding corporation'' within the meaning of Code Section 897(c)(2) at any time within the shorter of the five-year period preceding such disposition or such holder's holding period. In general, we would be a United States real property holding corporation if our interests in U.S. real estate comprise (by fair market value) at least half of our business assets. We believe that we have not been and we are not, and do not anticipate becoming, a United States real property holding corporation. Even if we are treated as a United States real property holding corporation, gain realized by a Non-U.S. Holder on a disposition of our Class A common stock will not be subject to U.S. federal income tax so long as (1) the Non-U.S. Holder owned, directly, indirectly and constructively, no more than 5% of our Class A common stock at all times within the shorter of (i) the five-year period preceding the disposition or (ii) the holder's holding period and (2) our Class A common stock is regularly traded on an established securities market. There can be no assurance that our Class A common stock will continue to qualify as regularly traded on an established securities market. If any gain on your disposition is taxable because we are a United States real property holding corporation and your ownership of our Class A common stock exceeds 5%, you will be taxed on such disposition generally in the manner as gain that is effectively connected with the conduct of a U.S. trade or business (subject to the provisions under an applicable income tax treaty), except that the branch profits tax generally will not apply.

If you are a Non-U.S. Holder described in (a) above, you will be required to pay tax on the net gain derived from the sale at regular U.S. federal income tax rates, and corporate Non-U.S. Holders described in (a) above may be subject to the additional branch profits tax at a 30% rate or such lower rate as may be specified by an applicable income tax treaty. Gain described in (b) above will be subject to U.S. federal income tax at a flat 30% rate or such lower rate as may be specified by an applicable income tax treaty, which gain may be offset by certain U.S.-source capital losses (even though you are not considered a resident of the United States), provided that the Non-U.S. Holder has timely filed U.S. federal income tax returns with respect to such losses.

Information Reporting Requirements and Backup Withholding

Generally, we must report information to the IRS with respect to any dividends we pay on our Class A common stock (even if the payments are exempt from withholding), including the amount of any such dividends, the name and address of the recipient, and the amount, if any, of tax withheld. A similar report is sent to the holder to whom any such dividends are paid. Pursuant to tax treaties or certain other agreements, the IRS may make its reports available to tax authorities in the recipient's country of residence.

Dividends paid by us (or our paying agents) to a Non-U.S. Holder may also be subject to U.S. backup withholding. U.S. backup withholding generally will not apply to a Non-U.S. Holder who provides a properly executed IRS Form W-8BEN, IRS Form W-8BEN-E, or IRS Form W-ECI, or otherwise establishes an exemption. Notwithstanding the foregoing, backup withholding may apply if the payor has actual knowledge, or reason to know, that the holder is a U.S. person who is not an exempt recipient.

U.S. information reporting and backup withholding requirements generally will apply to the proceeds of a disposition of our Class A common stock effected by or through a U.S. office of any broker, U.S. or foreign, except that information reporting and such requirements may be avoided if the holder provides a properly executed IRS Form W-8BEN or IRS Form W-8BEN-E or otherwise meets documentary evidence requirements for establishing non-U.S. person status or otherwise establishes an exemption. Generally, U.S. information reporting and backup withholding requirements will not apply to a payment of disposition proceeds to a Non-U.S. Holder where the transaction is effected outside the United States through a non-U.S. office of a non-U.S. broker. Information reporting and backup withholding requirements may, however, apply to a payment of disposition proceeds if the broker has actual knowledge, or reason to know, that the holder is, in fact, a U.S. person. For information reporting purposes, certain brokers with substantial U.S. ownership or operations will generally be treated in a manner similar to U.S. brokers.

Backup withholding is not an additional tax. Any amounts withheld under the backup withholding rules may be credited against the tax liability of persons subject to backup withholding, provided that the required information is timely furnished to the IRS.

Foreign Accounts

Sections 1471 through 1474 of the Code (commonly referred to as FATCA) impose a U.S. federal withholding tax of 30% on certain payments, including dividends paid on, and the gross proceeds of a disposition of, our Class A common stock paid to a foreign financial institution (as specifically defined by applicable rules) unless such institution enters into an agreement with the U.S. government to withhold on certain payments and to collect and provide to the U.S. tax authorities substantial information regarding U.S. account holders of such institution (which includes certain equity holders of such institution, as well as certain account holders that are foreign entities with U.S. owners). FATCA also generally imposes a federal withholding tax of 30% on certain payments, including dividends paid on, and the gross proceeds of a disposition of, our Class A common stock to a non-financial foreign entity unless such entity provides the withholding agent with either a certification that it does not have any substantial direct or indirect U.S. owners or provides information regarding substantial direct and indirect U.S. owners of the entity. An intergovernmental agreement between the United States and an applicable foreign country may modify those requirements. The withholding tax described above will not apply if the foreign financial institution or non-financial foreign entity otherwise qualifies for an exemption from the rules.

The withholding provisions described above currently apply to payments of dividends, and, subject to the recently released proposed Treasury Regulations described below, will apply to payments of gross proceeds from a sale or other disposition of Class A common stock on or after January 1, 2019.

The U.S. Treasury Department recently released proposed regulations which, if finalized in their present form, would eliminate the federal withholding tax of 30% applicable to the gross proceeds of a disposition of our Class A common stock. In its preamble to such proposed regulations, the U.S. Treasury Department stated that taxpayers may generally rely on the proposed regulations until final regulations are issued. Holders are encouraged to consult with their own tax advisors regarding the possible implications of FATCA on their investment in our Class A common stock.

EACH PROSPECTIVE INVESTOR SHOULD CONSULT ITS OWN TAX ADVISOR REGARDING THE TAX CONSEQUENCES OF PURCHASING, HOLDING AND DISPOSING OF OUR CLASS A COMMON STOCK, INCLUDING THE CONSEQUENCES OF ANY RECENT OR PROPOSED CHANGE IN APPLICABLE LAW.

UNDERWRITING

We and the underwriters for the offering named below have entered into an underwriting agreement with respect to the common stock being offered. Subject to the terms and conditions of the underwriting agreement, each underwriter has severally agreed to purchase from us the number of shares of our common stock set forth opposite its name below. Cowen and Company, LLC, Evercore Group L.L.C. and Stifel, Nicolaus & Company, Incorporated are the representatives of the underwriters.

Underwriter	Number of Shares
Cowen and Company, LLC	2,572,500
Evercore Group L.L.C.	1,984,500
Stifel, Nicolaus & Company, Incorporated	1,984,500
Canaccord Genuity LLC	661,500
Arcadia Securities, LLC	147,000
Total	7,350,000

The underwriting agreement provides that the obligations of the underwriters are subject to certain conditions precedent and that 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, other than those shares covered by the overallotment option described below. 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 specified liabilities, including liabilities under the Securities Act, and to contribute to payments the underwriters may be required to make in respect thereof.

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 and other conditions specified in the underwriting agreement. The underwriters reserve the right to withdraw, cancel or modify offers to the public and to reject orders in whole or in part.

Overallotment Option to Purchase Additional Shares. We have granted to the underwriters an option to purchase up to 1,102,500 additional shares of Class A common stock at the public offering price, less the underwriting discount. This option is exercisable for a period of 30 days. The underwriters may exercise this option solely for the purpose of covering overallotments, if any, made in connection with the sale of Class A common stock offered hereby. To the extent that the underwriters exercise this option, the underwriters will purchase additional shares from us in approximately the same proportion as shown in the table above.

Discounts and Commissions. The following table shows the public offering price, underwriting discount and proceeds, before expenses, to us. These amounts are shown assuming both no exercise and full exercise of the underwriters' option to purchase additional shares.

We estimate that the total expenses of the offering, excluding underwriting discounts, will be approximately $2.4 million and are payable by us. We have also agreed to reimburse the

underwriters for expenses of up to $35,000 related to the clearance of this offering with the Financial Industry Regulatory Authority, Inc.

		Total	
	Per Share	Without Overallotment	With Overallotment
Public offering price	$17.00	$124,950,000	$143,692,500
Underwriting discount	1.19	8,746,500	10,058,475
Proceeds, before expenses, to us	$15.81	$116,203,500	$133,634,025

The underwriters propose to offer the shares of common stock to the public at the public offering price set forth on the cover of this prospectus. The underwriters may offer the shares of common stock to securities dealers at the public offering price less a concession not in excess of $0.714 per share. If all of the shares are not sold at the public offering price, the underwriters may change the offering price and other selling terms.

Discretionary Accounts. The underwriters do not intend to confirm sales of the shares to any accounts over which they have discretionary authority.

Market Information. Prior to this offering, there has been no public market for shares of our Class A common stock. The initial public offering price was determined by negotiations between us and the representatives of the underwriters. In addition to prevailing market conditions, the factors considered in these negotiations were:

- the history of, and prospects for, our company and the industry in which we compete;
- our past and present financial information;
- an assessment of our management;
- our 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.

Our Class A common stock is listed on The Nasdaq Global Select Market under the symbol ‘‘BCEL’’.

Stabilization. In connection with this offering, the underwriters may engage in stabilizing transactions, overallotment transactions, syndicate covering transactions, penalty bids and purchases to cover positions created by short sales.

- Stabilizing transactions permit bids to purchase shares of Class A common stock so long as the stabilizing bids do not exceed a specified maximum, and are engaged in for the purpose of preventing or retarding a decline in the market price of the Class A common stock while the offering is in progress.
- Overallotment transactions involve sales by the underwriters of shares of Class A common stock in excess of the number of shares the underwriters are obligated to purchase. This creates a syndicate short position which may be either a covered short position or a naked short position. In a covered short position, the number of shares over-allotted by the underwriters is not greater than the number of shares that they may purchase in the

overallotment option. In a naked short position, the number of shares involved is greater than the number of shares in the overallotment option. The underwriters may close out any short position by exercising their overallotment option or purchasing shares in the open market.

- Syndicate covering transactions involve purchases of Class A common stock in the open market after the distribution has been completed in order to cover syndicate short positions. In determining the source of shares to close out the short position, the underwriters will consider, among other things, the price of shares available for purchase in the open market as compared with the price at which they may purchase shares through exercise of the overallotment option. If the underwriters sell more shares than could be covered by exercise of the overallotment option and, therefore, have a naked short position, the position can be closed out only by buying shares in the open market. A naked short position is more likely to be created if the underwriters are concerned that after pricing there could be downward pressure on the price of the shares in the open market that could adversely affect investors who purchase in the offering.
- Penalty bids permit the representatives to reclaim a selling concession from a syndicate member when the Class A common stock originally sold by that syndicate member is purchased in stabilizing or syndicate covering transactions to cover syndicate short positions.

These stabilizing transactions, syndicate covering transactions and penalty bids may have the effect of raising or maintaining the market price of our Class A common stock or preventing or retarding a decline in the market price of our Class A common stock. As a result, the price of our Class A common stock in the open market may be higher than it would otherwise be in the absence of these transactions. Neither we nor the underwriters make any representation or prediction as to the effect that the transactions described above may have on the price of our Class A common stock. These transactions may be effected on The Nasdaq Global Select Market, in the over-the-counter market or otherwise and, if commenced, may be discontinued at any time.

Lock-Up Agreements. Pursuant to certain ‘‘lock-up’’ agreements, we and our executive officers, directors and substantially all of our other stockholders, have agreed, subject to certain exceptions, not to offer, sell, assign, transfer, pledge, contract to sell, or otherwise dispose of or announce the intention to otherwise dispose of, or enter into any swap, hedge or similar agreement or arrangement that transfers, in whole or in part, the economic consequence of ownership of, directly or indirectly, or make any demand or request or exercise any right with respect to the registration of, or file with the SEC a registration statement under the Securities Act relating to, any Class A common stock or securities convertible into or exchangeable or exercisable for any Class A common stock, including shares of our Class B common stock, without the prior written consent of the representatives, for a period of 180 days after the date of the pricing of the offering.

This lock-up provision applies to Class A common stock and to securities convertible into or exchangeable or exercisable for Class A common stock, including shares of our Class B common stock. It also applies to Class A common stock and Class B 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. The exceptions permit us, among other things and subject to restrictions, to: (a) issue Class A common stock or options pursuant to employee benefit plans, (b) issue Class A common stock upon exercise of outstanding options or warrants or (c) file registration statements on Form S-8.

The exceptions permit our executive officers, directors and shareholders, as parties to the ‘‘lock-up’’ agreements, among other things and subject to restrictions, to (a) make certain gifts,

(b) make transfers by will or intestate succession, (c) if the party is a corporation, partnership, limited liability company or other business entity, make transfers to any stockholders, partners, members of, or owners of similar equity interests in, the party, or to an affiliate of the party, if such transfer is not for value, (d) if the party is a corporation, partnership, limited liability company or other business entity, make transfers in connection with the sale or transfer of all of the party's capital stock, partnership interests, membership interests or other similar equity interests, as the case may be, or all or substantially all of the party's assets, in any such case not undertaken for the purpose of avoiding the restrictions imposed by the ''lock-up'' agreement, (e) enter into transactions relating to shares of Class A common stock acquired in open market transactions after completion of this offering, provided that no public announcement or filing is made regarding such transaction during the 180-day lock-up period, (f) enter into a 10b5-1 trading plan, provided that such plan does not permit the sale of any Class A common stock during the 180-day lock-up period and no public announcement or filing is made regarding such plan during the 180-day lock-up period, (g) make transfers to us to satisfy tax withholding obligations pursuant to our equity incentive plans disclosed in this prospectus, (h) if the party is a trust, make transfers to a trust, trustee or beneficiary of the trust or to the estate of a trustor, trustee or beneficiary of such trust, provided that no public announcement or filing is made regarding such transaction during the 180-day lock-up period, (i) make transfers pursuant to a divorce settlement, qualified domestic or other court order, (j) make transfers to us pursuant to any right to repurchase shares or any right of first refusal with respect to transfers of shares and (k) make transfers pursuant to a bona fide third-party tender offer, merger, consolidation or other similar transaction.

The representatives, in their sole discretion, may release our Class A common stock and other securities subject to the lock-up agreements described above in whole or in part at any time. When determining whether or not to release our Class A common stock and other securities from lock-up agreements, the representatives will consider, among other factors, the holder's reasons for requesting the release, the number of shares for which the release is being requested and market conditions at the time of the request. In the event of such a release or waiver for one of our directors or officers, the representatives shall provide us with notice of the impending release or waiver at least three business days before the effective date of such release or waiver and we will announce the impending release or waiver by issuing a press release at least two business days before the effective date of the release or waiver.

Canada. The Class A common stock may be sold only to purchasers purchasing, or deemed to be purchasing, as principal that are accredited investors, as defined in National Instrument 45-106 *Prospectus Exemptions* or subsection 73.3(1) of the *Securities Act* (Ontario), and are permitted clients, as defined in National Instrument 31-103 *Registration Requirements, Exemptions and Ongoing Registrant Obligations*. Any resale of the Class A common stock must be made in accordance with an exemption from, or in a transaction not subject to, the prospectus requirements of applicable securities laws.

Securities legislation in certain provinces or territories of Canada may provide a purchaser with remedies for rescission or damages if this prospectus (including any amendment thereto) contains a misrepresentation, provided that the remedies for rescission or damages are exercised by the purchaser within the time limit prescribed by the securities legislation of the purchaser's province or territory. The purchaser should refer to any applicable provisions of the securities legislation of the purchaser's province or territory for particulars of these rights or consult with a legal advisor.

Pursuant to section 3A.3 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.

United Kingdom. Each of the underwriters has represented and agreed that:

- it has not made or will not make an offer of the securities to the public in the United Kingdom within the meaning of section 102B of the Financial Services and Markets Act 2000 (as amended) (FSMA) except to legal entities which are authorized or regulated to operate in the financial markets or, if not so authorized or regulated, whose corporate purpose is solely to invest in securities or otherwise in circumstances which do not require the publication by us of a prospectus pursuant to the Prospectus Rules of the Financial Services Authority (FSA);
- it has only communicated or caused to be communicated and will only communicate or cause to be communicated an invitation or inducement to engage in investment activity (within the meaning of section 21 of FSMA) to persons 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 or in circumstances in which section 21 of FSMA does not apply to us; and
- it has complied with and will comply with all applicable provisions of FSMA with respect to anything done by it in relation to the securities in, from or otherwise involving the United Kingdom.

Switzerland. The securities will not be offered, directly or indirectly, to the public in Switzerland and this prospectus does not constitute a public offering prospectus as that term is understood pursuant to article 652a or 1156 of the Swiss Federal Code of Obligations.

European Economic Area. In relation to each Member State of the European Economic Area (the ''EEA'') which has implemented the European Prospectus Directive (each, a ''Relevant Member State''), an offer of our shares may not be made to the public in a Relevant Member State other than:

- to any legal entity which is a qualified investor, as defined in the European Prospectus Directive;
- to fewer 150 natural or legal persons (other than qualified investors as defined in the European Prospectus Directive), subject to obtaining the prior consent of the relevant dealer or dealers nominated by us for any such offer; or
- in any other circumstances falling within Article 3(2) of the European Prospectus Directive,

provided that no such offer of our shares shall require us or any underwriter to publish a prospectus pursuant to Article 3 of the European Prospectus Directive or supplement prospectus pursuant to Article 16 of the European Prospectus Directive and each person who initially acquires any shares or to whom any offer is made will be deemed to have represented, acknowledged and agreed to and with each of the underwriters and with us that it is a ''qualified investor'' within the meaning of the law in that Relevant Member State implementing Article 2(1)(e) of the European Prospectus Directive.

In the case of any shares being offered to a financial intermediary as that term is used in Article 3(2) of the European Prospectus Directive, each such financial intermediary will be deemed to have represented, acknowledged and agreed that the shares acquired by it in the offer have not been acquired on a non-discretionary basis on behalf of, nor have they been acquired with a view to their offer or resale to, persons in circumstances which may give rise to an offer or any shares to the public other than their offer or resale in a Relevant Member State to qualified investors as so defined or in circumstances in which the prior consent of the representatives has been obtained to each such proposed offer or resale.

For the purposes of this description, the expression an ‘‘offer to the public’’ in relation to the securities in any Relevant Member State means the communication in any form and by any means of sufficient information on the terms of the offer and the securities to be offered so as to enable an investor to decide to purchase or subscribe for the securities, as the expression may be varied in that Relevant Member State by any measure implementing the European Prospectus Directive in that member state, and the expression ‘‘European Prospectus Directive’’ means Directive 2003/71/EC (and amendments hereto, including the 2010 PD Amending Directive, to the extent implemented in the Relevant Member State) and includes any relevant implementing measure in each Relevant Member State. The expression 2010 PD Amending Directive means Directive 2010/73/EU.

Israel. In the State of Israel this prospectus shall not be regarded as an offer to the public to purchase shares of Class A common stock under the Israeli Securities Law, 5728-1968, which requires a prospectus to be published and authorized by the Israel Securities Authority, if it complies with certain provisions of Section 15 of the Israeli Securities Law, 5728-1968, including, inter alia, if: (i) the offer is made, distributed or directed to not more than 35 investors, subject to certain conditions (the ‘‘Addressed Investors’’); or (ii) the offer is made, distributed or directed to certain qualified investors defined in the First Addendum of the Israeli Securities Law, 5728-1968, subject to certain conditions (the ‘‘Qualified Investors’’). The Qualified Investors shall not be taken into account in the count of the Addressed Investors and may be offered to purchase securities in addition to the 35 Addressed Investors. The company has not and will not take any action that would require it to publish a prospectus in accordance with and subject to the Israeli Securities Law, 5728-1968. We have not and will not distribute this prospectus or make, distribute or direct an offer to subscribe for our Class A common stock to any person within the State of Israel, other than to Qualified Investors and up to 35 Addressed Investors.

Qualified Investors may have to submit written evidence that they meet the definitions set out in of the First Addendum to the Israeli Securities Law, 5728-1968. In particular, we may request, as a condition to be offered Class A common stock, that Qualified Investors will each represent, warrant and certify to us or to anyone acting on our behalf: (i) that it is an investor falling within one of the categories listed in the First Addendum to the Israeli Securities Law, 5728-1968; (ii) which of the categories listed in the First Addendum to the Israeli Securities Law, 5728-1968 regarding Qualified Investors is applicable to it; (iii) that it will abide by all provisions set forth in the Israeli Securities Law, 5728-1968 and the regulations promulgated thereunder in connection with the offer to be issued Class A common stock; (iv) that the shares of Class A common stock that it will be issued are, subject to exemptions available under the Israeli Securities Law, 5728-1968, (a) for its own account; (b) for investment purposes only; and (c) not issued with a view to resale within the State of Israel, other than in accordance with the provisions of the Israeli Securities Law, 5728-1968; and (v) that it is willing to provide further evidence of its Qualified Investor status. Addressed Investors may have to submit written evidence in respect of their identity and may have to sign and submit a declaration containing, inter alia, the Addressed Investor’s name, address and passport number or Israeli identification number.

We have not authorized and do not authorize the making of any offer of securities through any financial intermediary on our behalf, other than offers made by the underwriters and their respective affiliates, with a view to the final placement of the securities as contemplated in this document. Accordingly, no purchaser of the shares, other than the underwriters, is authorized to make any further offer of shares on our behalf or on behalf of the underwriters.

Electronic Offer, Sale and Distribution of Shares. A prospectus in electronic format may be made available on the websites maintained by one or more of the underwriters or selling group members, if any, participating in this offering and one or more of the underwriters participating in this

offering may distribute prospectuses electronically. The representatives may agree to allocate a number of shares to underwriters and selling group members for sale to their online brokerage account holders. Internet distributions will be allocated by the underwriters and selling group members that will make internet distributions on the same basis as other allocations. Other than the prospectus in electronic format, the information on these websites is not part of this prospectus or the registration statement of which this prospectus forms a part, has not been approved or endorsed by us or any underwriter in its capacity as underwriter, and should not be relied upon by investors.

Other Relationships. Certain of the underwriters and their affiliates have provided, and may in the future provide, various investment banking, commercial banking and other financial services for us and our affiliates for which they have received, and may in the future receive, customary fees.

LEGAL MATTERS

The validity of the shares of Class A common stock and Class B common stock being offered by this prospectus will be passed upon for us by Cooley LLP, Palo Alto, California. The underwriters are being represented by Davis Polk & Wardwell LLP, Menlo Park, California.

EXPERTS

The consolidated financial statements as of December 31, 2017 and 2018 included in this prospectus have been so included in reliance on the report of OUM & Co. LLP, an independent registered public accounting firm, given on the authority of said firm as experts in auditing and accounting.

CHANGES IN INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

Dismissal of Independent Registered Public Accounting Firm

We dismissed Frank, Rimerman + Co. LLP, or Frank, Rimerman, as our independent registered public accounting firm on November 13, 2017. The decision to dismiss Frank, Rimerman was approved by our board of directors.

The report of Frank, Rimerman on the financial statements for 2016 contained no adverse opinion or a disclaimer of opinion, and was not qualified or modified as to uncertainty, audit scope or accounting principle. Frank, Rimerman did not perform an audit of our 2017 financial statements.

During 2016, and the subsequent period through November 13, 2017, (1) there were no disagreements (as that term is used in Item 304(a)(1)(iv) of Regulation S-K and the related instructions) between us and Frank, Rimerman on any matter of accounting principles or practices, financial statement disclosure, or auditing scope or procedure, which disagreements, if not resolved to the satisfaction of Frank, Rimerman, would have caused Frank, Rimerman to make reference thereto in its report on our financial statements for the year ended December 31, 2016, and (2) there were no ''reportable events'' as such term is defined in Item 304(a)(1)(v) of Regulation S-K.

We have provided Frank, Rimerman with a copy of the disclosures set forth under the heading ''Changes in Independent Registered Public Accounting Firm'' included in this prospectus and have requested that Frank, Rimerman furnish a letter addressed to the SEC stating whether or not Frank, Rimerman agrees with statements related to them made by us under the heading ''Change in Independent Registered Public Accounting Firm'' in this prospectus. A copy of that letter is filed as Exhibit 16.1 to the registration statement of which this prospectus forms a part.

Newly Appointed Independent Registered Public Accounting Firm

We engaged OUM & Co. LLP, or OUM, as our independent registered public accounting firm on November 13, 2017 to audit our financial statements for 2016, 2017 and 2018. The decision to change our principal independent registered public accounting firm was approved by our board of directors.

During 2016, and the subsequent period preceding our engagement of OUM as our independent registered public accounting firm, we did not consult with OUM on matters that involved the application of accounting principles to a specified transaction, the type of audit opinion that might be

rendered on our financial statements or any other matter that was either the subject of a disagreement or reportable event.

WHERE YOU CAN FIND MORE INFORMATION

We have filed with the SEC a registration statement on Form S-1, including exhibits and schedules, under the Securities Act, with respect to the shares of Class A common stock being offered by this prospectus. This prospectus, which constitutes part of the registration statement, does not contain all of the information in the registration statement and its exhibits. For further information with respect to us and the Class A common stock offered by this prospectus, we refer you to the registration statement and its exhibits. Statements contained in this prospectus as to the contents of any contract or any other document referred to are not necessarily complete, and in each instance, we refer you to the copy of the contract or other document filed as an exhibit to the registration statement. Each of these statements is qualified in all respects by this reference.

You can read our SEC filings, including the registration statement, over the Internet at the SEC's website at www.sec.gov.

Upon the completion of this offering, we will be subject to the information reporting requirements of the Securities Exchange Act of 1934 and we will file reports, proxy statements and other information with the SEC. These reports, proxy statements and other information will be available at the web site of the SEC referred to above. We also maintain a website at www.atreca.com, at which, following the completion of this offering, you may access these materials free of charge as soon as reasonably practicable after they are electronically filed with, or furnished to, the SEC. Information contained on or accessible through our website is not a part of this prospectus, and the inclusion of our website address in this prospectus is an inactive textual reference only.

CONSOLIDATED FINANCIAL STATEMENTS ATRECA, INC.
Index to Consolidated Financial Statements

Audited financial statements for the years ended December 31, 2017 and 2018

Unaudited financial statements for the three months ended March 31, 2018 and 2019

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

Stockholders and Board of Directors
Atreca, Inc.
Redwood City, California

Opinion on the Financial Statements

We have audited the accompanying consolidated financial statements of Atreca, Inc., which comprise the consolidated balance sheets as December 31, 2017 and 2018, and the related consolidated statements of operations, comprehensive loss, convertible preferred stock and stockholders' equity and cash flows for each of the two years in the period ended December 31, 2018, and the related notes (collectively referred to as the financial statements). In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Company at December 31, 2017 and 2018, and the results of its operations and its cash flows for the years then ended in conformity with 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 audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (''PCAOB'') and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud. The Company is not required to have, nor were we engaged to perform, an audit of its internal control over financial reporting. As part of our audits we are required to obtain an understanding of internal control over financial reporting but not for the purpose of expressing an opinion on the effectiveness of the Company's internal control over financial reporting. Accordingly, we express no such opinion.

Our audits included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. We believe that our audits provide a reasonable basis for our opinion.

/s/ OUM & CO. LLP

San Francisco, California
March 5, 2019, except for Note 14, as to which the date is April 23, 2019 and except for the effects of the reverse stock split as described, under the heading *Reverse Stock Split,* as to which the date is June 10, 2019.
We have served as the Company's auditor since 2017.

Atreca, Inc.
Consolidated Balance Sheets
(in thousands, except share and per share data)

	December 31,		Pro Forma December 31, 2018
	2017	2018	(unaudited)
ASSETS			
Current Assets			
Cash and cash equivalents	$ 8,242	$114,504	
Investments	22,371	—	
Prepaid expenses and other current assets	1,369	2,721	
Total current assets	31,982	117,225	
Property and equipment, net	3,790	4,143	
Deposits and other	340	316	
Total assets	$ 36,112	$121,684	
LIABILITIES, CONVERTIBLE PREFERRED STOCK AND STOCKHOLDERS' EQUITY (DEFICIT)			
Current Liabilities			
Accounts payable	$ 609	$ 1,307	$ 1,307
Accrued expenses	2,084	3,208	3,208
Capital lease obligations, current portion	51	47	47
Total current liabilities	2,744	4,562	4,562
Capital lease obligations, net of current portion	144	100	100
Deferred rent	81	6	6
Preferred stock warrant liability	347	380	—
Total liabilities	3,316	5,048	4,668
Commitments and Contingencies (Note 8)			
Series A convertible preferred stock, $0.0001 par value, 32,133,287 shares authorized; 5,305,513 shares issued and outstanding (aggregate liquidation preference of $58,892), no shares issued and outstanding, pro forma (unaudited)	55,030	55,030	—
Series B convertible preferred stock, $0.0001 par value, 18,008,749 shares authorized (18,550,000 shares at 2017); 3,001,421 shares issued and outstanding (aggregate liquidation preference of $35,000), no shares issued and outstanding, pro forma (unaudited)	34,333	34,333	—
Series C1 convertible preferred stock, $0.0001 par value, 54,189,549 shares authorized (none at 2017); 5,007,134 shares issued and outstanding (aggregate liquidation preference of $70,000), no shares issued and outstanding, pro forma (unaudited)	—	65,691	—
Series C2 convertible preferred stock, $0.0001 par value, 23,605,150 shares authorized (none at 2017); 3,934,191 shares issued and outstanding (aggregate liquidation preference of $55,000), no shares issued and outstanding, pro forma (unaudited)	—	54,615	—
Stockholders' equity (deficit)			
Class A common stock, $0.0001 par value, 191,398,492 shares authorized (77,520,000 shares of single class common stock at 2017), 2,119,872 shares issued and outstanding (2,092,040 shares of single class common stock at 2017) 15,433,940 shares issued and outstanding, pro forma (unaudited)	—	—	2
Class B common stock, $0.0001 par value, 23,605,150 shares authorized (none at 2017), none issued and outstanding 3,934,191 shares issued and outstanding, pro forma (unaudited)	—	—	—
Additional paid-in capital	2,129	3,593	213,640
Accumulated other comprehensive loss	(14)	(4)	(4)
Accumulated deficit	(58,682)	(96,622)	(96,622)
Total stockholders' equity (deficit)	(56,566)	(93,032)	117,016
Total liabilities, convertible preferred stock and stockholders' equity (deficit)	$ 36,112	$121,684	$ 121,684

The accompanying Notes are an integral part of these consolidated financial statements.

Atreca, Inc.
Consolidated Statements of Operations
(in thousands, except share and per share data)

	Year Ended December 31,	
	2017	2018
Operating Expenses		
Research and development	$ 24,873	$ 32,513
General and administrative	4,562	7,060
Total operating expenses	29,435	39,573
Operating loss	(29,435)	(39,573)
Interest and other income (expense)		
Other income	1,719	961
Interest income	152	714
Interest expense	(14)	(9)
Preferred stock warrant liability revaluation	6	(33)
Gain (loss) on disposal of property and equipment	48	(1)
Loss before income tax benefit (expense)	(27,524)	(37,941)
Income tax benefit (expense)	(3)	1
Net loss	$ (27,527)	$ (37,940)
Net loss per share, basic and diluted	$ (13.14)	$ (18.02)
Weighted-average shares used in computing net loss per share, basic and diluted	2,094,795	2,104,861
Pro forma net loss per share, basic and diluted (unaudited)		$ (2.86)
Weighted-average shares used in computing pro forma net loss per share, basic and diluted (unaudited)		13,277,996

The accompanying Notes are an integral part of these consolidated financial statements.

Atreca, Inc.
Consolidated Statements of Comprehensive Loss
(in thousands)

	Year Ended December 31,	
	2017	2018
Net loss	$(27,527)	$(37,940)
Other comprehensive income (loss):		
Unrealized gain (loss) on fair value of investments	(31)	26
Unrealized gain (loss) on currency translation	34	(16)
Comprehensive loss	$(27,524)	$(37,930)

The accompanying Notes are an integral part of these consolidated financial statements.

Atreca, Inc.
Consolidated Statements of Convertible Preferred Stock and Stockholders' Deficit
Years Ended December 31, 2018 and 2017
(in thousands, except share data)

	Convertible Preferred Stock		Common Stock		Additional Paid-In Capital	Accumulated Other Comprehensive Loss	Accumulated Deficit	Total Stockholders' Deficit
	Shares	Amount	Shares	Amount				
Balances at December 31, 2016	5,305,513	$ 55,029	2,099,437	$ 1	$ 1,700	$ (17)	$ (31,155)	$ (29,471)
Issuance of Series B convertible preferred stock, net of issuance costs of $667	3,001,421	34,333	—	—	—	—	—	—
Issuance of common stock upon exercise of options	—	—	9,632	—	16	—	—	16
Vesting of early exercised stock options	—	—	—	—	4	—	—	4
Repurchase of unvested shares	—	—	(17,029)	—	—	—	—	—
Stock-based compensation	—	—	—	—	409	—	—	409
Unrealized loss in fair value of investments	—	—	—	—	—	(31)	—	(31)
Unrealized currency exchange gain	—	—	—	—	—	34	—	34
Net loss	—	—	—	—	—	—	(27,527)	(27,527)
Balances at December 31, 2017	8,306,934	89,362	2,092,040	1	2,129	(14)	(58,682)	(56,566)
Issuance of Series C1 convertible preferred stock net of issuance costs of $4,309	5,007,134	65,691	—	—	—	—	—	—
Issuance of Series C2 convertible preferred stock net of issuance costs of $385	3,934,191	54,615	—	—	—	—	—	—
Issuance of common stock upon exercise of options	—	—	27,832	—	45	—	—	45
Stock-based compensation	—	—	—	—	1,419	—	—	1,419
Unrealized gain on fair value of investments	—	—	—	—	—	26	—	26
Unrealized currency exchange loss	—	—	—	—	—	(16)	—	(16)
Net loss	—	—	—	—	—	—	(37,940)	(37,940)
Balances at December 31, 2018	17,248,259	$ 209,668	2,119,872	$ 1	$ 3,593	$ (4)	$ (96,622)	$ (93,032)

The accompanying Notes are an integral part of these consolidated financial statements.

Atreca, Inc.
Consolidated Statements of Cash Flows
(in thousands)

	Year Ended December 31,	
	2017	2018
Cash Flows from Operating Activities		
Net loss	$(27,527)	$ (37,940)
Adjustments to reconcile net loss to net cash used in operating activities:		
Depreciation and amortization	1,205	1,409
(Gain) loss on disposal of property and equipment	(48)	1
Stock-based compensation	409	1,419
Preferred stock warrant liability revaluation	(6)	33
Changes in operating assets and liabilities:		
Prepaid expenses and other current assets	596	(1,370)
Accounts payable	136	698
Accrued expenses	152	1,085
Deferred rent	(13)	(35)
Net cash used in operating activities	(25,096)	(34,700)
Cash Flows from Investing Activities		
Purchase of property and equipment	(1,377)	(1,764)
Purchase of investments	(29,780)	—
Proceeds from maturities of investments	22,176	22,398
Change in deposits	12	24
Net cash provided by (used in) investing activities	(8,969)	20,658
Cash Flows from Financing Activities		
Proceeds from issuance of convertible preferred stock, net	34,333	120,306
Proceeds from exercise of stock options	16	46
Principal payments on capital lease obligations	(60)	(48)
Net cash provided by financing activities	34,289	120,304
Net change in cash and cash equivalents	224	106,262
Cash and cash equivalents, beginning of period	8,018	8,242
Cash and cash equivalents, end of period	$ 8,242	$114,504
Supplemental Disclosure of Cash Flow Information:		
Cash paid for interest	$ 14	$ 9
Cash paid for income taxes	$ 3	$ (1)
Supplemental Schedule of Non-Cash Investing and Financing Activities:		
Vesting of early exercised common stock options	$ 4	$ —
Equipment returned under capital lease obligation	$ (43)	$ —

The accompanying Notes are an integral part of these consolidated financial statements.

1. Nature of Business and Management's Plans Regarding Financing of Future Operations

Nature of Business

Atreca, Inc. (the Company) was incorporated in the State of Delaware on June 11, 2010 (inception date), and is located in Redwood City, California. In April 2016, the Company formed a wholly owned subsidiary, Atreca Pte. Ltd., in Singapore. The Company is a biopharmaceutical company utilizing its differentiated platform to discover and develop novel antibody-based immunotherapeutics to treat a range of solid tumor types. The Company's lead product candidate, ATRC-101, is a monoclonal antibody in preclinical development with a novel mechanism of action and target derived from an antibody identified using its discovery platform. The Company operates in a single segment. Since inception, the Company has been primarily engaged in research and development, raising capital, building its management team and building its intellectual property portfolio.

Liquidity

Management evaluates whether there are relevant conditions and events that in the aggregate raise substantial doubt about the entity's ability to continue as a going concern and to meet its obligations as they become due within one year from the date that the financial statements are issued.

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 and the ability to secure additional capital to fund operations. Identification and development of product candidates 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

Principles of Consolidation

The consolidated financial statements include accounts of the Company and its wholly owned subsidiary. All significant intercompany accounts and transactions are eliminated upon consolidation.

Use of Estimates

The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, disclosure of contingent assets and liabilities, and reported amounts of income and expenses in the consolidated financial statements and accompanying notes. Actual results could differ from those estimates. Key estimates in the consolidated financial statements include estimated useful lives of property and equipment, impairment of long-lived assets, accrued expenses, valuation of deferred income tax assets, fair value of warrants issued to purchasers of shares of preferred stock and common stock and fair value of options granted under the Company's stock option plan.

2. Summary of Significant Accounting Policies (Continued)

Other Income

Other income is comprised of amounts earned from services performed under service agreements. Beginning January 1, 2018, the Company follows the provisions of Accounting Standards Update 2014-09 Accounting Standards Codification (ASC) Topic 606, *Revenue from Contracts with Customers* (Topic 606). The guidance provides a unified model to determine how income is recognized.

In determining the appropriate amount of other income to be recognized as it fulfills its obligations under the agreements, the Company performs the following steps: (i) identifies the promised goods or services in the contract; (ii) determines whether the promised goods or services are performance obligations including whether they are distinct in the context of the contract; (iii) measures the transaction price, including the constraint on variable consideration; (iv) allocates the transaction price to the performance obligations based on estimated selling prices; and (v) recognizes other income when (or as) the Company satisfies each performance obligation.

Upon adoption of Topic 606, there was no change to the units of accounting previously identified with respect to existing service agreements under legacy Generally Accepted Accounting Principles (GAAP), which are now considered performance obligations under Topic 606, and there was no change to the revenue recognition pattern for the performance obligations. Accordingly, the adoption of the new standard resulted in no cumulative effect change to the Company's opening accumulated deficit balance.

The Company generally allocates the transaction price to distinct performance obligations at their stand-alone selling prices, determined by their estimated costs plus some margin. Performance obligations are generally delivered over time and recognized based upon observable inputs as the related research services are performed, which are recorded as research and development expenses. Amounts due under service agreements are generally billed monthly as services are delivered and do not generally result in contract liabilities or assets. Receivables under service agreements of $37,000 and $282,000 are included in prepaid expenses and other current assets as of December 31, 2017 and 2018, respectively. The Company has received an advance payment of $200,000 for services to be performed under a service agreement. This represents the sole contract liability under Topic 606 and is included in other accrued expenses as of December 31, 2017 and 2018.

Collaboration and Service Arrangements

In March 2016, the Company entered into a research collaboration agreement with Genome Institute of Singapore (GIS) for the development of a high-throughput microfluidic droplet system for single cell phenotyping and genotyping. Under the agreement, the Company contributes reimbursement of research expenses and certain reagents and other consumables to GIS. The Company accounts for the collaboration agreement with GIS in accordance with ASC 808—*Collaborative Arrangements.* The Company recognized $280,000 and $522,000 of research and development expenses in 2017 and 2018, respectively under the collaboration agreement, including wind-down costs. The Company exercised its right to early terminate the collaboration agreement in December 2018.

2. Summary of Significant Accounting Policies (Continued)

The Company provides antibody sequencing and related repertoire analysis services to the Bill and Melinda Gates Foundation under a services agreement entered into in February 2013. Generally, services are billed as they are delivered, and service revenue is recognized in other income in accordance with Topic 606.

In December 2018, the Company entered into a service agreement with Bristol-Myers Squibb to provide antibody sequencing and related repertoire analysis services. As of December 31, 2018, services provided under the agreement were not material. Service revenue will be recognized in other income in accordance with Topic 606.

Unaudited Pro Forma Financial Information

The unaudited pro forma balance sheet information as of December 31, 2018, assumes the conversion of all outstanding shares of convertible preferred stock into 17,248,259 shares of the Company's common stock immediately prior to completion of the Company's planned initial public offering (IPO). Shares of common stock issued in the IPO and any related net proceeds are excluded from the pro forma information.

Unaudited pro forma net loss per share is computed using the weighted-average number of common shares outstanding after giving effect to the conversion of all convertible preferred stock into shares of common stock, as if such conversion had occurred at the beginning of the period presented, or the date of original issuance, if later. The conversion of convertible preferred stock has been reflected assuming shares of convertible preferred stock convert into shares of fully paid common stock at the applicable conversion ratios.

Cash and Cash Equivalents

Cash and cash equivalents include all cash balances and highly liquid investments purchased with an original maturity of three months or less.

Investments

The Company considers securities purchased with original maturities greater than three months to be investments. The Company's policy is to protect the value of its investment portfolio and minimize principal risk by earning returns based on current interest rates. The Company's intent is to convert all investments into cash to be used for operations and has classified them as available for sale. For purposes of determining realized gains and losses, the cost of securities sold is based on specific identification. There were no realized gains or losses on investments through December 31, 2018. Net unrealized holding losses on investments, which are included in accumulated other comprehensive loss, were $26,000 and $0 at December 31, 2017 and 2018, respectively. The Company's investments at December 31, 2017, consisted primarily of U.S. Treasury securities that are reported at fair value based on quoted prices in active markets.

Risks and Uncertainties

The Company is subject to a number of risks associated with companies at a similar stage, including dependence on key individuals, competition from similar services and larger companies, volatility of the industry, ability to obtain regulatory clearance, ability to obtain adequate financing to

2. Summary of Significant Accounting Policies (Continued)

support growth, the ability to attract and retain additional qualified personnel to manage the anticipated growth of the Company and general economic conditions.

Concentration of Credit Risk

Financial instruments that potentially subject the Company to concentration of credit risk consist of cash and cash equivalents, investments and other receivables. Cash and cash equivalents are held at one financial institution and were in excess of the Federal Deposit Insurance Corporation insurable limit at December 31, 2017 and 2018. Additionally, cash, cash equivalents and investments are maintained at a brokerage firm for which amounts are insured by the Securities Investor Protection Corporation subject to legal limits. The Company has not experienced any losses on its deposits to date.

The Company does not require collateral or other security for other receivables; however, credit risk is mitigated by the Company's ongoing evaluations of its debtors' credit worthiness. The Company recognized $0 and $7,000 of credit losses in 2017 and 2018, respectively.

Property and Equipment

Property and equipment are stated at cost less depreciation. Depreciation is computed using the straight-line method with the estimated useful lives of the assets ranging from two to five years. Leasehold improvements are amortized over the estimated useful life of the asset, or the remaining lease term, whichever is shorter. Expenditures for repairs and maintenance, which do not extend the useful life of the property and equipment, are expensed as incurred.

Accounting for Impairment of Long-Lived Assets

Long-lived assets consist of property and equipment. The Company reviews its long-lived assets for impairment whenever events or changes in circumstances indicate the carrying amount of an asset may not be recoverable. Recoverability of assets held and used is measured by comparison of the carrying amount of an asset to future net cash flows expected to be generated by the asset. If such assets are considered to be impaired, the impairment to be recognized is measured by the amount by which the carrying amount of the assets exceeds the fair value of the assets. The Company has not recorded any impairment of long-lived assets in 2017 or 2018.

Intellectual Property

The legal and professional costs incurred by the Company to maintain its patent rights have been expensed as part of research and development costs since inception. As of December 31, 2017 and 2018, the Company has determined that these expenses have not met the criteria to be capitalized. Intellectual property-related expenses for the years ended December 31, 2017 and 2018 were $487,000 and $1.1 million, respectively.

Deferred Rent

The Company has entered into lease agreements for its laboratory and office facilities. These leases qualify as and are accounted for as operating leases. Rent expense is recognized on a straight-line basis over the term of the lease and, accordingly, the Company records the difference between cash rent payments and the recognition of rent expense as a deferred rent liability.

2. Summary of Significant Accounting Policies (Continued)

Research and Development Costs

Research and development costs are expensed as incurred. Research and development costs consist primarily of salaries and benefits, consultant fees, stock-based compensation, certain facility costs, legal costs and other costs associated with preclinical development.

A substantial portion of the Company's ongoing research and development activities are conducted by third-party service providers in connection with preclinical development activities and contract manufacturing organizations in connection with the production of materials for clinical trials. At the end of the reporting period, the Company compares payments made to third-party service providers to the estimated progress toward completion of the research or development objectives. Such estimates are subject to change as additional information becomes available. Depending on the timing of payments to the service providers and the progress that the Company estimates has been made as a result of the service provided, the Company may record net prepaid or accrued expense relating to these costs.

Stock-Based Compensation

The Company generally grants stock options to its employees for a fixed number of shares with an exercise price equal to the fair value of the underlying shares at the date of grant. The Company accounts for stock option grants using the fair value method. The fair value of options is calculated using the Black-Scholes option pricing model. Stock-based compensation is recognized as the underlying options vest using the straight-line attribution approach, and forfeitures are recorded as they occur.

Beginning January 1, 2018, the Company follows the provisions of ASU 2018-07, *Improvements to Nonemployee Share-Based Payment Accounting* (Topic 718). The standard expands the scope of Topic 718 to include share-based payment transactions for acquiring goods and services from nonemployees. Consequently, the accounting for share-based payments to nonemployees and employees is substantially aligned.

Preferred Stock Warrant Liability

The Company accounts for outstanding warrants to purchase shares of the Company's convertible preferred stock in accordance with Financial Accounting Standards Board (FASB) ASC Topic 480, *Distinguishing Liabilities from Equity* (ASC Topic 480). Under ASC Topic 480, freestanding warrants for shares that are contingently redeemable are classified as liabilities on the consolidated balance sheets and are measured at their inception date fair value and subsequently re-measured to fair value at each reporting period (Note 9).

Fair Value of Financial Instruments:

The Company uses a three-level hierarchy, which prioritizes, within the measurement of fair value, the use of market-based information over entity-specific information for fair value measurements based on the nature of inputs used in the valuation of an asset or liability as of the measurement date. Fair value focuses on an exit price and is defined as the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market

2. Summary of Significant Accounting Policies (Continued)

participants at the measurement date. The inputs or methodology used for valuing financial instruments are not necessarily an indication of the risk associated with those financial instruments.

The three-level hierarchy for fair value measurements is defined as follows:

Level 1: Inputs to the valuation methodology are quoted prices (unadjusted) for identical assets or liabilities in active markets.

Level 2: Inputs to the valuation methodology include quoted prices for similar assets and liabilities in active markets, and inputs that are observable for the asset or liability, either directly or indirectly, for substantially the full term of the financial instrument.

Level 3: Inputs to the valuation methodology are unobservable and significant to the fair value measurement.

An asset or liability's categorization within the valuation hierarchy is based upon the lowest level of input that is significant to the fair value measurement.

Income Taxes

The Company accounts for income taxes using the asset and liability method. Under this method, deferred income tax assets and liabilities are recorded based on the estimated future tax effects of differences between the financial statement and income tax basis of existing assets and liabilities. A valuation allowance is provided against the Company's deferred income tax assets when realization is not reasonably assured.

Net Loss Per Share

The Company computes basic loss per share by dividing the net loss available to common stockholders by the weighted average number of common shares outstanding for the period, without consideration for common stock equivalents. Diluted net loss assumes the conversion, exercise or issuance of all potential common stock equivalents, unless the effect of inclusion would be anti-dilutive. For purposes of this calculation, common stock equivalents include the Company's stock options, common stock warrants, convertible preferred stock warrants and convertible preferred stock, which are convertible into shares of the Company's common stock. No shares related to the convertible preferred stock were included in the diluted net loss calculation for the years ended December 31, 2017 or 2018 because the inclusion of such shares would have had an anti-dilutive effect. The shares to be issued upon exercise of certain outstanding stock options were also excluded from the diluted net loss calculation for the years ended December 31, 2017 and 2018 because such shares are anti-dilutive.

2. Summary of Significant Accounting Policies (Continued)

Historical outstanding anti-dilutive securities not included in the diluted net loss per share calculation include the following:

	Year Ended December 31,	
	2017	2018
Convertible preferred stock (as converted)	8,306,934	17,248,259
Common stock options	567,319	2,136,291
Common stock warrants	62,936	62,936
Convertible preferred stock warrants	49,997	49,997
	8,487,186	19,497,483

Unaudited Pro Forma Net Loss Per Share

The following table summarizes the Company's unaudited pro forma net loss per share (in thousands, except share and per share data):

	Year Ended December 31, 2018
Numerator:	
Net loss attributable to common stockholders	$ 37,940
Denominator:	
Shares used to compute net loss per share, basic and diluted	2,104,861
Pro forma adjustments to reflect assumed weighted-average effect of conversion of convertible preferred stock	11,173,135
Shares used to compute pro forma net loss per share, basic and diluted	13,227,996
Pro forma net loss per share, basic and diluted	$ (2.86)

Foreign Currency

The U.S. dollar is the functional currency of the Company and the functional currency of its subsidiary is Singapore dollars. For consolidation purposes, assets and liabilities of its subsidiary are translated into U.S. dollars at exchange rates in effect at the balance sheet date. Revenue and expenses are translated at average exchange rates in effect during the period. Gains and losses from transactions denominated in foreign currency are included in the accumulated other comprehensive loss component of stockholders' equity. Translation adjustments are not included in earnings unless they are realized through a sale or upon a complete or substantially complete liquidation of the Company's net investment in its foreign operations.

Reverse stock split

In June 2019, the Company's board of directors and its stockholders approved an amendment and restatement of the Company's amended and restated certificate of incorporation to effect a reverse split of shares of the common stock and convertible preferred stock on a 1-for-6 basis (the ''Reverse Stock Split''). The par value and the authorized shares of the common stock and convertible preferred stock were not adjusted as a result of the Reverse Stock Split though the

2. Summary of Significant Accounting Policies (Continued)

Company concurrently authorized additional shares of common stock and convertible preferred stock. All issued and outstanding convertible preferred stock and common stock, stock options, warrants and related per share amounts contained in the financial statements have been retroactively adjusted to reflect this Reverse Stock Split for all periods presented. The Reverse Stock Split was effected on June 7, 2019.

Recent Accounting Pronouncements

In May 2014, the FASB issued ASU 2014-09, *Revenue from Contracts with Customers* (Topic 606). This accounting standard outlines a single comprehensive model for entities to use in accounting for revenue arising from contracts with customers to reflect the consideration to which the entity expects to be entitled to in exchange for goods and services.

The Company adopted Topic 606 as of January 1, 2018 using the modified retrospective method of adoption. Results for reporting periods beginning after January 1, 2018 are presented under the guidelines of Topic 606, while prior period amounts have not been adjusted and continue to be reported under the accounting standards in effect for those periods. Upon adoption of Topic 606, the Company did not recognize a cumulative effect adjustment of initially applying the standard as no material adjustments to contracts not completed as of the date of adoption were identified. The adoption of Topic 606 did not materially impact the amount of revenue recognized or any other financial statement line item as of and for the year ended December 31, 2018.

In June 2018, the FASB issued ASU 2018-07, *Improvements to Nonemployee Share-Based Payment Accounting* (Topic 718). The standard 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 certain specified exemptions. The early adoption of this new guidance, effective January 1, 2018, had no material impact on the Company's consolidated financial statements.

In November 2016, the FASB issued ASU 2016-18, *Statement of Cash Flows: Restricted Cash* (Topic 230), to address the diversity in the classification and presentation of changes in restricted cash in the statement of cash flows by requiring entities to combine the changes in cash and cash equivalents and restricted cash in one line. As a result, entities will no longer present transfers between cash and cash equivalents and restricted cash in the statement of cash flows. Additionally, if more than one line item is recorded on the balance sheet for cash and cash equivalents and restricted cash, a reconciliation between the statement of cash flows and balance sheet is required. The Company adopted the standard effective January 1, 2018 using the retrospective transition method. The adoption of the guidance did not have an impact on the Company's consolidated balance sheets or statements of cash flows.

In January 2016, the FASB issued ASU 2016-01, *Recognition and Measurement of Financial Assets and Financial Liabilities* (Subtopic 825-10), which amends the guidance on the recognition, measurement, presentation and disclosure of financial instruments. Subtopic 825-10 is effective for annual and interim reporting periods beginning after December 15, 2017. The adoption of this update had no material effect on the Company's consolidated financial statements.

2. Summary of Significant Accounting Policies (Continued)

In February 2016, the FASB issued ASU 2016-02, *Leases* (Topic 842), which modifies the accounting by lessees for all leases with a term greater than 12 months. This standard will require lessees to recognize on the balance sheet the assets and liabilities for the rights and obligations created by those leases. Topic 842 is effective for the Company as of January 1, 2020. Early adoption is permitted. The Company's most significant lease is its operating lease for its corporate headquarters, and, while the Company has not yet estimated the amounts by which its financial statements will be affected by the adoption of this guidance, it expects that the overall recognition of expense will be similar to current guidance, but that there will be a significant change in the balance sheet due to the recognition of right of use assets and the corresponding lease liabilities.

In August 2016, the FASB issued ASU 2016-15, *Statement of Cash Flows: Classification of Certain Cash Receipts and Cash Payments* (Topic 230). The standard clarifies how certain cash receipts and cash payments will be presented and classified in the statement of cash flows. Topic 230 is effective for the Company as of January 1, 2019. Early adoption is permitted. The Company does not expect the amended guidance to have a material impact on its financial statements.

3. Fair Value of Financial Instruments

The Company's financial assets and liabilities subject to fair value measurements on a recurring basis and the level of inputs used for such measurements were as follows:

	December 31, 2017			
Assets	**Level 1**	**Level 2**	**Level 3**	**Total**
Money market funds	$ 218	$ —	$ —	$ 218
U.S. Treasury securities	—	22,371	—	22,371
Total	$ 218	$ 22,371	$ —	$ 22,589
Liabilities				
Warrant liability	$ —	$ —	$ 347	$ 347
Total	$ —	$ —	$ 347	$ 347

	December 31, 2018			
Assets	**Level 1**	**Level 2**	**Level 3**	**Total**
Money market funds	$ 109,630	$ —	$ —	$ 109,630
Total	$ 109,630	$ —	$ —	$ 109,630
Liabilities				
Warrant liability	$ —	$ —	$ 380	$ 380
Total	$ —	$ —	$ 380	$ 380

3. Fair Value of Financial Instruments (Continued)

The fair value of the warrants were calculated using the Black-Scholes option pricing model and is revalued to fair value at the end of each reporting period until the earlier of the exercise or expiration of the warrants (Note 9). The liability was valued using the following assumptions:

	2017	2018
Exercise price(1)	$ 14.46	$ 14.46
Stock price(2)	$ 11.64	$ 13.20
Time to maturity (in years)	4.64	3.64
Volatility(3)	81.3%	83.7%
Risk-free interest rate(4)	2.15%	2.50%
Expected dividend	$ —	$ —

(1) Based upon terms provided in the warrant agreement.
(2) Based upon an independently prepared valuation as of December 31, 2018 and upon the most recent preferred share purchase price as of December 31, 2017.
(3) Based upon the historical daily volatility of a group of peer public company closing prices.
(4) Based upon interest rate for U.S. Treasury Bonds, as published by the U.S. Federal Reserve.

4. Cash, Cash Equivalents and Investments

The fair value and the amortized cost of cash, cash equivalents and available-for-sale investments by major security type consist of the following (in thousands):

	December 31, 2017			
Cash, cash equivalents and investments	Amortized Cost	Gross Unrealized Gains	Gross Unrealized Losses	Estimated Fair Value
Cash and money market funds	$ 8,242	$ —	$ —	$ 8,242
U.S. Treasury securities	22,401	—	(30)	22,371
Total	30,643	—	(30)	30,613
Less amounts classified as cash and cash equivalents	(8,242)	—	—	(8,242)
Total available-for-sale investments	$ 22,401	$ —	$ (30)	$ 22,371

	December 31, 2018			
Cash, cash equivalents and investments	Amortized Cost	Gross Unrealized Gains	Gross Unrealized Losses	Estimated Fair Value
Cash and money market funds	$ 114,504	$ —	$ —	$ 114,504
Total	114,504	—	—	114,504
Less amounts classified as cash and cash equivalents	(114,504)	—	—	(114,504)
Total available-for-sale investments	$ —	$ —	$ —	$ —

5. Prepaid Expenses and Other Current Assets

Prepaid expenses and other current assets consist of the following (in thousands):

	December 31,	
	2017	2018
Vendor prepayments and deposits	$1,039	$2,045
Prepaid rent	292	394
Non-trade receivables	38	282
Total prepaid expenses and other current assets	$1,369	$2,721

6. Property and Equipment, net

Property and equipment consists of the following (in thousands):

	December 31,	
	2017	2018
Laboratory equipment	$ 6,052	$ 7,561
Furniture and fixtures	385	386
Computer hardware and software	370	580
Leasehold improvements	196	236
	7,003	8,763
Less accumulated depreciation and amortization	(3,213)	(4,620)
Total property and equipment, net	$ 3,790	$ 4,143

Depreciation expense was $1.2 million and $1.4 million in 2017 and 2018, respectively.

The net book value of property and equipment under capital leases was $192,000 and $142,000 at December 31, 2017 and 2018, respectively.

7. Accrued Expenses

Accrued expenses consist of the following (in thousands):

	December 31,	
	2017	2018
Accrued compensation and related benefits	$1,604	$2,568
Other accruals	480	640
Total accrued expenses	$2,084	$3,208

8. Commitments and Contingencies

Leases

The Company leases its office facilities under non-cancellable operating lease agreements that expire at various dates through April 2020. Under the terms of the leases, the Company is responsible for certain insurance, property taxes and maintenance expenses. The office facilities

8. Commitments and Contingencies (Continued)

lease agreements contain scheduled increases over the lease term. The related rent expense is calculated on a straight-line basis with the difference recorded as deferred rent. Rent expense was $1.2 million and $1.3 million in 2017 and 2018, respectively.

The Company leases certain property and equipment under capital leases. In 2017, the Company financed purchases of $226,000 under a capital lease agreement. Outstanding amounts under the capital lease agreements are generally secured by liens on the related property and equipment.

Future minimum lease payments under non-cancelable operating and capital lease agreements consist of the following at December 31, 2018 (in thousands):

	Capital Leases	Operating Leases
Year ending December 31:		
2019	$ 53	$ 1,325
2020	51	205
2021	51	—
2022	4	—
Total minimum lease payments	159	$ 1,530
Less: amount representing interest	(12)	
Present value of capital lease obligation	147	
Less: current portion	(47)	
Non-current portion	$100	

Litigation

The Company is not aware of any asserted or unasserted claims against it where it believes that an unfavorable resolution would have an adverse material impact on the operations or financial position of the Company.

9. Capital Stock

Convertible Preferred Stock

The classes of preferred stock the Company was authorized to issue, and the amounts issued and outstanding as of December 31, 2017 and 2018 were as follows:

		December 31, 2017		December 31, 2018	
	Par Value	Authorized	Issued & Outstanding	Authorized	Issued & Outstanding
Series A	$0.0001	32,133,287	5,305,513	32,133,287	5,305,513
Series B	$0.0001	18,550,000	3,001,421	18,008,749	3,001,421
Series C1	$0.0001	—	—	54,189,549	5,007,134
Series C2	$0.0001	—	—	23,605,150	3,934,191

9. Capital Stock (Continued)

The rights, preferences, privileges and restrictions relating to Series A, Series B, Series C1 and Series C2 (together, the Series Preferred) are as set forth below:

Dividends

The holders of the Series Preferred are entitled to receive non-cumulative dividends prior to and in preference to any declaration or payment of dividends on common stock. In the event dividends are paid on any share of common stock, the Company will also pay a dividend on all outstanding shares of preferred stock in a per share amount equal to the amount paid or set aside for each share of common stock, on an as if converted to common stock basis. No dividends have been declared or paid as of December 31, 2018.

Voting

The holders of the Series Preferred are entitled to voting rights equal to the number of shares of common stock into which each share of preferred stock could be converted, except that Series C2 is not entitled to vote on the election of directors at any time.

The holders of Class A common stock, voting as a separate class, are entitled to elect three members of the Board of Directors. The remaining members of the Company's board of directors will be elected by the holders of the Series Preferred, except Series C2, and Class A common stock, voting together as a single class and on an as-converted basis.

Liquidation

In the event of any liquidation, dissolution or winding up of the Company, either voluntary or involuntary, the holders of the Series Preferred are entitled to be paid, out of the available funds and assets, and prior and in preference to any payment or distribution of any such funds on any shares of common stock, an amount per share equal to the original issue price for the Series Preferred, plus all accrued and declared but unpaid dividends. The original per share issue price is equal to $11.10 for Series A, $11.661 for Series B and $13.98 for Series C1 and Series C2. If assets are insufficient to permit such payment, payment will be distributed ratably among the holders of outstanding preferred stock in proportion to the amount owned by each holder. After the liquidation preference of the holders of the Series Preferred has been satisfied, the remaining assets of the Company will be distributed ratably among the holders of outstanding common stock in proportion to the amount owned by each holder.

Conversion

Each share of Series Preferred is convertible into shares of Class A common stock, at the option of the holder, at any time after the date of issuance, except that Series C2 is convertible into shares of Class B common stock. Each share of Series Preferred automatically converts into the number of shares of common stock determined in accordance with the conversion rate upon the earlier of (i) the date specified by election of the holders of a majority of the shares of Series Preferred or (ii) the closing of a public offering of common stock resulting in aggregate gross proceeds of at least $75,000,000 and having a price per share to the public of at least $17.475 adjusted for splits, recapitalizations and the like. At December 31, 2018, the conversion price for each share of Series A is $11.10, Series B is $11.661 and Series C1 and Series C2 is $13.98.

9. Capital Stock (Continued)

The Company recorded all convertible preferred stock issuances at fair value on the dates of issuance. The Company classifies the convertible preferred stock outside of stockholders' deficit in temporary equity because the shares contain contingent liquidation features that are not solely within its control. During the years ended December 31, 2017 and 2018, the Company did not adjust the carrying values of the convertible preferred stock to the deemed redemption values of such shares since a liquidation event was not probable. Subsequent adjustments to increase the carrying values to the ultimate redemption values will be made only when it becomes probable that such a liquidation event will occur.

Redemption

The Series Preferred is not redeemable at the option of the holder.

Protective Provisions

The holders of Series Preferred have certain protective provisions. As long as at least 2,083,333 shares of Series Preferred remain outstanding, the Company cannot, without the approval of at least two-thirds of the holders of Series Preferred, take any action that (i) adversely changes the rights, preferences or privileges of Series Preferred; (ii) increases or decreases the authorized number of shares of preferred stock; (iii) creates or authorizes any capital stock having the rights, preferences or privileges senior or on a parity with preferred stock; (iv) results in redemption, repurchase, payment or declaration of dividends or other distributions with respect to shares of preferred stock or common stock other than permitted repurchases and dividends; (v) consummates a liquidation, dissolution or winding up of the Company; (vi) increases or decreases the authorized members of the Company's board of directors; (vii) sells, assigns, licenses, pledges or encumbers the intellectual property of the Company; or (viii) enters into any inbound license or acquisition by merger or asset transfer or similar corporate strategic relationship, in each case involving the Company's assets having a value (as determined by the Company's board of directors in good faith) greater than $500,000.

As long as at least 750,000 Series B remain outstanding, the Company cannot, without the approval of at least two-thirds of the holders of Series B, take any action that (i) adversely changes the rights, preferences or privileges of Series B; or (ii) increases or decreases the authorized number of shares of Series B.

As long as at least 1,666,666 Series C1 and Series C2 remain outstanding, the Company cannot, without the approval of at least two-thirds of the holders of Series C1 and Series C2, take any action that (i) adversely changes the rights, preferences or privileges of Series C1 and Series C2; or (ii) increases or decreases the authorized number of shares of Series C1 and Series C2.

Classification of Convertible Preferred Stock

The deemed liquidation preference provisions of the convertible preferred stock are considered contingent redemption provisions that are not solely within the Company's control. Accordingly, the convertible preferred stock has been presented outside of permanent equity in the mezzanine section of the consolidated balance sheets.

9. Capital Stock (Continued)

Convertible Preferred Stock Warrants

In connection with the issuance of Series A in August 2015, the Company issued warrants to purchase an aggregate of 49,997 shares of Series A at $14.46 per share. The warrants were immediately exercisable and expire, if not exercised, in August 2022. At issuance, the fair value of the warrants was determined to be $382,765 using the Black-Scholes pricing model and was recorded as a Series A issuance cost and a preferred stock warrant liability (Note 2). The liability was valued using the following assumptions at issuance: expected life of 7 years, fair value of Series A of $11.10 per share, risk-free interest rate of 1.79%, volatility of 80% and no expected dividends. At December 31, 2018, the warrants remain outstanding.

Class A and Class B Common Stock

In connection with the issuance of Series C1 and C2 in 2018, the Company authorized two classes of common stock, Class A and Class B common stock. Each holder of Class A common stock and Class B common stock is entitled to one vote per share, except that Class B common stock is not entitled to vote on the election of directors at any time. The holders of Class A common stock, voting as a separate class, are entitled to elect three members of the Company's board of directors. All shares of common stock outstanding as of the authorization of two classes of common stock in September 2018 became shares of Class A common stock. As of December 31, 2018, the Company is authorized to issue 191,398,492 shares of Class A common stock and 23,605,150 of Class B common stock with a par value of $0.0001 per share. As of December 31, 2018, the Company had 2,119,872 shares issued of Class A common stock outstanding. As of December 31, 2017, the Company was authorized to issue 77,520,000 shares of single class common stock with a par value of $0.0001 per share. As of December 31, 2017, the Company had 2,092,040 shares single class common stock outstanding.

In June 2012, the Company issued 118,534 shares of common stock to a founder of the Company through the 2010 Equity Incentive Plan (Note 10). The founder entered into a restricted stock purchase agreement with the Company, which allows the Company to repurchase the shares of common stock from the founder at the original issuance price if the founder ceases providing services to the Company. The Company's right to repurchase the stock lapses over 48 months. At December 31, 2018 and 2017, all shares of common stock were vested and no longer subject to repurchase.

The Company has also allowed certain option holders to exercise unvested options to purchase shares of common stock. Shares received from such early exercises are subject to a right of repurchase at the issuance price. The Company's repurchase right lapses over the same period the options vest. In June 2017, the Company repurchased 17,026 unvested shares at $0.42 per share from a terminated option holder. At December 31, 2018, 658 shares at a weighted-average price of $0.66 per share were subject to repurchase. At December 31, 2018, the proceeds received for unvested shares of common stock subject to repurchase of $435 were recorded within accrued expenses. There were no shares subject to repurchase at December 31, 2017.

Common Stock Warrant

In connection with the issuance of Series A in August 2015, the Company issued a warrant to purchase an aggregate of 62,936 shares of common stock at $0.0006 per share. The warrant was

9. Capital Stock (Continued)

immediately exercisable and expires, if not exercised, in August 2025. At issuance, the fair value of the warrant was determined to be $41,509, which was recorded as a Series A issuance cost and additional paid-in capital. At December 31, 2018, the warrant remains outstanding.

10. Stock Option Plan

In September 2010, the Company adopted the 2010 Equity Incentive Plan (the Plan) under which 3,540,114 shares of the Company's common stock have been reserved for issuance to employees, directors and consultants.

Under the Plan, the Company's board of directors may grant incentive stock options or non-statutory stock options. Incentive stock options may only be granted to Company employees. The exercise price of incentive stock options and non-statutory stock options will be no less than 100% of the fair value per share of the Company's common stock on the grant date. If an individual owns capital stock representing more than 10% of the outstanding shares, the price of each share will be at 110% of the fair value. Fair value is determined by the Company's board of directors. Options expire after ten years (five years for stockholders owning greater than 10% of all classes of stock). The Company's board of directors determines the period over which options vest and become exercisable. The Company has a repurchase option exercisable upon the voluntary or involuntary termination of the purchaser's employment with the Company for any reason. 3,108,393 shares of the Company's common stock are reserved for future issuance under the Plan as of December 31, 2018.

The Company recognized $409,000 and $1.4 million of stock-based compensation expense related to options granted to employees and non-employees in 2017 and 2018, respectively. The compensation expense is allocated on a departmental basis, based on the classification of the option holder as follows (in thousands):

	Year Ended December 31,	
	2017	2018
Research and development	$272	$ 631
General and administrative	137	788
	$409	$1,419

No income tax benefits have been recognized in the statements of operations for stock-based compensation arrangements and no stock-based compensation costs have been capitalized as property and equipment as of December 31, 2018 (in thousands, except share and per share data).

10. Stock Option Plan (Continued)

Stock option activity under the Plan is as follows:

	Options Outstanding			
	Number of Shares	Weighted-Average Exercise Price	Weighted-Average Remaining Contractual Life (Years)	Aggregate Intrinsic Value
Balances, December 31, 2016	469,358	$3.72	8.7	$ 432
Granted	115,662	4.74		
Exercised	(9,632)	1.68		
Cancelled	(8,069)	4.56		
Balances, December 31, 2017	567,319	3.96	8.1	$ 694
Granted	1,609,086	6.66		
Exercised	(27,832)	1.68		
Cancelled	(12,282)	4.92		
Balances, December 31, 2018	2,136,291	$6.06	8.9	$12,881
Vested and expected to vest at December 31, 2018	2,136,291	$6.06	8.9	$12,881
Exerciseable at December 31, 2018	1,592,838	$4.86	8.6	$11,489
Vested at December 31, 2018	468,329	$4.32	7.4	$ 3,633

Additional information regarding the Company's stock options outstanding and vested and exercisable as of December 31, 2018 is summarized below:

	Options Outstanding			Options Exercisable	
Exercise Prices	Number of Stock Options Outstanding	Weighted-Average Remaining Contractual Life (Years)	Weighted-Average Exercise Price per Share	Shares Subject to Stock Options	Weighted-Average Exercise Price per Share
Up to $0.66	68,200	4.3	$ 0.24	68,032	$ 0.24
$4.56—5.16	1,563,295	8.8	$ 4.98	1,508,039	$ 4.98
$10.02—$10.02	504,796	9.8	$10.02	16,767	$10.02
	2,136,291	8.9	$ 6.06	1,592,838	$ 4.86

The weighted-average grant date fair value of options granted to employees and non-employees in 2017 and 2018 was $3.48 per share and $5.16 per share, repectively. The fair value of each

10. Stock Option Plan (Continued)

option is estimated on the date of grant using the Black-Scholes option pricing model, assuming no expected dividends and the following weighted average assumptions:

	Year Ended December 31,	
	2017	2018
Expected life (in years)	7.06	6.01
Volatility	82.8%	78.3%
Risk-free interest rate	2.17%	2.88%

Expected volatility is based on volatilities of public companies operating in the Company's industry. The expected life of the options is estimated using the simplified method detailed in SEC Staff Accounting Bulletin No. 107. The simplified method calculates the expected term as the mid-point between the weighted-average time to vesting and the contractual maturity. The risk-free rate is based on the U.S. Treasury yield curve in effect at the time of grant. The Company has elected to account for forfeitures as they occur, rather than estimate expected forfeitures.

Unrecognized estimated compensation expense totaled $7.8 million related to non-vested stock options with a remaining requisite service period of 3.4 years.

11. Income Taxes

The Company applies the provisions set forth in FASB ASC Topic 740, *Income Taxes*, to account for the uncertainty in income taxes. In the preparation of income tax returns in federal, foreign and state jurisdictions, the Company asserts certain income tax positions based on its understanding and interpretation of income tax laws. The taxing authorities may challenge such positions, and the resolution of such matters could result in recognition of income tax expense in the Company's consolidated financial statements. Management believes it has used reasonable judgments and conclusions in the preparation of its income tax returns.

The Company uses the ''more likely than not'' criterion for recognizing the income tax benefit of uncertain income tax positions and establishing measurement criteria for income tax benefits. The Company has evaluated the impact of these positions and has reserved an unrecognized tax benefit of $915,000 and $1.4 million as of December 31, 2017 and 2018, respectively. The increase in the unrecognized tax benefit in 2018 is primarily additions based on tax positions related to 2018. In the event the Company should need to recognize interest and penalties related to unrecognized income tax liabilities, this amount will be recorded as an accrued liability and an increase to income tax expense. No amounts of interest or penalties were recognized in the Company's consolidated financial statements for 2017 or 2018. The Company is not currently under examination by income tax authorities in federal, state or other foreign jurisdictions. The Company does not anticipate any significant changes within 12 months of this reporting date of its uncertain tax positions.

11. Income Taxes (Continued)

A reconciliation of the federal statutory income tax rate and the Company's effective income tax rate is as follows:

	December 31,	
	2017	2018
Tax computed at federal statutory rate	34.0%	21.0%
State income taxes, net of federal benefit	—	—
Other	(2.1)%	0.8%
Tax reform rate change	(24.8)%	0.4%
Change in valuation allowance	(7.1)%	(22.2)%
Effective income tax rate	0.0%	0.0%

Deferred income taxes result from the tax effect of transactions that are recognized in different periods for financial statement and income tax reporting purposes, as well as operating loss and tax credit carryforwards. Significant components of the Company's deferred income tax assets and liabilities are as follows (in thousands):

	December 31,	
	2017	2018
Deferred tax assets:		
Net operating loss carryforward	$ 10,987	$ 18,636
Tax credits	2,530	4,121
Intangibles	1,785	1,554
Other	160	366
Total deferred tax assets	15,462	24,677
Deferred tax liabilities:		
Fixed assets	96	133
Total deferred tax liabilities	96	133
Valuation allowance	(15,366)	(24,544)
Total	$ —	$ —

The net increase in the valuation allowance was $2.6 million and $9.2 million in 2017 and 2018, respectively.

At December 31, 2018, the Company has federal and state net operating loss carryforwards of $46.5 million and $14.9 million, respectively, which begin to expire in 2030 and $36.8 million of federal net operating loss carryforwards which do not expire but are subject to the 80% taxable income limitation. Additionally, the Company had federal tax credits totaling $1.9 million and $3.2 million at December 31, 2017 and 2018, respectively, and state tax credits totaling $1.8 million and $2.9 million, at December 31, 2017 and 2018, respectively. The federal tax credits begin to expire in 2032. The state tax credits may be carried forward indefinitely.

11. Income Taxes (Continued)

Section 382 of the Internal Revenue Code of 1986, as amended (the Code), limits the use of net operating losses and income tax credit carryforwards in certain situations where changes occur in stock ownership of a company. If the Company should have an ownership change of more than 50% of the value of the Company's capital stock, utilization of the carryforwards could be restricted.

The Company files income tax returns in the U.S. federal jurisdiction, various state jurisdictions and Singapore. The U.S. federal and state tax years from 2010 to 2018 remain open to examination due to the carryover of unused net operating loss carryforwards and tax credits.

In December 2017, the 2017 Tax Cuts and Jobs Act (2017 Tax Act) was enacted and includes a broad range of provisions, many of which differ significantly from those contained in previous U.S. tax law. Changes in tax law are accounted for in the period of enactment. As such, the Company's financial statements as of December 31, 2017 reflect the impact of this 2017 Tax Act, which primarily consisted of measuring the Company's deferred tax assets and valuation allowance using the newly enacted U.S. corporate tax rate. As a result, at December 31, 2017, the Company recognized a tax expense of $6.8 million from revaluing U.S net deferred tax assets which was offset by a corresponding change in the Company's valuation allowance.

In January 2018, the FASB released guidance on the accounting for tax on the global intangible low-taxed income (GILTI) provisions of the 2017 Tax Act. The GILTI provisions subject certain U.S. entities to current tax on GILTI earned by certain foreign subsidiaries. The Company has considered these new provisions as they are effective for tax years starting after December 31, 2017 and determined that none will likely apply for the year ended December 31, 2018.

12. 401(k) Plan

The Company has a 401(k) plan that qualifies as a deferred compensation arrangement under Section 401 of the Code. Eligible employees may elect to defer a portion of their pretax earnings subject to certain statutory limits. The Company has not made any matching contributions to date.

13. Related Party Transactions

The Company recorded other income of $1.0 million and $892,000 under service contracts with a stockholder of the Company in 2017 and 2018, respectively. The Company had a receivable from the stockholder at December 31, 2017 and 2018 of $7,000 and $89,000, respectively.

The Company paid intellectual property related legal fees of $487,000 and $1.1 million in 2017 and 2018, respectively, to a related party. The Company owed $70,000 and $134,000 to the related party at December 31, 2017 and 2018, respectively.

The Company paid legal fees of $407,000 and $541,000 in 2017 and 2018, respectively, to a related party. The Company owed $79,000 and $40,000 to the related party at December 31, 2017 and 2018, respectively.

The Company recorded research and development expense of $400,000 and $400,000 under consulting agreements with two members of the Company's board of directors in 2017 and 2018, respectively.

14. Subsequent Events

Subsequent events have been evaluated through the date referenced in the independent auditors' report.

In January 2019, the Company entered into a commercial lease agreement for an additional 33,000 square feet of office space. The 36-month lease commences March 1, 2019. The initial base rent is approximately $181,000 per month and the total minimum rental commitment under this lease is approximately $6.7 million.

Atreca, Inc.
Condensed Consolidated Balance Sheets
(in thousands, except share and per share data)

	December 31, 2018	March 31, 2019 (Unaudited)	Pro Forma March 31, 2019 (Unaudited)
ASSETS			
Current Assets			
Cash and cash equivalents	$ 114,504	$ 26,319	
Investments	—	74,342	
Prepaid expenses and other current assets	2,721	3,291	
Total current assets	117,225	103,952	
Property and equipment, net	4,143	3,906	
Deposits and other	316	1,268	
Total assets	$ 121,684	$ 109,126	
LIABILITIES AND STOCKHOLDERS' EQUITY			
Current Liabilities			
Accounts payable	$ 1,307	$ 2,099	$ 2,099
Accrued expenses	3,008	2,162	2,162
Other current liabilities	200	425	425
Capital lease obligations, current portion	47	47	47
Total current liabilities	4,562	4,733	4,733
Capital lease obligations, net of current portion	100	88	88
Deferred rent	6	2	2
Preferred stock warrant liability	380	430	—
Total liabilities	5,048	5,253	4,823
Commitments and contingencies (Note 8)			
Series A convertible preferred stock, $0.0001 par value, 32,133,287 shares authorized; 5,305,513 shares issued and outstanding (aggregate liquidation preference of $58,892), no shares issued and outstanding, pro forma (unaudited)	55,030	55,030	—
Series B convertible preferred stock, $0.0001 par value, 18,008,749 shares authorized; 3,001,421 shares issued and outstanding (aggregate liquidation preference of $35,000), no shares issued and outstanding, pro forma (unaudited)	34,333	34,333	—
Series C1 convertible preferred stock, $0.0001 par value, 54,184,549 shares authorized; 5,007,134 shares issued and outstanding (aggregate liquidation preference of $70,000), no shares issued and outstanding, pro forma (unaudited)	65,691	65,691	—
Series C2 convertible preferred stock, $0.0001 par value, 23,605,150 shares authorized; 3,934,191 shares issued and outstanding (aggregate liquidation preference of $55,000), no shares issued and outstanding, pro forma (unaudited)	54,615	54,615	—
Stockholders' equity			
Class A common stock, $0.0001 par value, 191,398,492 shares authorized; 2,119,872 and 2,123,257 shares issued and outstanding at December 31, 2018 and March 31, 2019 (unaudited), respectively; 15,437,325 shares issued and outstanding, pro forma (unaudited)	—	—	2
Class B common stock, $0.0001 par value, 23,605,150 shares authorized; none issued and outstanding; 3,934,191 shares issued and outstanding, pro forma (unaudited)	—	—	—
Additional paid-in capital	3,593	4,382	214,479
Accumulated other comprehensive loss	(4)	23	23
Accumulated deficit	(96,622)	(110,201)	(110,201)
Total stockholders' equity	(93,032)	(105,795)	104,303
Total liabilities and stockholders' equity	$ 121,684	$ 109,126	$ 109,126

Atreca, Inc.
Condensed Consolidated Statements of Operations
(in thousands, except share and per share data)
(unaudited)

	Three Months Ended March 31,	
	2018	2019
Operating Expenses		
Research and development	$ 6,643	$ 11,713
General and administrative	1,300	2,518
Total operating expenses	7,943	14,231
Operating loss	(7,943)	(14,231)
Interest and other income (expense)		
Other income	213	165
Interest income	56	545
Interest expense	(2)	(2)
Preferred stock warrant liability revaluation	20	(50)
Loss on disposal of property and equipment	—	(5)
Loss before income tax expense	(7,656)	(13,578)
Income tax expense	—	(1)
Net loss	$ (7,656)	$ (13,579)
Net loss per share, basic and diluted	$ (3.66)	$ (6.40)
Weighted-average shares used in computing net loss per share, basic and diluted	2,093,413	2,120,925
Pro forma net loss per shares, basic and diluted (unaudited)		$ (0.70)
Weighted-average shares used in computing pro forma net loss per share, basic and diluted (unaudited)		19,369,275

Atreca, Inc.
Condensed Consolidated Statements of Comprehensive Loss
(in thousands)
(unaudited)

	Three Months Ended March 31,	
	2018	2019
Net loss	$(7,656)	$(13,579)
Other comprehensive income (loss);		
Unrealized gain on fair value of investments	5	28
Unrealized loss on currency translation	(7)	(1)
Comprehensive loss	$(7,658)	$(13,552)

Atreca, Inc.
Condensed Consolidated Statements of Convertible Preferred Stock and Stockholders' Deficit
(in thousands, except share data)
(unaudited)

	Convertible Preferred Stock		Common Stock		Additional Paid-In Capital	Accumulated Other Comprehensive Loss	Accumulated Deficit	Total Stockholders' Equity
	Shares	Amount	Shares	Amount				
Balances at December 31, 2017	8,306,934	$ 89,362	2,092,040	$ 1	$ 2,129	$ (14)	$ (58,682)	$ (56,566)
Issuance of common stock upon exercise of options	—	—	1,433	—	—	—	—	—
Stock-based compensation	—	—	—	—	113	—	—	113
Unrealized gain on fair value of investments	—	—	—	—	—	5	—	5
Unrealized currency exchange loss	—	—	—	—	—	(7)	—	(7)
Net loss	—	—	—	—	—	—	(7,656)	(7,656)
Balances at March 31, 2018	8,306,934	$ 89,362	2,093,473	$ 1	$ 2,242	$ (16)	$ (66,338)	$ (64,111)
Balances at December 31, 2018	17,248,259	$ 209,668	2,119,872	$ 1	$ 3,593	$ (4)	$ (96,622)	$ (93,032)
Issuance of common stock upon exercise of options	—	—	3,385	—	13	—	—	13
Stock-based compensation	—	—	—	—	776	—	—	776
Unrealized gain on fair value of investments	—	—	—	—	—	28	—	28
Unrealized currency exchange loss	—	—	—	—	—	(1)	—	(1)
Net loss	—	—	—	—	—	—	(13,579)	(13,579)
Balances at March 31, 2019	17,248,259	$ 209,668	2,123,257	$ 1	$ 4,382	$ 23	$ (110,201)	$ (105,795)

Atreca, Inc.
Condensed Consolidated Statements of Cash Flows
(in thousands)
(unaudited)

	Three Months Ended March 31,	
	2018	2019
Cash Flows from Operating Activities		
Net loss	$(7,656)	$ (13,579)
Adjustments to reconcile net loss to net cash used in operating activities:		
Depreciation and amortization	326	397
Loss on disposal of property and equipment	—	5
Stock-based compensation	113	776
Preferred stock warrant liability revaluation	(20)	50
Changes in operating assets and liabilities:		
Prepaid expenses and other current assets	(122)	(562)
Accounts payable	249	716
Accrued expenses	(1,013)	(993)
Other current liabilities	—	225
Deferred rent	26	(12)
Net cash used in operating activities	(8,097)	(12,977)
Cash Flows from Investing Activities		
Purchase of property and equipment	(152)	(166)
Purchase of investments	—	(74,314)
Proceeds from maturities of investments	7,445	—
Change in deposits	1	52
Net cash provided by (used in) investing activities	7,294	(74,428)
Cash Flows from Financing Activities		
Proceeds from exercise of stock options	—	13
Principal payments on capital lease obligations	(12)	(12)
Payments of deferred offering costs	—	(57)
Net cash used in financing activities	(12)	(56)
Net change in cash, cash equivalents and restricted cash	(815)	(87,461)
Cash, cash equivalents and restricted cash, beginning of period	8,242	114,504
Cash, cash equivalents and restricted cash, end of period	$ 7,427	$ 27,043
Supplemental Disclosure of Cash Flow Information		
Cash paid for interest	$ 2	$ 2
Cash paid for income taxes	$ —	$ 1
Supplemental Schedule of Non-Cash Investing and Financing Activities		
Deferred offering costs included in accounts payable and accrued expenses	$ —	$ 223

Notes to Unaudited Interim Condensed Consolidated Financial Statements

1. Nature of Business and Management's Plans Regarding Financing of Future Operations

Nature of Business

Atreca, Inc. (the Company) was incorporated in the State of Delaware on June 11, 2010 (inception date), and is located in Redwood City, California. In April 2016, the Company formed a wholly owned subsidiary, Atreca Pte. Ltd., in Singapore. The Company is a biopharmaceutical company utilizing its differentiated platform to discover and develop novel antibody-based immunotherapeutics to treat a range of solid tumor types. The Company's lead product candidate, ATRC-101, is a monoclonal antibody in preclinical development with a novel mechanism of action and target derived from an antibody identified using its discovery platform. The Company operates in a single segment. Since inception, the Company has been primarily engaged in research and development, raising capital, building its management team and building its intellectual property portfolio.

Liquidity

Management evaluates whether there are relevant conditions and events that in the aggregate raise substantial doubt about the entity's ability to continue as a going concern and to meet its obligations as they become due within one year from the date that the financial statements are issued.

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 and the ability to secure additional capital to fund operations. Identification and development of product candidates 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

Principles of Consolidation

The condensed consolidated financial statements include accounts of the Company and its wholly owned subsidiary. All significant intercompany accounts and transactions are eliminated upon consolidation.

Use of Estimates

The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, disclosure of contingent assets and liabilities, and reported amounts of income and expenses in the consolidated financial statements and accompanying notes. Actual results could differ from those estimates. Key estimates in the consolidated financial statements include estimated useful lives of property and equipment, impairment of long-lived assets, accrued expenses, valuation of deferred income tax assets, fair value of warrants issued to purchasers of shares of preferred stock and common stock and fair value of options granted under the Company's stock option plan.

2. Summary of Significant Accounting Policies (Continued)

Unaudited Interim Condensed Financial Statements

The accompanying condensed consolidated financial statements are unaudited. The unaudited interim condensed financial statements have been prepared on the same basis as the annual consolidated financial statements and reflect, in the opinion of management, all adjustments of a normal and recurring nature that are necessary for the fair statement of the Company's financial position as of March 31, 2019 and its results of operations and cash flows for the three months ended March 31, 2018 and 2019. The financial data and the other financial information contained in these notes to the condensed consolidated financial statements related to the three-month periods are also unaudited. The condensed results of operations for the three months ended March 31, 2019 are not necessarily indicative of the results to be expected for the year ending December 31, 2019 or for any other future annual or interim period. The condensed consolidated balance sheet as of December 31, 2018 included herein was derived from the audited consolidated financial statements as of that date. These interim condensed financial statements should be read in conjunction with the Company's audited consolidated financial statements included elsewhere in this prospectus.

Other Income

Other income is comprised of amounts earned from services performed under service agreements. Beginning January 1, 2018, the Company follows the provisions of Accounting Standards Update 2014-09 Accounting Standards Codification (ASC) Topic 606, *Revenue from Contracts with Customers (Topic 606).* The guidance provides a unified model to determine how income is recognized.

In determining the appropriate amount of other income to be recognized as it fulfills its obligations under the agreements, the Company performs the following steps: (i) identifies the promised goods or services in the contract; (ii) determines whether the promised goods or services are performance obligations including whether they are distinct in the context of the contract; (iii) measures the transaction price, including the constraint on variable consideration; (iv) allocates the transaction price to the performance obligations based on estimated selling prices; and (v) recognizes other income when (or as) the Company satisfies each performance obligation.

Upon adoption of Topic 606, there was no change to the units of accounting previously identified with respect to existing service agreements under legacy Generally Accepted Accounting Principles (GAAP), which are now considered performance obligations under Topic 606, and there was no change to the revenue recognition pattern for the performance obligations. Accordingly, the adoption of the new standard resulted in no cumulative effect change to the Company's opening accumulated deficit balance.

The Company generally allocates the transaction price to distinct performance obligations at their stand-alone selling prices, determined by their estimated costs plus some margin. Performance obligations are generally delivered over time and recognized based upon observable inputs as the related research services are performed, which are recorded as research and development expenses. Amounts due under service agreements are generally billed monthly as services are delivered and do not generally result in contract liabilities or assets. Receivables under service agreements of $282,000 and $361,000 are included in prepaid expenses and other current assets as of December 31, 2018 and March 31, 2019, respectively. Contract liabilities of $200,000 and

2. Summary of Significant Accounting Policies (Continued)

$425,000 are included in other current liabilities as of December 31, 2018 and March 31, 2019, respectively.

Collaboration and Service Arrangements

In March 2016, the Company entered into a research collaboration agreement with Genome Institute of Singapore (GIS) for the development of a high-throughput microfluidic droplet system for single cell phenotyping and genotyping. Under the agreement, the Company contributes reimbursement of research expenses and certain reagents and other consumables to GIS. The Company accounts for the collaboration agreement with GIS in accordance with ASC 808—*Collaborative Arrangements*. The Company recognized $19,000 and $36,000 of research and development expenses for the three months ended March 31, 2018 and 2019, respectively, under the collaboration agreement, including wind-down costs. The Company exercised its right to early terminate the collaboration agreement in December 2018.

The Company provides antibody sequencing and related repertoire analysis services to the Bill and Melinda Gates Foundation under a services agreement entered into in February 2013. Generally, services are billed as they are delivered, and service revenue is recognized in other income in accordance with Topic 606.

In December 2018, the Company entered into a service agreement with Bristol-Myers Squibb to provide antibody sequencing and related repertoire analysis services. As of March 31, 2019, services provided under the agreement were not material. Service revenue will be recognized in other income in accordance with Topic 606.

Unaudited Pro Forma Financial Information

The unaudited pro forma balance sheet information as of March 31, 2019, assumes the conversion of all outstanding shares of convertible preferred stock into 17,248,259 shares of the Company's common stock immediately prior to completion of the Company's planned initial public offering (IPO). Shares of common stock issued in the IPO and any related net proceeds are excluded from the pro forma information.

Unaudited pro forma net loss per share is computed using the weighted-average number of common shares outstanding after giving effect to the conversion of all convertible preferred stock into shares of common stock, as if such conversion had occurred at the beginning of the period presented, or the date of original issuance, if later. The conversion of convertible preferred stock has been reflected assuming shares of convertible preferred stock convert into shares of fully paid common stock at the applicable conversion ratios.

Cash, Cash Equivalents and Restricted Cash

Cash and cash equivalents include all cash balances and highly liquid investments purchased with an original maturity of three months or less.

The Company maintained restricted cash of zero and $724,000 as of December 31, 2018 and March 31, 2019, respectively. This amount as of March 31, 2019 is included in deposits and other in the accompanying condensed consolidated balance sheets and is comprised solely of a letter of

2. Summary of Significant Accounting Policies (Continued)

credit required pursuant a lease for Company facilities entered into in January 2019 as discussed in Note 8.

The following table provides a reconciliation of cash, cash equivalents and restricted cash reported within the condensed consolidated balance sheets that sum to the total of the same amounts shown in the condensed consolidated statements of cash flows.

	December 31, 2018	March 31, 2019
Cash and cash equivalents	$ 114,504	$26,319
Restricted cash	—	724
Cash, cash equivalents and restricted cash shown in the condensed consolidated statements of cash flows	$ 114,504	$27,043

Investments

The Company considers securities purchased with original maturities greater than three months to be investments. The Company's policy is to protect the value of its investment portfolio and minimize principal risk by earning returns based on current interest rates. The Company's intent is to convert all investments into cash to be used for operations and has classified them as available for sale. For purposes of determining realized gains and losses, the cost of securities sold is based on specific identification. There were no realized gains or losses on investments through March 31, 2019. Net unrealized holding losses on investments, which are included in accumulated other comprehensive loss, were $0 and $28,000 at December 31, 2018 and March 31, 2019, respectively. The Company's investments at March 31, 2019 consisted primarily of U.S. Treasury securities that are reported at fair value based on quoted prices in active markets.

Risks and Uncertainties

The Company is subject to a number of risks associated with companies at a similar stage, including dependence on key individuals, competition from similar services and larger companies, volatility of the industry, ability to obtain regulatory clearance, ability to obtain adequate financing to support growth, the ability to attract and retain additional qualified personnel to manage the anticipated growth of the Company and general economic conditions.

Concentration of Credit Risk

Financial instruments that potentially subject the Company to concentration of credit risk consist of cash, cash equivalents, investments and other receivables. Cash and cash equivalents are held at one financial institution and were in excess of the Federal Deposit Insurance Corporation insurable limit at December 31, 2018 and March 31, 2019. Additionally, cash and cash equivalents and investments are maintained at a brokerage firm for which amounts are insured by the Securities Investor Protection Corporation subject to legal limits. The Company has not experienced any losses on its deposits to date.

The Company does not require collateral or other security for other receivables; however, credit risk is mitigated by the Company's ongoing evaluations of its debtors' credit worthiness.

2. Summary of Significant Accounting Policies (Continued)

Property and Equipment

Property and equipment are stated at cost less depreciation. Depreciation is computed using the straight-line method with the estimated useful lives of the assets ranging from two to five years. Leasehold improvements are amortized over the estimated useful life of the asset, or the remaining lease term, whichever is shorter. Expenditures for repairs and maintenance, which do not extend the useful life of the property and equipment, are expensed as incurred.

Accounting for Impairment of Long-Lived Assets

Long-lived assets consist of property and equipment. The Company reviews its long-lived assets for impairment whenever events or changes in circumstances indicate the carrying amount of an asset may not be recoverable. Recoverability of assets held and used is measured by comparison of the carrying amount of an asset to future net cash flows expected to be generated by the asset. If such assets are considered to be impaired, the impairment to be recognized is measured by the amount by which the carrying amount of the assets exceeds the fair value of the assets. The Company has not recorded any impairment of long-lived assets for the three months ended March 31, 2018 or 2019.

Intellectual Property

The legal and professional costs incurred by the Company to maintain its patent rights have been expensed as part of research and development costs since inception. As of December 31, 2018, and March 31, 2019, the Company has determined that these expenses have not met the criteria to be capitalized. Intellectual property-related expenses for the three months ended March 31, 2018 and 2019 were $296,000 and $464,000, respectively.

Deferred Rent

The Company has entered into lease agreements for its laboratory and office facilities. These leases qualify as and are accounted for as operating leases. Rent expense is recognized on a straight-line basis over the term of the lease and, accordingly, the Company records the difference between cash rent payments and the recognition of rent expense as a deferred rent liability.

Research and Development Costs

Research and development costs are expensed as incurred. Research and development costs consist primarily of salaries and benefits, consultant fees, stock-based compensation, certain facility costs, legal costs and other costs associated with preclinical development.

A substantial portion of the Company's ongoing research and development activities are conducted by third-party service providers in connection with preclinical development activities and contract manufacturing organizations in connection with the production of materials for clinical trials. At the end of the reporting period, the Company compares payments made to third-party service providers to the estimated progress toward completion of the research or development objectives. Such estimates are subject to change as additional information becomes available. Depending on the timing of payments to the service providers and the progress that the Company estimates has been made as a result of the service provided, the Company may record net prepaid or accrued expense relating to these costs.

2. Summary of Significant Accounting Policies (Continued)

Stock-Based Compensation

The Company generally grants stock options to its employees for a fixed number of shares with an exercise price equal to the fair value of the underlying shares at the date of grant. The Company accounts for stock option grants using the fair value method. The fair value of options is calculated using the Black-Scholes option pricing model. Stock-based compensation is recognized as the underlying options vest using the straight-line attribution approach, and forfeitures are recorded as they occur.

Beginning January 1, 2018, the Company follows the provisions of ASU 2018-07, *Improvements to Nonemployee Share-Based Payment Accounting* (Topic 718). The standard expands the scope of Topic 718 to include share-based payment transactions for acquiring goods and services from nonemployees. Consequently, the accounting for share-based payments to nonemployees and employees is substantially aligned.

Preferred Stock Warrant Liability

The Company accounts for outstanding warrants to purchase shares of the Company's convertible preferred stock in accordance with Financial Accounting Standards Board (FASB) ASC Topic 480, *Distinguishing Liabilities from Equity* (ASC Topic 480). Under ASC Topic 480, freestanding warrants for shares that are contingently redeemable are classified as liabilities on the consolidated balance sheets and are measured at their inception date fair value and subsequently re-measured to fair value at each reporting period.

Fair Value of Financial Instruments:

The Company uses a three-level hierarchy, which prioritizes, within the measurement of fair value, the use of market-based information over entity-specific information for fair value measurements based on the nature of inputs used in the valuation of an asset or liability as of the measurement date. Fair value focuses on an exit price and is defined as the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. The inputs or methodology used for valuing financial instruments are not necessarily an indication of the risk associated with those financial instruments.

The three-level hierarchy for fair value measurements is defined as follows:

Level 1: Inputs to the valuation methodology are quoted prices (unadjusted) for identical assets or liabilities in active markets.

Level 2: Inputs to the valuation methodology include quoted prices for similar assets and liabilities in active markets, and inputs that are observable for the asset or liability, either directly or indirectly, for substantially the full term of the financial instrument.

Level 3: Inputs to the valuation methodology are unobservable and significant to the fair value measurement.

An asset or liability's categorization within the valuation hierarchy is based upon the lowest level of input that is significant to the fair value measurement.

2. Summary of Significant Accounting Policies (Continued)

Net Loss Per Share

The Company computes basic loss per share by dividing the net loss available to common stockholders by the weighted average number of common shares outstanding for the period, without consideration for common stock equivalents. Diluted net loss assumes the conversion, exercise or issuance of all potential common stock equivalents, unless the effect of inclusion would be anti-dilutive. For purposes of this calculation, common stock equivalents include the Company's stock options, common stock warrants, convertible preferred stock warrants and convertible preferred stock, which are convertible into shares of the Company's common stock. No shares related to the convertible preferred stock were included in the diluted net loss calculation for the three months ended March 31, 2018 or 2019 because the inclusion of such shares would have had an anti-dilutive effect. The shares to be issued upon exercise of certain outstanding stock options were also excluded from the diluted net loss calculation for the three months ended March 31, 2018 and 2019 because such shares are anti-dilutive.

Historical outstanding anti-dilutive securities not included in the diluted net loss per share calculation include the following:

	Three Months Ended March 31,	
	2018	2019
Convertible preferred stock (as converted)	8,306,934	17,248,259
Common stock options	579,852	2,587,996
Common stock warrants	62,936	62,936
Convertible preferred stock warrants	49,997	49,997
	8,999,719	19,949,188

Unaudited Pro Forma Net Loss Per Share

The following table summarizes the Company's unaudited pro forma net loss per share (in thousands, except share and per share data):

	Three Months Ended March 31, 2019
Numerator:	
Net loss attributable to common stockholders	$ 13,579
Denominator:	
Shares used to compute net loss per share, basic and diluted	2,120,925
Pro forma adjustments to reflect assumed weighted-average effect of conversion of convertible preferred stock	17,248,259
Shares used to compute pro forma net loss per share, basic and diluted	19,369,275
Pro forma net loss per share, basic and diluted	$ (0.70)

2. Summary of Significant Accounting Policies (Continued)

Foreign Currency

The U.S. dollar is the functional currency of the Company and the functional currency of its subsidiary is Singapore dollars. For consolidation purposes, assets and liabilities of its subsidiary are translated into U.S. dollars at exchange rates in effect at the balance sheet date. Revenue and expenses are translated at average exchange rates in effect during the period. Gains and losses from transactions denominated in foreign currency are included in the accumulated other comprehensive loss component of stockholders' equity. Translation adjustments are not included in earnings unless they are realized through a sale or upon a complete or substantially complete liquidation of the Company's net investment in its foreign operations.

Reverse stock split

In June 2019, the Company's board of directors and its stockholders approved an amendment and restatement of the Company's amended and restated certificate of incorporation to effect a reverse split of shares of the common stock and convertible preferred stock on a 1-for-6 basis (the ''Reverse Stock Split''). The par value and the authorized shares of the common stock and convertible preferred stock were not adjusted as a result of the Reverse Stock Split though the Company concurrently authorized additional shares of common stock and convertible preferred stock. All issued and outstanding convertible preferred stock and common stock, stock options, warrants and related per share amounts contained in the financial statements have been retroactively adjusted to reflect this Reverse Stock Split for all periods presented. The Reverse Stock Split was effected on June 7, 2019.

Recent Accounting Pronouncements

In February 2016, the FASB issued ASU 2016-02, *Leases (Topic 842),* which modifies the accounting by lessees for all leases with a term greater than 12 months. This standard will require lessees to recognize on the balance sheet the assets and liabilities for the rights and obligations created by those leases. Topic 842 is effective for the Company as of January 1, 2020. Early adoption is permitted. The Company's most significant lease is its operating lease for its corporate headquarters, and, while the Company has not yet estimated the amounts by which its financial statements will be affected by the adoption of this guidance, it expects that the overall recognition of expense will be similar to current guidance, but that there will be a significant change in the balance sheet due to the recognition of right of use assets and the corresponding lease liabilities.

In August 2016, the FASB issued ASU 2016-15, *Statement of Cash Flows: Classification of Certain Cash Receipts and Cash Payments* (Topic 230). The standard clarifies how certain cash receipts and cash payments will be presented and classified in the statement of cash flows. Topic 230 is effective for the Company as of January 1, 2019. The adoption of this update had no material effect on the Company's consolidated financial statements.

3. Fair Value of Financial Instruments

The Company's financial assets and liabilities subject to fair value measurements on a recurring basis and the level of inputs used for such measurements were as follows:

	December 31, 2018			
Assets	**Level 1**	**Level 2**	**Level 3**	**Total**
Money market funds	$ 109,630	$ —	$ —	$ 109,630
Total	$ 109,630	$ —	$ —	$ 109,630
Liabilities				
Warrant liability	$ —	$ —	$ 380	$ 380
Total	$ —	$ —	$ 380	$ 380

	March 31, 2019			
Assets	**Level 1**	**Level 2**	**Level 3**	**Total**
Money market funds	$ 8,554	$ —	$ —	$ 8,554
U.S. Treasury securities	—	74,342	—	74,342
Total	$ 8,554	$ 74,342	$ —	$ 82,896
Liabilities				
Warrant liability	$ —	$ —	$ 430	$ 430
Total	$ —	$ —	$ 430	$ 430

The fair value of the warrants were calculated using the Black-Scholes option pricing model and is revalued to fair value at the end of each reporting period until the earlier of the exercise or expiration of the warrants. The liability was valued using the following assumptions:

	December 31, 2018	March 31, 2019
Exercise price(1)	$ 14.46	$ 14.46
Stock price(2)	$ 13.20	$ 14.94
Time to maturity (in years)	3.64	3.39
Volatility(3)	83.7%	82.3%
Risk-free interest rate(4)	2.50%	2.21%
Expected dividend	$ —	$ —

(1) Based upon terms provided in the warrant agreement.
(2) Based upon an independently prepared valuation as of December 31, 2018. The Company considered the independently prepared valuation as of December 31, 2018 and estimated offering price in an IPO in determining the estimated fair value as of March 31, 2018.
(3) Based upon the historical daily volatility of a group of peer public company closing prices.
(4) Based upon interest rate for U.S. Treasury Bonds, as published by the U.S. Federal Reserve.

4. Cash, Cash Equivalents and Investments

The fair value and the amortized cost of cash, cash equivalents and available-for-sale investments by major security type consist of the following (in thousands):

	As of December 31, 2018			
Cash, cash equivalents and investments	Amortized Cost	Gross Unrealized Gains	Gross Unrealized Losses	Estimated Fair Value
Cash and money market funds	$ 114,504	$ —	$ —	$ 114,504
Total	114,504	—	—	114,504
Less amounts classified as cash and cash equivalents	(114,504)	—	—	(114,504)
Total available-for-sale investments	$ —	$ —	$ —	$ —

	As of March 31, 2019			
Cash, cash equivalents and investments	Amortized Cost	Gross Unrealized Gains	Gross Unrealized Losses	Estimated Fair Value
Cash and money market funds	$ 26,319	$ —	$ —	$ 26,319
U.S. Treasury securities	74,314	28	—	74,342
Total	100,633	28	—	100,661
Less amounts classified as cash and cash equivalents	(26,319)	—	—	(26,319)
Total available-for-sale investments	$ 74,314	$ 28	$ —	$ 74,342

5. Prepaid Expenses and Other Current Assets

Prepaid expenses and other current assets consist of the following (in thousands):

	December 31, 2018	March 31, 2019
Vendor prepayments and deposits	$ 2,045	$ 2,243
Prepaid rent	394	687
Non-trade receivables	282	361
	$ 2,721	$ 3,291

6. Property and Equipment, net

Property and equipment consists of the following (in thousands):

	December 31, 2018	March 31, 2019
Laboratory equipment	$ 7,561	$ 7,678
Furniture and fixtures	386	389
Computer hardware and software	580	617
Leasehold improvements	236	236
	8,763	8,920
Less accumulated depreciation and amortization	(4,620)	(5,014)
	$ 4,143	$ 3,906

Depreciation expense was $326,000 and $397,000 for the three months ended March 31, 2018 and 2019, respectively.

The net book value of property and equipment under capital leases was $142,000 and $129,000 at December 31, 2018 and March 31, 2019, respectively.

7. Accrued Expenses

Accrued expenses consist of the following (in thousands):

	December 31, 2018	March 31, 2019
Compensation and related benefits	$ 2,568	$ 1,224
Professional fees	183	360
Contract research fees	43	278
Other	214	300
Total accrued expenses	$ 3,008	$ 2,162

8. Commitments and Contingencies

Leases

The Company leases its office facilities under non-cancellable operating lease agreements that expire at various dates through April 2022. Under the terms of the leases, the Company is responsible for certain insurance, property taxes and maintenance expenses. The office facilities lease agreements contain scheduled increases over the lease term. The related rent expense is calculated on a straight-line basis with the difference recorded as deferred rent. Rent expense was $313,000 and $385,000 for the three months ended March 31, 2018 and 2019, respectively.

The Company leases certain property and equipment under capital leases. In 2017, the Company financed purchases of $226,000 under a capital lease agreement. Outstanding amounts under the capital lease agreements are generally secured by liens on the related property and equipment.

8. Commitments and Contingencies (Continued)

Future minimum lease payments under non-cancelable operating and capital lease agreements consist of the following at December 31, 2018 (in thousands):

	Capital Leases	Operating Leases
Years ending December 31:		
2019 (remaining 9 months)	$ 39	$ 2,628
2020	51	2,436
2021	51	2,310
2022	4	504
Total minimum lease payments	145	$ 7,878
Less: amount representing interest	(10)	
Present value of capital lease obligation	135	
Less: current portion	(47)	
Non-current portion	$ 88	

Litigation

The Company is not aware of any asserted or unasserted claims against it where it believes that an unfavorable resolution would have an adverse material impact on the operations or financial position of the Company.

9. Capital Stock

Convertible Preferred Stock

The classes of preferred stock the Company was authorized to issue, and the amounts issued and outstanding as of December 31, 2018 and March 31, 2019 were as follows:

	Par Value	Authorized	Issued & Outstanding
Series A	$0.0001	32,133,287	5,305,513
Series B	$0.0001	18,550,000	3,001,421
Series C1	$0.0001	54,189,549	5,007,134
Series C2	$0.0001	23,605,150	3,934,191

The rights, preferences, privileges and restrictions relating to Series A, Series B, Series C1 and Series C2 (together, the Series Preferred) are as set forth below:

Dividends

The holders of the Series Preferred are entitled to receive non-cumulative dividends prior to and in preference to any declaration or payment of dividends on common stock. In the event dividends are paid on any share of common stock, the Company will also pay a dividend on all outstanding shares of preferred stock in a per share amount equal to the amount paid or set aside for each share of common stock, on an as if converted to common stock basis. No dividends have been declared or paid as of March 31, 2019.

9. Capital Stock (Continued)

Voting

The holders of the Series Preferred are entitled to voting rights equal to the number of shares of common stock into which each share of preferred stock could be converted, except that Series C2 is not entitled to vote on the election of directors at any time.

The holders of Class A common stock, voting as a separate class, are entitled to elect three members of the Board of Directors. The remaining members of the Company's board of directors will be elected by the holders of the Series Preferred, except Series C2, and Class A common stock, voting together as a single class and on an as-converted basis.

Liquidation

In the event of any liquidation, dissolution or winding up of the Company, either voluntary or involuntary, the holders of the Series Preferred are entitled to be paid, out of the available funds and assets, and prior and in preference to any payment or distribution of any such funds on any shares of common stock, an amount per share equal to the original issue price for the Series Preferred, plus all accrued and declared but unpaid dividends. The original per share issue price is equal to $11.10 for Series A, $11.661 for Series B and $13.98 for Series C1 and Series C2. If assets are insufficient to permit such payment, payment will be distributed ratably among the holders of outstanding preferred stock in proportion to the amount owned by each holder. After the liquidation preference of the holders of the Series Preferred has been satisfied, the remaining assets of the Company will be distributed ratably among the holders of outstanding common stock in proportion to the amount owned by each holder.

Conversion

Each share of Series Preferred is convertible into shares of Class A common stock, at the option of the holder, at any time after the date of issuance, except that Series C2 is convertible into shares of Class B common stock. Each share of Series Preferred automatically converts into the number of shares of common stock determined in accordance with the conversion rate upon the earlier of (i) the date specified by election of the holders of a majority of the shares of Series Preferred or (ii) the closing of a public offering of common stock resulting in aggregate gross proceeds of at least $75,000,000 and having a price per share to the public of at least $17.475 adjusted for splits, recapitalizations and the like. At March 31, 2019, the conversion price for each share of Series A is $11.10, Series B is $11.661 and Series C1 and Series C2 is $13.98.

The Company recorded all convertible preferred stock issuances at fair value on the dates of issuance. The Company classifies the convertible preferred stock outside of stockholders' deficit in temporary equity because the shares contain contingent liquidation features that are not solely within its control. The Company has elected not to adjust the carrying values of the convertible preferred stock to the deemed redemption values of such shares since a liquidation event was not probable. Subsequent adjustments to increase the carrying values to the ultimate redemption values will be made only when it becomes probable that such a liquidation event will occur.

Redemption

The Series Preferred is not redeemable at the option of the holder.

9. Capital Stock (Continued)

Protective Provisions

The holders of Series Preferred have certain protective provisions. As long as at least 2,083,333 shares of Series Preferred remain outstanding, the Company cannot, without the approval of at least two-thirds of the holders of Series Preferred, take any action that (i) adversely changes the rights, preferences or privileges of Series Preferred; (ii) increases or decreases the authorized number of shares of preferred stock; (iii) creates or authorizes any capital stock having the rights, preferences or privileges senior or on a parity with preferred stock; (iv) results in redemption, repurchase, payment or declaration of dividends or other distributions with respect to shares of preferred stock or common stock other than permitted repurchases and dividends; (v) consummates a liquidation, dissolution or winding up of the Company; (vi) increases or decreases the authorized members of the Company's board of directors; (vii) sells, assigns, licenses, pledges or encumbers the intellectual property of the Company; or (viii) enters into any inbound license or acquisition by merger or asset transfer or similar corporate strategic relationship, in each case involving the Company's assets having a value (as determined by the Company's board of directors in good faith) greater than $500,000.

As long as at least 750,000 Series B remain outstanding, the Company cannot, without the approval of at least two-thirds of the holders of Series B, take any action that (i) adversely changes the rights, preferences or privileges of Series B; or (ii) increases or decreases the authorized number of shares of Series B.

As long as at least 1,666,666 Series C1 and Series C2 remain outstanding, the Company cannot, without the approval of at least two-thirds of the holders of Series C1 and Series C2, take any action that (i) adversely changes the rights, preferences or privileges of Series C1 and Series C2; or (ii) increases or decreases the authorized number of shares of Series C1 and Series C2.

Classification of Convertible Preferred Stock

The deemed liquidation preference provisions of the convertible preferred stock are considered contingent redemption provisions that are not solely within the Company's control. Accordingly, the convertible preferred stock has been presented outside of permanent equity in the mezzanine section of the consolidated balance sheets.

Convertible Preferred Stock Warrants

In connection with the issuance of Series A in August 2015, the Company issued warrants to purchase an aggregate of 49,997 shares of Series A at $14.46 per share. The warrants were immediately exercisable and expire, if not exercised, in August 2022. At issuance, the fair value of the warrants was determined to be $382,765 using the Black-Scholes pricing model and was recorded as a Series A issuance cost and a preferred stock warrant liability (Note 2). The liability was valued using the following assumptions at issuance: expected life of 7 years, fair value of Series A of $11.10 per share, risk-free interest rate of 1.79%, volatility of 80% and no expected dividends. At March 31, 2019, the warrants remain outstanding.

Class A and Class B Common Stock

In connection with the issuance of Series C1 and C2 in 2018, the Company authorized two classes of common stock, Class A and Class B common stock. Each holder of Class A common

9. Capital Stock (Continued)

stock and Class B common stock is entitled to one vote per share, except that Class B common stock is not entitled to vote on the election of directors at any time. The holders of Class A common stock, voting as a separate class, are entitled to elect three members of the Company's board of directors. All shares of common stock outstanding as of the authorization of two classes of common stock in September 2018 became shares of Class A common stock. As of December 31, 2018 and March 31, 2019, the Company is authorized to issue 191,398,492 shares of Class A common stock and 23,605,150 of Class B common stock with a par value of $0.0001 per share. As of March 31, 2019, the Company had 2,123,257 shares issued of Class A common stock outstanding.

In June 2012, the Company issued 118,534 shares of common stock to a founder of the Company through the 2010 Equity Incentive Plan (Note 10). The founder entered into a restricted stock purchase agreement with the Company, which allows the Company to repurchase the shares of common stock from the founder at the original issuance price if the founder ceases providing services to the Company. The Company's right to repurchase the stock lapses over 48 months. At December 31, 2018 and March 31, 2019, all shares of common stock were vested and no longer subject to repurchase.

The Company has also allowed certain option holders to exercise unvested options to purchase shares of common stock. Shares received from such early exercises are subject to a right of repurchase at the issuance price. The Company's repurchase right lapses over the same period the options vest. In June 2017, the Company repurchased 17,026 unvested shares at $0.42 per share from a terminated option holder. At December 31, 2018, 658 shares at a weighted-average price of $0.66 per share were subject to repurchase. At December 31, 2018, the proceeds received for unvested shares of common stock subject to repurchase of $435 were recorded within accrued expenses. There were no shares subject to repurchase at March 31, 2019.

Common Stock Warrant

In connection with the issuance of Series A in August 2015, the Company issued a warrant to purchase an aggregate of 62,936 shares of common stock at $0.0001 per share. The warrant was immediately exercisable and expires, if not exercised, in August 2025. At issuance, the fair value of the warrant was determined to be $41,509, which was recorded as a Series A issuance cost and additional paid-in capital. At March 31, 2019, the warrant remains outstanding.

10. Stock Option Plan

In September 2010, the Company adopted the 2010 Equity Incentive Plan (the Plan) under which 3,540,114 shares of the Company's common stock have been reserved for issuance to employees, directors and consultants.

Under the Plan, the Company's board of directors may grant incentive stock options or non-statutory stock options. Incentive stock options may only be granted to Company employees. The exercise price of incentive stock options and non-statutory stock options will be no less than 100% of the fair value per share of the Company's common stock on the grant date. If an individual owns capital stock representing more than 10% of the outstanding shares, the price of each share will be at 110% of the fair value. Fair value is determined by the Company's board of directors. Options expire after ten years (five years for stockholders owning greater than 10% of all classes of stock). The Company's board of directors determines the period over which options vest and

10. Stock Option Plan (Continued)

become exercisable. The Company has a repurchase option exercisable upon the voluntary or involuntary termination of the purchaser's employment with the Company for any reason. 3,105,031 shares of the Company's common stock are reserved for future issuance under the Plan as of March 31, 2019.

The Company recognized $113,000 and $776,000 of stock-based compensation expense related to options granted to employees and non-employees for the three months ended March 31, 2018 and 2019, respectively. The compensation expense is allocated on a departmental basis, based on the classification of the option holder as follows (in thousands):

	Three Months Ended March 31,	
	2018	2019
Research and development	$ 77	$419
General and administrative	36	357
	$113	$776

No income tax benefits have been recognized in the statements of operations for stock-based compensation arrangements and no stock-based compensation costs have been capitalized as property and equipment as of March 31, 2019.

Stock option activity under the Plan is as follows (in thousands, except share and per share data):

	Options Outstanding			
	Number of Shares	Weighted-Average Exercise Price	Weighted-Average Remaining Contractual Life (years)	Aggregate Intrinsic Value
Balances, December 31, 2018	2,136,291	$6.06	8.9	$12,881
Granted	461,390	12.06		
Exercised	(3,385)	3.78		
Cancelled	(6,300)	9.60		
Balances, March 31, 2019	2,587,996	$7.08	8.9	$12,837
Vested and expected to vest at March 31, 2019	2,587,996	$7.08	8.9	$12,837
Exerciseable at March 31, 2019	1,633,014	$4.98	8.4	$11,579
Vested at March 31, 2019	552,256	$4.74	7.4	$ 4,039

The weighted-average grant date fair value of options granted to employees and non-employees in the three months ended March 31, 2018 and 2019 was $3.54 and $8.46, respectively. The fair

10. Stock Option Plan (Continued)

value of each option is estimated on the date of grant using the Black-Scholes option pricing model, assuming no expected dividends and the following weighted average assumptions:

	Three Months Ended March 31,	
	2018	2019
Expected life (in years)	5.96	6.02
Volatility	78.7%	80.8%
Risk-free interest rate	2.56%	2.46%

Expected volatility is based on volatilities of public companies operating in the Company's industry. The expected life of the options is estimated using the simplified method detailed in SEC Staff Accounting Bulletin No. 107. The simplified method calculates the expected term as the mid-point between the weighted-average time to vesting and the contractual maturity. The risk-free rate is based on the U.S. Treasury yield curve in effect at the time of grant. The Company has elected to account for forfeitures as they occur, rather than estimate expected forfeitures.

Unrecognized estimated compensation expense totaled $10.8 million related to non-vested stock options with a remaining requisite service period of 3.4 years.

11. 401(k) Plan

The Company has a 401(k) plan that qualifies as a deferred compensation arrangement under Section 401 of the Code. Eligible employees may elect to defer a portion of their pretax earnings subject to certain statutory limits. The Company has not made any matching contributions to date.

12. Related Party Transactions

The Company recorded other income of $148,000 and $165,000 under service contracts with a stockholder of the Company for the three months ended March 31, 2018 and 2019, respectively. The Company had a receivable from the stockholder at December 31, 2018 and March 31, 2019 of $89,000 and $20,000, respectively.

The Company paid intellectual property related legal fees of $288,000 and $381,000 for the three months ended March 31, 2018 and 2019, respectively, to a related party. The Company owed $134,000 and $394,000 to the related party at December 31, 2018 and March 31, 2019, respectively.

The Company paid legal fees of $110,000 and $370,000 for the three months ended March 31, 2018 and 2019, respectively, to a related party. The Company owed $40,000 and $349,000 to the related party at December 31, 2018 and March 31, 2019, respectively.

The Company recorded research and development expense of $100,000 and $106,000 under consulting agreements with two members of the Company's board of directors for the three months ended March 31, 2018 and 2019, respectively.

13. Subsequent Events

The Company has evaluated subsequent events that may require adjustments to or disclosure in the unaudited interim condensed consolidated financial statements through May 24, 2019, the date on which the unaudited interim condensed consolidated financial statements were available to be issued, and, with respect to the reverse stock split and increase in authorized shares described below, through June 10, 2019.

In June 2019, the Company's board of directors and its stockholders approved an amendment and restatement of the Company's amended and restated certificate of incorporation to effect a reverse split of shares of the common stock and convertible preferred stock on a 1-for-6 basis (the ''Reverse Stock Split''). The par value and the authorized shares of the common stock and convertible preferred stock were not adjusted as a result of the Reverse Stock Split though the Company concurrently authorized additional shares of common stock and convertible preferred stock. All issued and outstanding convertible preferred stock and common stock, stock options, warrants and related per share amounts contained in the financial statements have been retroactively adjusted to reflect this Reverse Stock Split for all periods presented. The Reverse Stock Split was effected on June 7, 2019.

Subsequent to the original issuance of these financial statements, in June 2019, the Company amended and restated its certificate of incorporation to increase the total number of authorized shares of all classes of capital stock to 1,000,000,000 from 342,935,376, of which 700,000,000 are designated as common stock and 300,000,000 are designated as convertible preferred stock.

7,350,000 Shares

Common Stock

PROSPECTUS

Cowen **Evercore ISI** **Stifel**

Canaccord Genuity

Arcadia Securities

June 19, 2019

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