
gritstone
ONCOLOGY
first the biopsy
next, the diagnosis
18 months
life expectancy
now what...

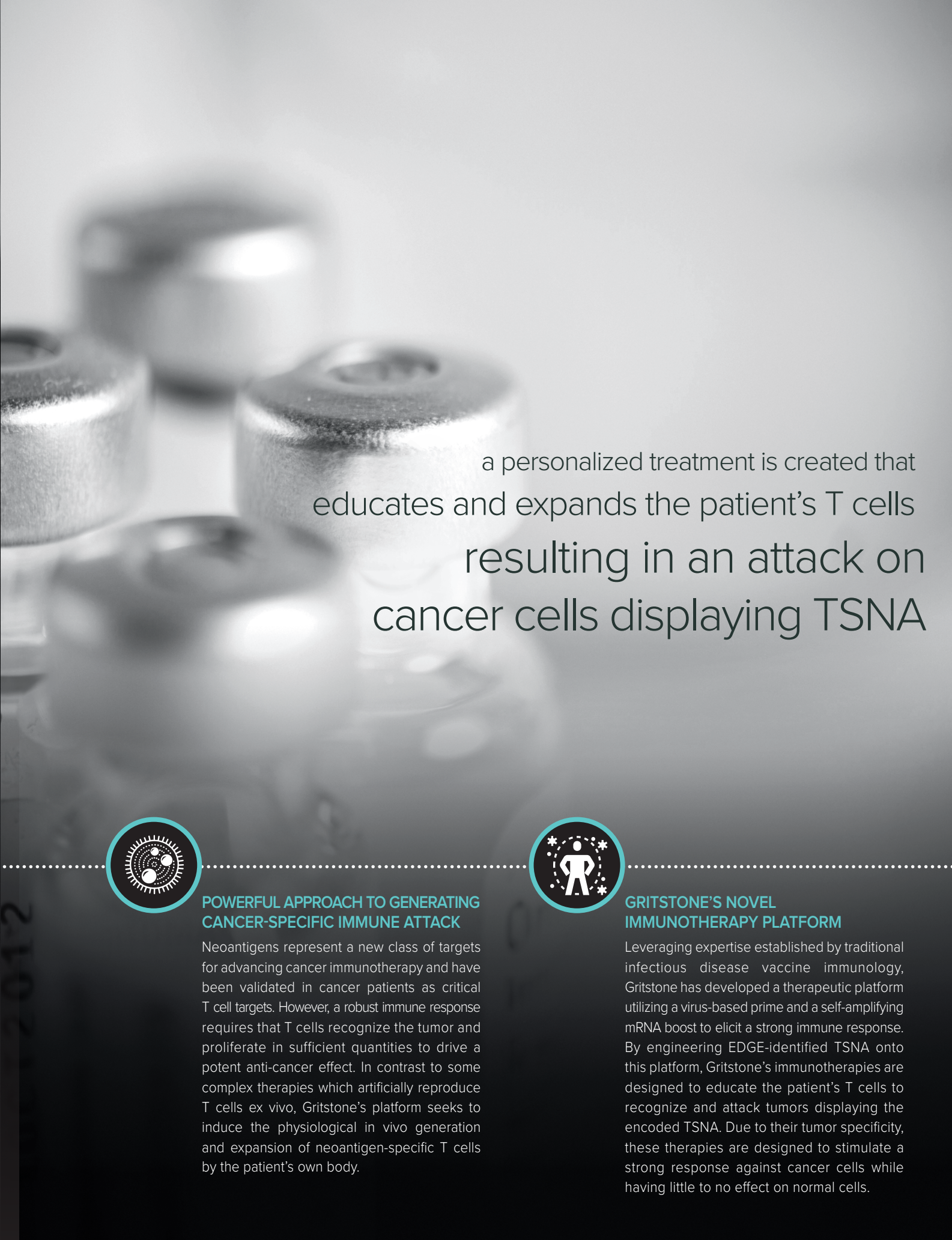
using a patient's routine tumor biopsy

tumor DNA and RNA is sequenced and analyzed by

Gritstone EDGE™ to identify relevant tumor-specific neoantigens (TSNA)

EDGE IS A LEADING, PATENTED, ARTIFICIAL INTELLIGENCE PLATFORM

Its novel integrated neural network model architecture was trained on millions of datapoints from hundreds of tumor and normal tissue samples from patients with a variety of cancers and ancestries, with diverse human leukocyte antigen (HLA) types. Data validating its capabilities were published in Nature Biotechnology, and today, its positive predictive value for HLA class I peptide presentation is nearly 75%, which is an estimated 10-fold improvement over common public tools.



a personalized treatment is created that
educates and expands the patient's T cells
resulting in an attack on
cancer cells displaying TSNA

POWERFUL APPROACH TO GENERATING CANCER-SPECIFIC IMMUNE ATTACK

Neoantigens represent a new class of targets for advancing cancer immunotherapy and have been validated in cancer patients as critical T cell targets. However, a robust immune response requires that T cells recognize the tumor and proliferate in sufficient quantities to drive a potent anti-cancer effect. In contrast to some complex therapies which artificially reproduce T cells ex vivo, Gritstone's platform seeks to induce the physiological in vivo generation and expansion of neoantigen-specific T cells by the patient's own body.

GRITSTONE'S NOVEL IMMUNOTHERAPY PLATFORM

Leveraging expertise established by traditional infectious disease vaccine immunology, Gritstone has developed a therapeutic platform utilizing a virus-based prime and a self-amplifying mRNA boost to elicit a strong immune response. By engineering EDGE-identified TSNA onto this platform, Gritstone's immunotherapies are designed to educate the patient's T cells to recognize and attack tumors displaying the encoded TSNA. Due to their tumor specificity, these therapies are designed to stimulate a strong response against cancer cells while having little to no effect on normal cells.

through a simple intramuscular vaccine
easily administered in a community clinic
patients with advanced cancers are
receiving investigational SLATE or GRANITE

SLATE: "OFF-THE-SHELF" TARGETED IMMUNOTHERAPY

SLATE targets neoantigens that are shared among patients with particular tumor types due to common tumor driver mutations. SLATE is being evaluated in combination with immune checkpoint blockade in a Phase 1 clinical study for the treatment of patients with advanced solid tumors, including metastatic non-small cell lung cancer, pancreatic ductal adenocarcinoma and microsatellite-stable colorectal cancer, as well as in patients with other solid tumor types who have relevant mutation/HLA combinations.

GRANITE: INDIVIDUALIZED IMMUNOTHERAPHY

GRANITE targets neoantigens that are uniquely identified on an individual patient's tumor. GRANITE is being studied in a Phase 1 clinical study in combination with immune checkpoint blockade for the treatment of patients with metastatic non-small cell lung cancer, microsatellite-stable colorectal cancer (MSS-CRC), gastroesophageal cancer and bladder cancer. GRANITE was granted Fast Track designation by the U.S. Food and Drug Administration for MSS-CRC.

INNOVATING FOR A CURE

Gritstone's goal is to eradicate cancer through the development of potent immunotherapies. The company is making progress against this goal by first completing and reporting data from its Phase 1 trials of SLATE and GRANITE in advanced cancers this year. The company also recognizes the potential of these immunotherapies in the adjuvant setting where new therapies to prevent cancer recurrence following tumor resection are needed. Additionally, with access to tumor-specific antigens, Gritstone is advancing and expanding its pipeline, including a bispecific antibody program that is in lead optimization.

To our stockholders, collaborators and colleagues,

Cancer continues to cause immense suffering across the world, and we need better answers. Immunotherapy has demonstrated the ability to induce long-term remissions, perhaps even cures, in selected patients, and enormous research efforts continue to explore the mechanisms underlying such dramatic responses. Gritstone Oncology is at the forefront of these efforts and is testing novel immunotherapy product candidates and combinations in an attempt to broaden the benefits of immunotherapy.

A central mechanism behind successful immunotherapy is cytotoxic T cell recognition of mutant peptides presented on the surface of tumor cells. Some patients appear to have pre-existing immune responses to their own tumor's mutant peptides (termed neoantigens), which are inactivated by tumors that stimulate the PD-1 receptor on threatening T cells. This inhibitory signaling can be blocked with an anti-PD-1 antibody, and the tumor-specific T cells can reactivate and kill the target tumor cell. Unfortunately, most solid tumor patients do not have a large population of pre-existing neoantigen-specific T cells, and this deficiency likely renders many patients unresponsive to anti-PD-1 (checkpoint inhibitor) therapy.

Gritstone has established an artificial intelligence-enabled process whereby a cancer patient can be assessed to determine which neoantigens are presented by their tumor. A few patients may have a shared neoantigen, but the majority will have neoantigens unique to their own tumor. To address these two populations in a personalized fashion, Gritstone has developed two distinct, but related, products. Both products use the same virus-derived vectors to deliver neoantigens to the patient's immune system and drive a strong T cell response to those neoantigens. The SLATE program is an off-the-shelf product which is pre-made and may ultimately be given to the approximately 10-15% of colorectal and lung cancer patients (and approximately 25% of pancreatic cancer patients) whose tumors possess a suitable neoantigen contained within the SLATE product. Most solid tumor patients do not possess a shared neoantigen, however, and for those patients who are predicted to have neoantigens, we design and manufacture an individualized product, called GRANITE. Both SLATE and GRANITE are administered by simple intramuscular injection and are co-administered with FDA-approved checkpoint inhibitors.

These two programs are in Phase 1 testing in cancer patients currently, and we have recently shown early data which are very encouraging. The products appear safe at doses tested to date, and strong neoantigen-specific T cell responses have been demonstrated across multiple patients, even at the first, low, doses tested. There is evidence of anti-tumor activity with prolonged stable disease and reductions in the amount of tumor-derived mutant DNA found in the blood of several patients. We continue to increase the doses administered in the expectation that this will drive a stronger immune response, with potentially even greater anti-tumor activity. Once we have determined the optimal dose and schedule of these therapeutics, we will then expand into Phase 2 efficacy testing in larger numbers of patients in the second half of 2020. We are also very excited to move these experimental approaches to the early treatment of patients who receive adjuvant therapy after surgical removal of tumors. This is a context in which immunotherapy likely has the greatest effect, and new diagnostic blood tests are enabling us to identify patients at high risk of cancer recurrence after surgery, such that we expect to run small, short, focused trials in patients who need help.

Biomanufacturing remains a core component of the Gritstone model, and we have been progressively bringing in-house the entire set of capabilities required to successfully make our products. At this point, we only out-source a few elements on the product release-testing checklist. This independence positions us well to continue optimizing our manufacturing process and make everything simpler, faster and cheaper – a key attribute for commercialization of an individualized therapy. This independence positions us well to continue optimizing our manufacturing process and make everything simpler, faster and cheaper – a key attribute for commercialization of an individualized therapy upon product approval.

And finally, to capitalize upon our industry-leading tumor-specific antigen discovery capabilities, we are working hard on developing bispecific antibodies which, at one end, recognize tumor antigens (such as neoantigens), and on the other end recruit and activate T cells, thus enabling tumor destruction. We expect this program to deliver a clinical development candidate by the end of this year.

Gritstone is poised to demonstrate exciting anti-tumor activity of its novel neoantigen-directed immunotherapy programs this year. We are thrilled to see if we can really help cancer patients win their battle.

Sincerely,

Andrew Allen, M.D., Ph.D.
Co-founder, President and Chief Executive Officer
April 15, 2020

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

FORM 10-K

(Mark One)

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

For the fiscal year ended December 31, 2019

OR

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

Commission File Number 001-38663

Gritstone Oncology, Inc.

(Exact name of Registrant as specified in its Charter)

Delaware	**47-4859534**
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification No.)**
5959 Horton Street, Suite 300	
Emeryville, CA	**94608**
(Address of principal executive offices)	**(Zip Code)**

(510) 871-6100

Registrant's telephone number, including area code

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

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Common Stock, $0.0001 par value per share	**GRTS**	**The Nasdaq Global Select Market**

Securities Registered Pursuant to Section 12(g) of the Act: None

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

Indicate by check mark if the Registrant is not required to file reports pursuant to Section 13 or 15(d) of the Act. YES ☐ NO ☒

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

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

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

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

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

Indicate by check mark whether the Registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act). YES ☐ NO ☒

The aggregate market value of the common stock held by non-affiliates of the registrant as of June 28, 2019 (the last business day of the registrant's most recently completed second fiscal quarter) was approximately $277.1 million, based on the closing price of the registrant's common stock, as reported by the NASDAQ Global Select Market on June 28, 2019 of $11.14 per share. Shares of the registrant's common stock held by each executive officer, director, and holder of 5% or more of the outstanding common stock have been excluded in that such persons may deemed to be affiliates. This calculation does not reflect a determination that certain persons are affiliates of the registrant for any other purpose.

The number of shares of Registrant's Common Stock outstanding as of March 6, 2020 was 36,976,352.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the Registrant's Definitive Proxy Statement relating to the Annual Meeting of Shareholders, scheduled to be held on June 18, 2020, are incorporated by reference into Part III of this Annual Report on Form 10-K where indicated. Such Definitive Proxy Statement will be filed with the Securities and Exchange Commission within 120 days after the fiscal year to which this report relates.

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PART I

Note Regarding Forward-Looking Statements

This Annual Report on Form 10-K, including "Business" in Part I Item I and "Management's Discussion and Analysis of Financial Condition and Results of Operations" in Part II Item 7, contains "forward-looking statements" within the meaning of Section 21E of the Securities Exchange Act of 1934, as amended, or the Exchange Act. All statements other than statements of historical fact are statements that could be deemed forward-looking statements. In some cases, you can identify forward-looking statements by terminology such as “aim,” “anticipate,” “assume,” “believe,” “contemplate,” “continue,” “could,” “due,” “estimate,” “expect,” “goal,” “intend,” “may,” “objective,” “plan,” “predict,” “potential,” “positioned,” “seek,” “should,” “target,” “will,” “would,” and other similar expressions that are predictions of or indicate future events and future trends, or the negative of these terms or other comparable terminology. These forward-looking statements include, but are not limited to, statements about:

- our expectations regarding the potential market size and size of the potential patient populations for SLATE, GRANITE and any future product candidates, if approved for commercial use;
- our clinical and regulatory development plans for our product candidates;
- our expectations with regard to our Gritstone EDGE™ platform, including our ability to utilize the platform to predict the TSNA that will be presented on a patient’s tumor cells and identify shared antigens for other therapeutic classes;
- our expectations with regard to the data to be derived in our Phase 1/2 clinical trials or any clinical trials for other product candidates;
- the timing of commencement of future nonclinical studies and clinical trials and research and development programs;
- our ability to acquire, discover, develop and advance product candidates into, and successfully complete, clinical trials;
- our intentions and our ability to establish collaborations and/or partnerships;
- the timing or likelihood of regulatory filings and approvals for our product candidates;
- our commercialization, marketing and manufacturing capabilities and expectations;
- our intentions with respect to the commercialization of our product candidates;
- the pricing and reimbursement of our product candidates, if approved;
- the implementation of our business model and strategic plans for our business, product candidates and technology platforms, including additional indications for which we may pursue;
- the scope of protection we are able to establish and maintain for intellectual property rights covering our product candidates, including the projected terms of patent protection;
- estimates of our expenses, future revenue, capital requirements, our needs for additional financing and our ability to obtain additional capital;
- our future financial performance; and
- developments and projections relating to our competitors and our industry, including competing therapies and procedures.

These statements relate to future events or to our future financial performance and involve known and unknown risks, uncertainties and other factors that may cause our actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by these forward-looking statements. Factors that may cause actual results to differ materially from current expectations include, among other things, those listed under “Item 1A. Risk Factors” and elsewhere in this Annual Report on Form 10-K. Any forward-looking statement in this Annual Report on Form 10-K reflects our current views with respect to future events and is subject to these and other risks, uncertainties and assumptions relating to our operations, results of operations, industry and future growth. Given these uncertainties, you should not place undue reliance on these forward-looking statements. Except as required by law, we assume no obligation to update or revise these forward-looking statements for any reason, even if new information becomes available in the future.

This Annual Report on Form 10-K also contains estimates, projections and other information concerning our industry, our business, and the markets for our product candidates, including data regarding the estimated patient population and market size for our product candidates, as well as data regarding market research, estimates and forecasts prepared by our management. Information that is based on estimates, forecasts, projections or similar methodologies is inherently subject to uncertainties and actual events or circumstances may differ materially from events and circumstances reflected in this information. Unless otherwise expressly stated, we obtained this industry, business, market and other data from reports, research surveys, studies and similar data prepared by third parties, industry, medical and general publications, government data and similar sources. In some cases, we do not expressly refer to the sources from which this data is derived. In that regard, when we refer to one or more sources of this type of data in any paragraph, you should assume that other data of this type appearing in the same paragraph is derived from the same sources, unless otherwise expressly stated or the context otherwise requires.

Item 1. Business.

Overview and Strategy

We are an immuno-oncology company developing tumor-specific cancer immunotherapies to fight multiple cancer types. Our approach harnesses the natural power of a patient's own immune system to recognize short tumor-specific peptide sequences presented on cancer cells, referred to as tumor-specific neoantigens, or TSNA, in order to destroy tumor cells. Our programs are built on two key pillars—first, our proprietary Gritstone EDGE artificial intelligence platform which enables us to identify TSNA with high accuracy; and second, a potent immunotherapy platform which we have engineered to deliver the selected TSNA and drive the patient's immune system to attack and destroy tumors. Our product candidates are designed to fit easily into a community oncology setting and to be administered in earlier lines of treatment, in combination with checkpoint inhibitors to further drive a robust T cell response, rather than only in refractory or relapsed cancers. This is important because there is growing evidence that immunotherapy is more effective when deployed early in a cancer patient's disease course.

We initiated a Phase 1/2 first-in-human clinical trial of our personalized immunotherapy product candidate, GRANITE, in the fourth quarter of 2018, and a Phase 1/2 clinical trial of our "off-the-shelf" immunotherapy product candidate, SLATE (also targeting TSNA), in the third quarter of 2019, both for the treatment of several common solid tumors. In these studies, patients have received our immunotherapy product candidates with acceptable tolerability at doses tested to date, and, importantly, we have observed substantial cytotoxic T cell responses to multiple administered TSNA. We expect to present preliminary clinical data in the first half of 2020. Patient selection for the two programs is distinct. SLATE patients must carry both a particular tissue type human leukocyte antigen, or HLA, which is similar to the ABO blood type, but with more variants, and at least one of twenty specific gene mutations, with a particular focus upon common KRAS gene mutations, to be eligible for this "off-the-shelf" therapy. In contrast, GRANITE patients have an immunotherapy made specifically for them, based upon their tumor DNA/RNA sequence. Separately, we have also recently initiated lead optimization of a separate product class of bispecific antibodies, or BiSAb, which are designed to offer an alternative form of off-the-shelf therapy against our EDGE - identified novel tumor-specific antigens. We expect to file an IND for this program in the second half of 2021.

Immuno-oncology represents one of the most significant advances in the history of cancer treatment. In 2014, the first checkpoint inhibitor was approved and today, despite only a modest breadth of efficacy across patients, this class of therapies is predicted to reach over $32.0 billion in combined global sales by 2022. However, because checkpoint inhibitors work through relatively non-specific stimulation of occasional, pre-existing, tumor-specific (typically TSNA-specific) T cells, they are effective in only a subset of patients, with objective responses (substantial tumor shrinkage) observed in 0-20% of all patients with cancer of the lung, breast, prostate, colon/rectum and ovary (the major lethal solid tumor types). Many patients appear not to possess meaningful numbers of T cells that recognize their tumor (so-called "cold" tumors). We believe the path to broader immuno-oncology efficacy and more meaningful clinical responses resides in the de novo generation of new, potent, tumor-specific T cell responses.

The first pillar of our tumor-specific cancer immunotherapy approach is our understanding of TSNA and the application of our artificial intelligence-based, proprietary Gritstone EDGE platform to predict (and for SLATE, to help validate) often novel or unique TSNA on tumor cells. EDGE is a proprietary machine learning model that uses DNA/RNA sequence data derived from a patient's tumor biopsy to predict which mutations will generate TSNA most likely to be presented on the tumor cell surface. While there are frequently hundreds of mutations in the DNA of a tumor cell, only approximately 1% of these mutations are actually transcribed, translated and processed into a unique "non-self" peptide sequence that is presented on the surface of tumor cells and can therefore be recognized by the patient's own T cells. Some TSNA arise in classical oncogenes, the growth-related genes which are recurrently mutated across cancer patients because the mutations promote the formation and progression of cancer-like behavior. These are referred to as driver gene mutations, and such mutations that form TSNA are the basis of the SLATE product concept. Few driver gene (or "shared") TSNA are described in the scientific literature, and Gritstone uses EDGE to predict new shared TSNA, and then validate them by directly observing them on the surface of human tumor cells from cancer patients. Some of these data were presented at the Society for Immunotherapy of Cancer (SITC) conference in November 2019. However, shared TSNA are relatively rare (found

in approximately 10-15% of patients with lung or colorectal cancer), and most TSNA are unique to each individual patient's tumor (termed "private"), arising as mutations in random genes, that are thought to be neutral for the cell's growth. Previously available technologies cannot predict the presence of TSNA with sufficient accuracy to design a therapy that is likely to be effective, and so Gritstone built the EDGE platform. Applying this platform to sequence data from human tumors, we have shown a 9-10 fold improvement in prediction performance with our platform compared to traditional approaches. These data were published in Nature Biotechnology in December 2018 (Bulik-Sullivan, et al, Nature (2018)), and a US patent covering the concept issued to Gritstone in 2018. Of note, a large academic study published in Nature Biotechnology has recently confirmed the utility of this class of machine learning approaches for the prediction of HLA presented peptides and TSNA (Sarkizova, et al, Nature (2019)). We continue to identify novel shared TSNA and improve the performance of the EDGE model.

The second pillar of our tumor-specific cancer immunotherapy approach is our potent antigen delivery system which delivers TSNA to patients in order to direct a robust T cell response to those TSNA predicted to be presented on the patient's tumor. Grounded in traditional infectious disease vaccinology, this two-step immunization utilizes prime and separate boosts to educate and expand the patient's T cells to detect TSNA and destroy tumor cells. In non-human primate models, we have demonstrated a profound and specific CD8+ and CD4+ T cell response to antigens administered in this way. Similarly, our tumor-specific immunotherapy candidates, SLATE and GRANITE, comprise a sequential immunization of a viral-vector based prime and boosts with self-amplifying RNA (SAM) delivered by intramuscular injection, which we refer to as heterologous prime-boost. In our SLATE product candidate series, the viral-vector prime and RNA boosts both contain the same fixed TSNA cassette that is designed for the subset of patients who carry these antigens, whereas for our GRANITE product candidate, each of the viral-vector prime and RNA boost immunizations contain a patient-specific set of predicted TSNA. Importantly, we also have the capability to manufacture these products at our own fully integrated GMP biomanufacturing facilities. The ability to control the manufacturing of high-quality tumor-specific immunotherapy products, and scale production, if early data are positive, is critical for efficient clinical development and commercialization. We have invested significant resources in our Cambridge, Massachusetts sequencing lab and our Pleasanton, California biomanufacturing facility to address these needs and position ourselves to control the critical steps in the production of our tumor-specific immunotherapy candidates.

Our off-the-shelf, TSNA-directed immunotherapy product candidate, SLATE platform, entered a Phase 1/2 clinical trial in the third quarter of 2019. SLATE and GRANITE utilize the same heterologous prime-boost approach, but SLATE contains a fixed cassette with TSNA that are shared across a subset of cancer patients rather than a cassette unique to an individual patient, which distinguishes it as an off-the-shelf alternative to our personalized manufactured product candidate, GRANITE. SLATE is therefore designed to be readily available for rapid initiation of therapy and is less expensive to manufacture than a personalized product. Our data suggest that while each such shared neoantigen may only be found in less than 5% of patients with a particular tumor type, our heterologous prime-boost can contain at least 20 of these TSNA, which we believe will result in the off-the-shelf product having an addressable population of approximately 10-15% of patients within common solid tumor types such as colorectal cancer and lung cancer. Our off-the-shelf product candidates are specific to a particular tumor type, and the TSNA module is fixed for each product. Consequently, it is critically important to be able to accurately identify patients whose tumors contain at least one of the TSNA represented within the off-the-shelf product candidate. Today, this can be simply achieved by screening the patient's tumor for driver mutations using commercially-available genomic screens and identifying the patient's HLA type from blood with a standard clinical assay. The SLATE and GRANITE clinical trials involve the combined use of our heterologous prime-boost system together with checkpoint inhibitor therapy. Additionally, we have entered into a clinical trial collaboration and supply agreement with Bristol-Myers Squibb Company to evaluate the safety and tolerability of SLATE and GRANITE in combination with OPDIVO (nivolumab) and in combination with OPDIVO plus YERVOY (ipilimumab), in patients with advanced solid tumors. The Phase 1 portion of our SLATE Phase 1/2 trial, initiated in August 2019, seeks to establish a dose for further investigation in Phase 2 and to evaluate safety, tolerability and, importantly, immunogenicity of our lead product candidate, in suitable patients with colorectal cancer, lung cancer and pancreatic cancer, together with a tumor-type agnostic cohort in patients with other tumor types who possess appropriate shared TSNA. We will seek to further evaluate efficacy and safety in the Phase 2 cohort expansion portion in several common solid tumor types.

Our personalized immunotherapy product candidate, GRANITE, has two potential benefits in comparison with SLATE – (1) the potential for a larger addressable patient population, since many patients with common solid tumors such as NSCLC will have sufficient private TSNA to merit use of our immunotherapy; and (2) a greater chance that patients will mount an immune response to multiple TSNA in parallel, which may reduce the chances of a tumor developing acquired resistance by altering a particular neoantigen or its cell-surface presentation. The GRANITE process begins with receipt of a routine tumor biopsy from the patient. We utilize our in-house sequencing capabilities on the tumor sample and then apply our proprietary EDGE platform to derive a set of predicted TSNA likely to be presented on the patient's tumor. Using these TSNA, we design a highly potent personalized immunotherapy candidate containing the relevant neoantigens to be administered by simple intramuscular injection. We have designed each of our tumor-specific immunotherapy candidates such that oncologists will not have to alter their treatment practices, and we believe this would extend the utility of our medicines into the community oncology setting and not limit their use to scarce centers of

excellence. We believe that as a result of its design, our tumor-specific immunotherapy candidate has the potential to expand the efficacy of immunotherapy into broader patient populations.

We initiated a first-in-human Phase 1/2 clinical trial of our first personalized immunotherapy product candidate, GRANITE, in the fourth quarter of 2018, evaluating it in the treatment of common solid tumors, including metastatic non-small cell lung cancer, or NSCLC, and gastroesophageal, bladder and microsatellite stable, or MSS, colorectal cancers, in each case in combination with checkpoint inhibitors. We dosed our first patient in the first quarter of 2019. Similar to SLATE, the Phase 1 portion of our Phase 1/2 trial will seek to establish a dose for further investigation in Phase 2 and to evaluate safety, tolerability and, importantly, immunogenicity of our lead product candidate. We will seek to further evaluate efficacy and safety in the Phase 2 cohort expansion portion in several common solid tumor types.

We presented early immunogenicity data from both the GRANITE and SLATE Phase 1 clinical trials at the European Society of Medical Oncology Immuno-Oncology meeting (ESMO-IO) in December 2019. We showed that our immunotherapy product candidates could be administered safely to cancer patients at the doses studied to date, with typical adverse events expected with potent viral-vector based immunizations, such as fever and injection site reactions that were self-limiting, but with no dose-limiting toxicities. No other toxicity patterns have emerged to date. Despite the low doses deployed, and absence of ipilimumab (which will be included in later cohorts), potent immune responses were observed in GRANITE patients, with very strong CD8+ T cell responses to TSNA measurable in all patients, as assessed using a standard overnight ("ex vivo") ELISpot assay. (There was an insufficient number of SLATE patients available for analysis at that time.) Responses to multiple neoantigens were detected, and in one patient who provided large numbers of T cells for analysis (by voluntary leukapheresis), specific responses to 12 of 20 administered neoantigens were measured. In addition to being large in number (over 1,000 TSNA-specific CD8+ T cells per 10^6 peripheral blood mononuclear cells in 2 of 3 patients), the elicited T cells were also cytotoxic in phenotype, with Granzyme B production demonstrated for multiple patients. We also demonstrated that some of the TSNA specific T cells were de novo primed by the heterologous prime boost immunotherapy versus others, which were preexistent at low frequency before vaccination. Early efficacy data will be presented in the first half of 2020.

We are also leveraging our expertise in cancer genomics and our tumor antigen discovery platform to go beyond shared TSNA and identify novel peptide sequences (not mutated) that may be shared across common tumor types (tumor-specific shared antigens), which we believe are likely to have value as targets to direct T cells onto tumors specifically. Shared antigen targets enable us to develop additional therapeutic approaches to redirect T cells to tumors using these highly specific targets, such as our bispecific antibody (BiSAb) platform. Redirecting T cells to tumors using BiSAb has been validated in the treatment of B cell malignancies with compelling data generated using CD19-CD3, CD20-CD3 and BCMA-CD3 bispecific antibodies. The CD3 binding domain recruits and activates T cells, and the CD19, CD20 or BCMA binding domains ensure recognition and killing of the B cells by the activated T cells. While these approaches do not distinguish between normal and malignant B cells, which leads to the killing of normal B cells, human survival in the absence of normal B cells is feasible (intravenous immunoglobulin infusions can be administered as needed). We believe the strategy is viable given the existence of absolute B cell lineage specific markers (such as CD19, CD20, CD22, and BCMA) which are not found on any other normal tissues. Applying this concept to the treatment of solid tumors has proven to be challenging because most solid tumor cell-surface markers are also expressed on vital normal tissues, that will result in on-target, off-tumor toxicities. Gritstone's proposed solution to this problem is to develop BiSAb that bind to HLA-peptide complexes on the surface of tumor cells where the peptide is either a mutant peptide (derived from a shared neoantigen such as KRAS) or a peptide from a cancer testis antigen (a family of intracellular proteins, some of which are only expressed on normal testis tissue and tumors). Identifying antibody fragments that only bind to the specific HLA-peptide complex is challenging but achievable (so-called TCR-mimetic antibodies) and these can be combined with traditional CD3 binding domains to generate BiSAb which we have shown have the potential to kill tumor cells potently and specifically in vitro and in vivo. Gritstone has elected to focus its efforts on a KRAS mutation and a cancer-testis antigen as lead clinical candidates, and the nomination of the final sequences (development candidate nomination) is expected in the second half of 2020, with an IND filing expected in the second half of 2021.

An additional therapeutic approach that uses shared tumor-specific antigens is the modification of the receptors of the patient's own T cells to redirect them to recognize tumor targets (adoptive T cell therapy). In August 2018, we announced our first collaboration supporting this strategy with bluebird bio, Inc., or bluebird, whereby we will identify up to ten tumor-specific targets and associated T cell receptors for some of the selected targets for therapeutic application within bluebird's cell therapy platform.

To deliver on the promise of our novel therapeutic approach, we have assembled a highly experienced management team with focused expertise in each of our core disciplines of cancer genomics, immunology and vaccinology, clinical development, regulatory, and biomanufacturing from several leading biotechnology companies, including Clovis Oncology, Inc., Pfizer Inc., Genentech, Inc. and Foundation Medicine, Inc. Our co-founder Dr. Andrew Allen brings experience as a co-founder and Chief Medical Officer of Clovis Oncology, Inc., with prior experience in various leadership roles at Pharmion Corporation and Chiron Corporation, where he worked on Proleukin (IL-2), the first cancer immunotherapy. The scientific advisory board includes selected experts in relevant disciplines, including Dr. Timothy Chan (Memorial Sloan Kettering Cancer Center) and Dr. Naiyer Rizvi (Columbia University

Medical Center) who together first demonstrated that TSNA are key T cell targets in cancer patients responding to checkpoint inhibitor therapy, as well as Dr. James Gulley (National Cancer Institute) who is an international expert in cancer immunotherapy with a focus on vaccines.

We have assembled a team of industry leaders, each possessing specific expertise that we believe will allow us to build and deploy our proprietary EDGE platform to predict tumor-specific T cell targets and deliver personalized cancer immunotherapies to patients. Our goal is to eradicate cancer by initially developing personalized immunotherapies that focus on the unique and individual nature of a patient's tumor. Our strategy to achieve this includes the following key components:

- ***Drive the SLATE clinical program into Phase 2 testing, including adjuvant indications, and expand into multiple tumor types which may require different TSNA cassettes.*** The first version of SLATE is largely focused on KRAS mutations and is thus has potential for use in patients with lung, colorectal and pancreatic cancer in whom such mutations are common. Driving this program forwards is a priority, and Phase 1 dose escalation is moving quickly since the product is "off-the-shelf." Once a recommended Phase 2 dose (RP2D) has been identified, Phase 2 expansion (single-arm cohorts) into microsatellite-stable (MSS) colorectal cancer (3rd line), NSCLC (2nd line after prior immunotherapy) and pancreatic cancer (1st line maintenance) is planned, where efficacy signals may be discernable, notwithstanding combination therapy with checkpoint inhibitors (CPI), since CPI have very modest efficacy in these contexts. Furthermore, if we observe durable and frequent objective responses in the first two of these settings (excluding maintenance), then we may pursue development under the accelerated approval pathway in the US with single-arm pivotal trials given low efficacy of typical treatment options. The discovery of novel shared TSNA is ongoing at Gritstone, and successive SLATE product candidates focused on different mutations (from KRAS) are expected.
- ***Rapidly advance the GRANITE clinical program into Phase 2 testing, including an adjuvant indication.*** GRANITE clinical data has already demonstrated initial positive safety results and an ability to induce substantial neoantigen-specific CD8+ T cell responses in cancer patients. Once RP2D has been established, we intend to move into Phase 2 (single-arm) expansion cohorts in patients with advanced gastric (2nd line) and MSS-colorectal cancer (3rd line) with a similar approach as the SLATE program, where efficacy signals may be discerned given low CPI activity, and the possibility of pursuing an accelerated approval strategy with objective response rate/duration data from single-arm trials.
- ***Invest in our Gritstone EDGE platform and maximize its utility across modalities***. Using contemporary DNA/RNA sequencing, mass spectrometry and machine learning approaches, we have developed our EDGE platform, which is designed to predict the antigenic landscape of a tumor that allows for select targeting with personalized immunotherapy. We have analyzed surface HLA-peptide presentation of over 1,000 human tumor and normal tissue samples from a variety of ethnicities, together with multiple cell lines, and this enormous dataset comprising >3 million tumor-presented peptides has been used to advance our detailed understanding of tumor antigens (both neoantigens and other non-mutated shared tumor-specific antigens). We have trained the EDGE model to predict class I HLA-presented neoantigens on human tumors (as used in our clinical SLATE and GRANITE programs), and we have extended the model to include class II HLA-presented neoantigens which we anticipate will also be deployed clinically during 2020. We have predicted and then validated multiple novel shared TSNA, and this has enabled development of the SLATE program. We are now using EDGE to identify novel classes of neoantigens, and are investigating the inclusion of T cell responses to peptides into the prediction model to further drive predictive performance for the development and application of our personalized immunotherapies.
- ***Develop novel bispecific antibodies (BiSAb) with solid tumor-specific targets.*** We are focused on optimizing a BiSAb that is specific to (a) CD3 (T cell activation) and (b) a solid tumor-specific HLA-peptide complex. We expect to nominate a development candidate in the second half of 2020 and file an investigational new drug application, or IND, in the second half of 2021. We may seek to partner within this program for solid tumor-specific targets.
- ***Continue to build our in-house biomanufacturing capabilities to maintain the highest controls on quality and capacity.*** We believe the speed, quality, reliability and scalability of our manufacturing capabilities will be a core competitive advantage to our clinical development and commercial success, and we have invested extensively in building our own manufacturing facilities for the GRANITE and SLATE programs. While we initially outsourced all of our manufacturing, over the past three years we have successfully internalized all of the biomanufacturing steps to drive down both cost and production time, as well as establish full control over intellectual property and product quality. We do still outsource some quality control testing, although we have internalized many of these elements as well, where prudent and feasible. We believe that operating our own manufacturing facility will provide us with enhanced control of material supply for both clinical trials and the commercial market, will enable the more rapid implementation of process changes, and will allow for better long-term manufacturing cost control. We may elect to outsource certain aspects of product manufacturing (such as lipid nanoparticle encapsulation of our RNA) for convenience, but importantly, we have the capability to manufacture every element of our heterologous prime-boost immunotherapy candidates.

- ***Move tumor-specific immunotherapy into community oncology settings and earlier lines of treatment.*** We are designing our tumor-specific immunotherapy product candidates to fit into a community oncology setting, where the vast majority of cancer patients are treated. For SLATE, patient identification simply requires a routine tumor mutation test (such as those performed by Foundation Medicine, Guardant and Tempus) plus HLA typing (a routine blood test performed on 3-5 ml peripheral blood at most academic medical centers). For GRANITE, we assess program eligibility and design product using a routine tumor needle biopsy. This approach is designed to enable oncologists to integrate our tumor-specific immunotherapy product candidates into their treatment practices without requiring a change in the current treatment paradigm. We believe this strategy has the potential to extend the use of our medicines into the community setting, potentially enabling rapid trial execution, and potentially allowing for commercial use beyond limited centers of research excellence. This is key since we intend to develop our tumor-specific immunotherapy product candidates in earlier lines of treatment (adjuvant, neo-adjuvant, front-line treatment of advanced disease), where recent clinical data with other forms of immunotherapy suggest efficacy is likely to be stronger, versus being only used in highly refractory or late-stage cancer patients. This intention is enabled by new liquid biopsy techniques whereby the reliable detection of minute amounts of tumor-derived DNA in blood may be used both to stratify patients (identify those at high risk of disease recurrence or progression even if imaging data suggests eradication of disease) and may potentially offer a surrogate endpoint for more rapid assessment of therapeutic efficacy versus traditional clinical endpoints.
- ***Enter into collaborations to realize the full potential of our platform.*** The breadth of our EDGE platform enables its application to a variety of therapeutic formats, including cell therapy, bispecific antibodies and other areas where shared tumor (neo)antigens could be impactful to cancer treatment. We intend to form collaborations around certain aspects of our platform, such as shared tumor antigens, as we believe we will benefit from the resources and capabilities of other organizations in the manufacture, development and commercialization of such diverse immunotherapies. Aligned with this strategy, our strategic collaboration with bluebird involves use of our EDGE platform to identify tumor-specific targets and associated T cell receptors for clinical application within bluebird's cell therapy platform.

Our Immuno-Oncology Based Approach to Cancer Therapy

Immuno-Oncology and Tumor-Specific Neoantigens

Immuno-oncology is an emerging field of cancer therapy that aims to activate the immune system to enhance and/or create anti-cancer immune responses, as well as to overcome the immuno-suppressive mechanisms that cancer cells have developed against the immune system. It is now well established that the immune system can, on occasion, successfully eliminate all tumor cells, leading to long-term benefit, even cures, in some patients with solid tumors. The primary challenge in immuno-oncology is to extend this useful biology to many more cancer patients, and to do so earlier in the treatment paradigm. Understanding which cells of the immune system are critical, what they recognize on tumor cells, and why they are typically absent or ineffective in cancer patients is core to overcoming this challenge. T cells are the vital foot soldiers in the immune attack upon cancer cells. T cells have evolved to recognize "foreign" markers on cells infected by viruses, and DNA mutations, which are a hallmark of cancer, often lead to the generation of such "foreign" markers, which are different from normal or "wild-type" proteins. Exploitation of this cancer cell vulnerability using new biological and computational tools lies at the heart of our programs.

Critical Importance of T Cells

The most critical components of the immune response to tumors are T cells, white blood cells which mature in the thymus gland. T cells can be classified into two major subsets, CD4+ T cells and CD8+ T cells, based on expression of CD4 or CD8 markers on the surface of the T cell. CD4+ T cells (also referred to as helper T cells) provide help to the immune response by secreting cytokines that enhance the activation, expansion, migration and effector functions of other types of immune cells. CD8+ T cells (also referred to as cytotoxic or "killer" T cells) can directly attack and kill cells they recognize as abnormal. An activated CD8+ T cell attacks and kills a target cell when the T cell encounters its target and the T cell receptor, or TCR, recognizes and binds to a specific protein complex on the target cell. This protein complex is comprised of a short peptide (fragment of a protein) bound to a platform molecule called, in humans, the human leukocyte antigen, or HLA, complex. This HLA/peptide complex is the antigen recognized by a T cell receptor. The peptides recognized by typical CD8+ T cells are quite short (8-12 amino acids long) and are presented on so-called Class I HLA molecules (such as HLA-A, -B or -C). The peptides recognized by typical CD4+ T cells are longer (15-25 amino acids) and are presented on Class II HLA molecules (such as HLA-DP, -DQ and -DR).

One of the primary functions of T cells is to detect and eliminate normal cells that have been infected by a virus to prevent virus spread and limit harm to the host. To accomplish this, T cells are "trained" in the thymus early in life to differentiate between HLA/peptide complexes that are "self" derived (an HLA presenting a peptide derived from a normal self-protein) and those that are "foreign" or "non-self" (an HLA presenting a peptide derived from a non-self-protein such as a viral protein). When the immune system develops early in life, T cells that recognize self peptides are eliminated in the thymus to avoid the risk of an auto-immune

reaction, in a process called central tolerance. T cells that recognize a non-self peptide are nurtured and sent from the thymus to patrol the body, looking for evidence of non-self markers on cells, such as virally infected cells. Because cancer cells carry DNA mutations, which may alter protein/peptide sequences, tumor cells can also present non-self peptides bound to HLA platforms on the cell surface and, as a result, can be recognized as non-self and destroyed by T cells. In this case, the DNA mutation in a tumor creates a novel non-self peptide sequence, which, if it can be recognized by a TCR, is called a tumor-specific neoantigen, or TSNA.

Tumor-Specific Neoantigens

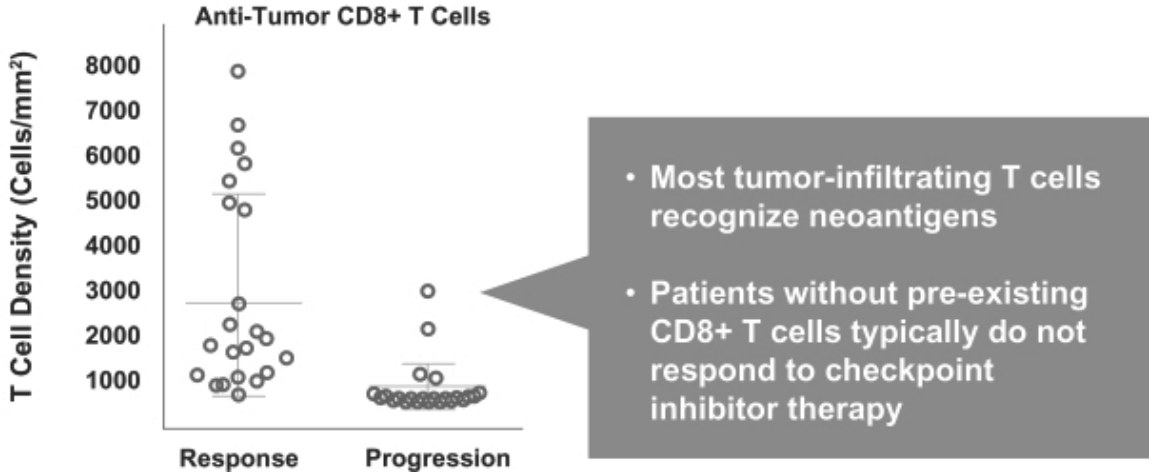
The notion that T cells can recognize TSNA on the surface of tumor cells is well established. It is only recently, however, that tools and techniques have been developed to test this idea in humans. Two advances proved critical. First, the advent of checkpoint inhibitors provided cohorts of cancer patients who developed immune responses that destroyed their tumors, leading to clinical responses that could be studied at a molecular level. Second, the development of fast, inexpensive DNA and RNA sequencing techniques provided the ability to sequence and catalog tumor DNA mutations that might give rise to neoantigens. T cells from cancer patients who had responded well to checkpoint inhibitors could then be screened against candidate neoantigens to see if the patient data supported the hypothesis that T cell recognition of TSNA could kill tumor cells effectively.

In 2014 and 2015, two of our co-founders, Dr. Timothy Chan and Dr. Naiyer Rizvi, brought these two concepts together in papers demonstrating that melanoma and lung cancer patients who responded to checkpoint inhibitor therapies had developed T cells that recognized TSNA (Snyder et al., The New England Journal of Medicine (2014); Rizvi et al., Science (2015)). Further evidence from Dr. Steven Rosenberg (Center for Cancer Research) and Dr. Ton Schumacher (Netherlands Cancer Institute) demonstrated that in patients with solid tumors, T cells could be found infiltrating tumors which were specific for TSNA, and could be expanded and used therapeutically to kill tumor cells (Stevanovic et al., Science (2017); Schumacher and Schreiber, Science (2015)). Together, this body of research suggests that in patients with common solid tumors, T cells can selectively destroy tumor cells through recognition of TSNA.

Immune Evasion

While some patients do respond to checkpoint inhibitor therapy with the mobilization of T cells that recognize TSNA and kill tumor cells, such patients are in the minority (0-20% for most common solid tumors (Kiy et al., Febs Letters (2013)). Research into this clinical observation has shown that patients who respond to checkpoint inhibitors typically have, prior to therapy, inflamed tumors that contain infiltrating T cells (particularly cytotoxic CD8+ T cells) and that express markers of immune activation.

Figure 1. Response in Melanoma Patients Treated with Anti-PD-1 Antibody (Pembrolizumab) is Associated with Anti-Tumor T Cell Infiltration of the Tumor at Baseline*



* Adapted from Tumeh et al., *Nature* (2014)

While the immune systems of these patients have recognized their tumors through the recognition of TSNA, the tumor-specific T cells have been shut down or inactivated in the tumor. Checkpoint inhibitors are capable of "re-activating" these T cells, but most patients fail to respond to checkpoint inhibitor treatment because tumor-specific T cells are absent from the tumor due to tumor "evasion" of the patient's immune response. We believe it is highly likely these patients have so-called "naïve" T cells in their bodies

that have the ability to recognize the TSNA on tumor cells but that have not yet been activated. As a result, immune recognition, or the activation of the naïve T cells to the tumor antigen, and the generation of a large memory tumor-specific T cell response has not (yet) taken place.

Our Therapeutic Hypothesis

TSNA offer extremely attractive therapeutic targets for T cell-directed therapy because they are non-self and tumor-specific, and have been shown to function as the key T cell targets in humans responding to immune checkpoint inhibitor therapies. The fact that TSNA are non-self has several key implications:

- Every person's existing, internal TCR repertoire of naïve T cells should be able to recognize TSNA presented by any tumor that arises within the body.
- A potent, focused T cell response against TSNA should be limited to an attack on the tumor, with minimal destruction of normal cells (off-tumor toxicity).
- TSNA are key targets for an effective human anti-tumor immune response, which means TSNA can be used therapeutically.

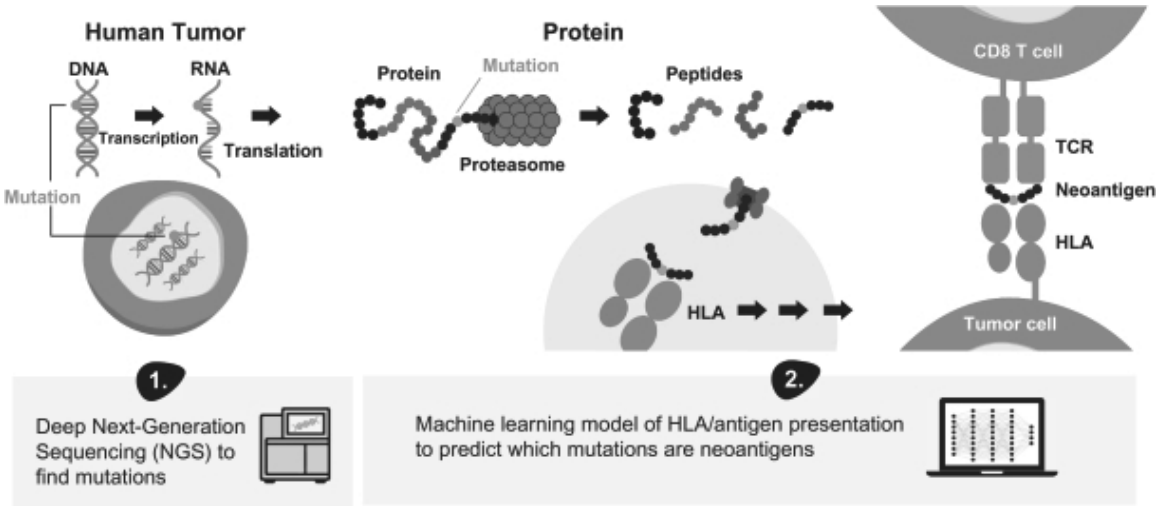
Our fundamental therapeutic hypothesis is that patients with common solid tumors often have TSNA, but the tumors have successfully evaded the patient's immune system. Our goal is simple—to activate a potent TSNA-targeted T cell response using routine therapeutic interventions.

Our Gritstone EDGE Platform

Design of Our EDGE Platform

Neoantigens in tumors are created via a multi-step process starting with mutation in the cancer DNA, and leading to mutated peptides presented by the HLA on the surface of tumor cells. To select neoantigens for immunotherapy for cancer patients, we created our EDGE platform, which captures the essential elements of neoantigen biology via a combination of laboratory assays and computational analyses. The two steps of our EDGE platform prediction process are shown in Figure 2 below.

Figure 2. EDGE Platform



EDGE Step 1—Mutation Identification

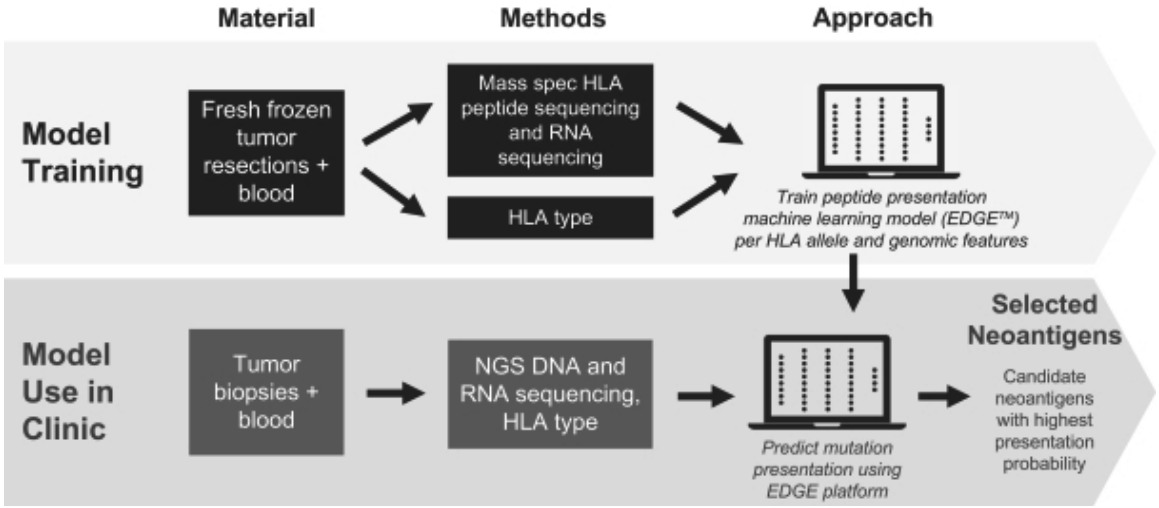
Identification of neoantigens requires accurate identification of tumor mutations and measurement of their expression levels in patient cancer specimens. To achieve this, we have built an in-house next-generation sequencing laboratory to perform deep sequencing of tumor DNA and RNA, as well as sequencing of the patient's normal DNA. This first step in the EDGE process analyzes routine, core needle, formalin-fixed paraffin embedded tumor biopsies and identifies tens to hundreds of tumor mutated sequences.

EDGE Step 2—Neoantigen Prediction

Only a small fraction of tumor mutated sequences are expected to result in actual neoantigens presented on the surface of tumor cells. This fraction may be as low as approximately 1% of all mutations. To accurately predict which neoantigens will be presented on the surface of tumor cells, we have generated a large dataset of HLA/peptides from human tumor and matched normal tissue specimens. Our process isolates and sequences HLA/peptides, using the immunopeptidomics mass spectrometry approach. We also analyze tumors for level of RNA expression of all genes. Our dataset now comprises more than 600 tumor, normal tissue, and cell-line specimens subjected to broad (DDA) immunopeptidomics for Class I or Class II HLA. These samples span a variety of solid cancers from patients of several ancestries to ensure broad coverage of diverse patient HLA types. Each tumor specimen can yield thousands of HLA/peptides and the total dataset has now grown to >3 million (>1.5 million unique) HLA-presented peptides.

We use a subset of these and selected published peptide datasets to train a machine-learning model for Class I neoantigen prediction in our EDGE platform. The model learns the critical DNA/RNA sequence features and other factors like RNA expression that lead to a greater likelihood of peptide presentation by the HLA. Our EDGE model analyzes mutated peptides in turn and calculates the probability that the peptide will be presented by the patient's HLA on the surface of the tumor cell, or HLA-presented peptides. We prioritize mutations with the highest probability of presentation for inclusion in that patient's personalized immunotherapy. A schema of EDGE model training and clinical application are illustrated in Figure 3 below. Given that HLA Class I presentation is most common in solid tumors, we initially focused on collecting data and training EDGE to predict HLA Class I peptides. Recently, EDGE was extended to also predict HLA Class II peptides and thus allow identification of neoantigens presented by the patient's professional antigen presenting cells (APCs), which we believe may strengthen the anti-tumor immune response further.

Figure 3. EDGE Model Training and Application



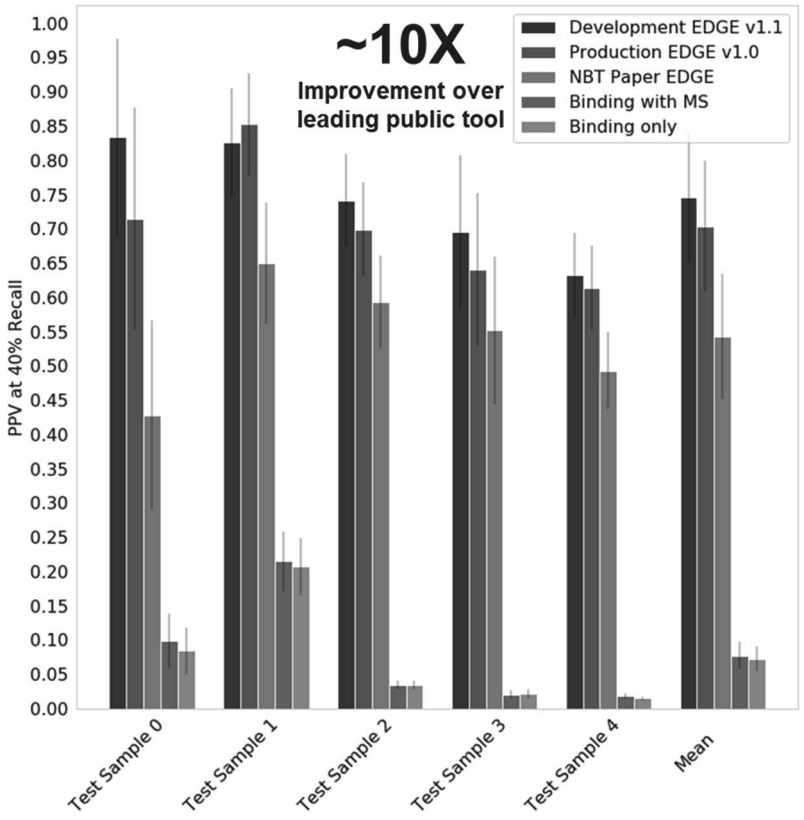
EDGE Neoantigen Prediction Performance

Accurate TSNA prediction is critical for our personalized immunotherapy, and we have evaluated the prediction performance of our EDGE model in two ways. First, we assessed the ability of the EDGE model to predict HLA presented peptides. We then tested whether the ability to predict HLA presented peptides translated into the ability to predict which mutations give rise to neoantigens with tumor-relevant T cell responses in patients. These results were initially published in Nature Biotechnology (Bulik-Sullivan et al., Nature Biotech., (2018)) and updated in follow-on internal analyses throughout 2019.

Prediction of HLA-Presented Peptides

To assess EDGE model performance for prediction of HLA presented peptides, we used five tumor samples with HLA/peptides measured by mass-spectrometry that were not included in model training. For these test specimens, we predicted which peptides are likely to be presented on the tumor cell surface. We evaluated the quality of our predictions by calculating the positive predictive value, or PPV, which is the fraction of predicted peptides that were detected on the tumor HLA. As a benchmark, we compared performance of our prediction to that of a leading open source tool. Averaged over the test samples, our EDGE platform achieved a PPV of greater than 70%, representing an approximately 9-10-fold improvement over standard methods, as shown in Figure 4 below. We believe that TSNA selected by our EDGE platform have a much higher likelihood of being useful targets for immunization than those selected using previous methods.

Figure 4. Performance of EDGE Model for HLA/Peptide Prediction

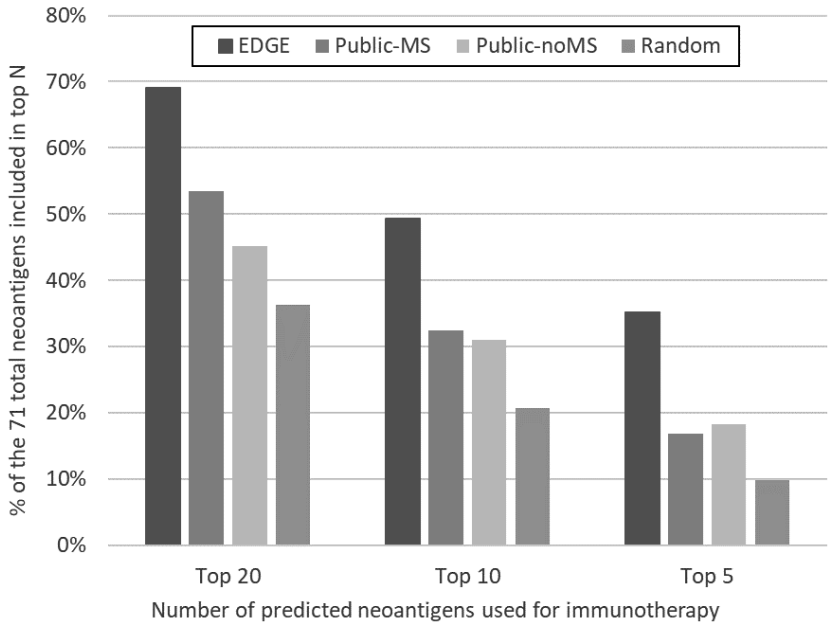


Prediction of TSNA with T Cell Responses in Patients

To show that our prediction of HLA/peptide presentation enables prediction of tumor-specific neoantigens that can be targeted by T cells in patients, we assembled a large test set of independently validated, published neoantigens. The dataset comprised five studies from the literature, including 45 patients with melanoma, gastro-intestinal cancers and breast cancer who had CD8 responses against one or more neoantigens in their tumor. In these patients, over 5,000 mutations were comprehensively analyzed for anti-tumor immune response using either tumor-infiltrating lymphocytes (TIL) or activated T cells from the blood. 71 mutations were demonstrated to result in neoantigens. Applying our EDGE model to select the top mutations for each patient from DNA/RNA sequence alone to simulate GRANITE production, we found that EDGE was able to prioritize the majority of these validated neoantigens and outperformed the public approach.

These results are illustrated in Figure 5 below.

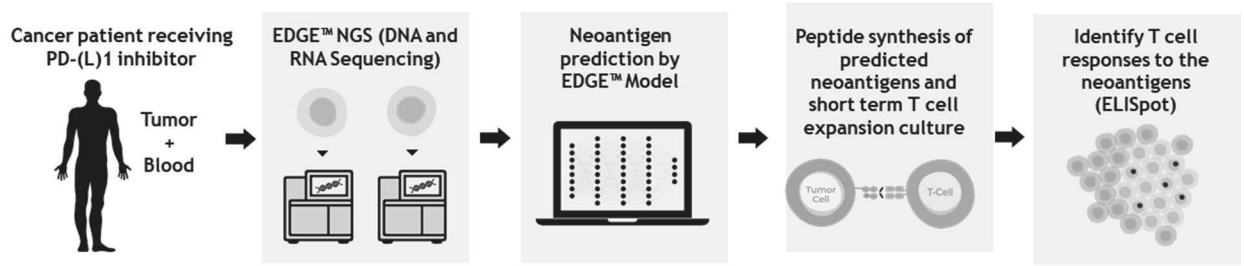
Figure 5. EDGE Platform Identification of TSNA for Immunization in 45 Patients



Ongoing EDGE Platform Validation

To further validate our EDGE platform's ability to identify TSNA in patients, we also analyzed peripheral blood obtained from NSCLC and prostate cancer patients receiving PD-(L)1 checkpoint inhibitors, wherein T cell recognition of predicted TSNA is assessed. This process is shown in Figure 6 below.

Figure 6. Gritstone Analysis of Neoantigen T Cell Responses in NSCLC Patients



Data from this study have shown that our EDGE platform identified TSNA-specific T cells in a majority (9/13, 69%) of patients tested, with an average of two peptides recognized per patient in patients with detectable TSNA-specific T cells.

Genomic and immune response data from our clinical trials will serve to further validate and refine our EDGE platform.

Our Personalized Tumor-Specific Neoantigen Therapy

Overview

Our therapeutic hypothesis is that treatment with personalized TSNA-containing vectors combined with immune checkpoint inhibitor therapy will generate *de novo*, or augment existing, selective, TSNA-specific T cell response, unleashing the natural power of the immune system on tumor cells, potentially improving efficacy without a substantial increase in off-tumor toxicity. Our personalized immunotherapy candidates are designed to fit easily into a community oncology setting and to be administered in earlier

lines of treatment rather than only in refractory or relapsed cancers. We have designed our personalized immunotherapy candidates such that oncologists will not have to alter their treatment practices, and we believe that this will extend the utility of our product candidates, if approved, into the community setting and not limit their use to scarce centers of excellence. We believe that as a result of its design, our personalized immunotherapy candidate has the potential to expand the efficacy of immunotherapy into broader patient populations.

Gritstone is developing two forms of personalized immunotherapy, both of which are in clinical testing. The first, represented by the SLATE product class, involves the administration of a neoantigen therapy containing shared neoantigens derived from common driver mutations such as in KRAS and TP53. To be a candidate for SLATE, a patient must first be assessed by asking two questions: (1) does their tumor genome contain a DNA mutation represented within the SLATE cassette; and (2) do their cells express a specific HLA molecule that can present a particular mutated peptide as a neoantigen on the tumor cell surface? The tumor genome is routinely studied in contemporary oncology clinical practice either using a tumor DNA gene panel test (as offered by Foundation Medicine, Tempus, Personalis, etc.) or using a peripheral blood gene panel that probes blood for the presence of mutant tumor-derived DNA (as offered by Guardant, etc.). HLA typing is routinely performed by most academic centers on a 3-5 ml peripheral blood sample. Consequently, screening patients takes approximately one week, and SLATE is designed to start very soon after a mutation/HLA match has been identified.

The second personalized immunotherapy from Gritstone is the GRANITE product candidate. This requires a routine tumor biopsy sample to be sent to Gritstone for sequencing, followed by personalized product manufacturing, with a neoantigen cassette designed uniquely for that patient. This process is described in more detail below.

Our Portfolio

We are developing a portfolio of cancer immunotherapy product candidates aimed at the highly targeted activation of tumor-specific T cells in solid tumors. Our leading two clinical-stage programs aim to induce a substantial neoantigen-specific CD8+ T cell response using neoantigen-containing immunotherapies. Earlier in development is our bispecific antibody program which aims to redirect and activate the patients' own T cells adjacent to tumors using tumor-specific HLA-peptide complexes as targets. Multiple HLA-peptide targets are under consideration for this program. T cell receptors, or TCRs, against such HLA-peptide complex targets also have potential therapeutic value if deployed in a cell therapy platform. We have elected not to develop an in-house cell therapy platform at this point, and instead we are using this approach in partnership with bluebird and their adoptive cell therapy platform. The internal programs are described in more detail below.

"Off-The-Shelf" Neoantigen-Directed Immunotherapy Product (SLATE) Product Concept

Using our EDGE platform, we are identifying novel neoantigens arising from genes which are recurrently mutated in cancer because their function is altered in a cancer-promoting manner. Such mutations are termed driver mutations, and they are well characterized given their importance as functional drug targets. Examples include activating mutations in KRAS or EGFR genes which drive cell proliferation and/or growth, and inactivating mutations in genes such as TP53 and APC which normally limit DNA damage or cell proliferation, respectively. As noted above, the existence of a neoantigen is determined by the combination of a mutated peptide and the presenting HLA molecule. It has been demonstrated that a common KRAS mutation (G12D), often found in colorectal cancer, could be processed by tumor cells and presented as a functional neoantigen by tumor cells carrying the HLA-C*08:02 protein. This combination of KRAS mutation and HLA is estimated to be found in 1-2% of colorectal cancer patients. KRAS mutations are also common in lung and pancreatic cancers.

Building on this observation, we have applied our EDGE antigen prediction model to common tumor driver mutations and common Class I HLA alleles, and predicted a large set of candidate shared neoantigens. We have validated several of these predicted candidate neoantigens using mass spectrometry analysis of patient-derived human tumor samples wherein we directly detect a predicted HLA-peptide complex. We have also developed a cell-line system to more efficiently assess predicted shared neoantigens and determine their validity. These data were presented publicly at the SITC conference in November 2019 and Table 1 shows the shared neoantigens, many novel, validated in clinical samples at that point and included in SLATE.

Table 1

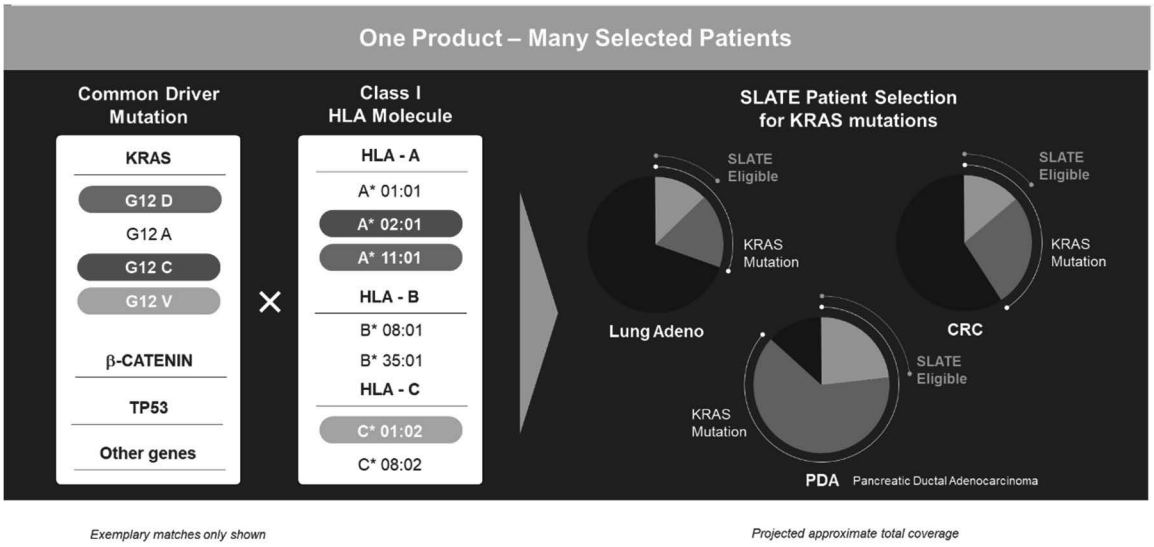
Gene / Mutation	HLA Type validated	Peptide	# of tumor samples detected	Tumor types	First reported in this study*
CHD4_K73fs	B*08:01	8-mer	1	CRC	✓
CTNNB1_S37Y	A*02:01	10-mer	1	Ovarian	✓
CTNNB1_S45P	A*03:01	9-mer	2	CRC	✓
KRAS_G12C	A*02:01	10-mer	2	Lung	✓
KRAS_G12D	A*11:01	10-mer	1	CRC	✓
KRAS_G12D	A*11:01	9-mer	1	CRC	✓
KRAS_G12V	A*03:01	10-mer	2	CRC	✓
KRAS_G12V	A*11:01	10-mer	3	Gastric, Pancreatic, CRC	
KRAS_G12V	A*11:01	9-mer	1	Pancreatic	
KRAS_G12V	C*01:02	9-mer	1	Lung	✓
TP53_K132N	A*24:02	10-mer	1	Ovarian	✓

*As compared to Gritstone literature summary of neoantigens observed in patients; TCR to KRAS G12D A*11 previously reported in murine model

Population genetic analyses suggest that while each such shared neoantigen may only be found in less than 5% of patients with a particular tumor type, our heterologous prime-boost can deliver at least 20 of these TSNA, which we believe has the potential to result in the off-the-shelf product having an addressable population of approximately 10-15% of patients within common solid tumor types such as colorectal cancer and lung cancer. Our off-the-shelf product candidates, the first of which in development is SLATE-,

are designed to be specific to a particular tumor type(s), and the TSNA cassette is fixed for each product. The process for determining which patients are eligible for SLATE therapy is illustrated below in Figure 7.

Figure 7. Gritstone's Prime/Boost Platform Enables Multiple Product Options Including Gritstone's Off-The-Shelf Immunotherapy Platform, SLATE

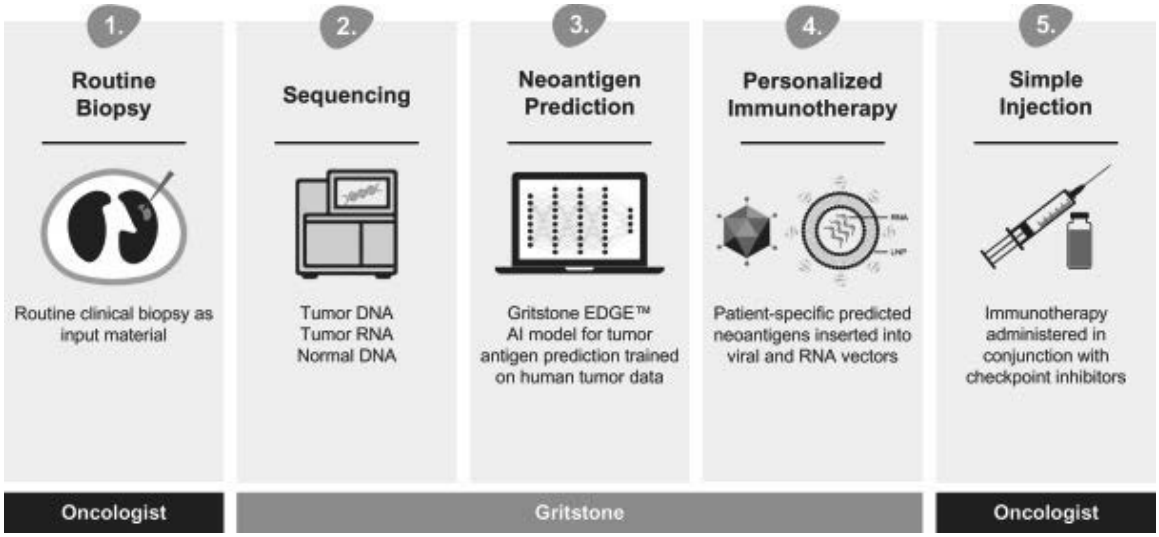


Both of our personalized immunotherapy product candidates, SLATE and GRANITE, use a 20-neoantigen (TSNA) cassette within the same heterologous prime-boost system comprising a viral-vector based prime and SAM boosts. The vector system and its associated pre-clinical data are described below. SLATE entered Phase 1 clinical testing in August 2019 and early clinical data are presented below.

Our "N of 1" Neoantigen-Directed Immunotherapy Product (GRANITE) Product Concept

Our GRANITE personalized immunotherapy process leverages our proprietary EDGE platform to predict the TSNA that will be presented on a patient's tumor, allowing us to create a patient-specific (termed "N of 1") heterologous prime-boost immunotherapy candidate that is designed to elicit a potent anti-tumor T cell response. This process is outlined in Figure 8 below.

Figure 8. Gritstone's GRANITE Personalized Immunotherapy Process



Step 1—Routine Biopsy

Most cancer care takes place in a community oncologist's office rather than an academic center, and we believe products should ideally be designed to be usable in these settings. We are designing and developing our product candidate for administration early in the cancer treatment paradigm, particularly where disease burden is low and a cure is perceived to be more likely. Such early care is also heavily weighted to the community oncologist setting. Consequently, our product development process necessarily begins with a routine biopsy to obtain a specimen of the tumor with a standard needle biopsy performed by an oncologist or radiologist.

Step 2—Sequencing

We then apply customized deep-sequencing and bioinformatic processes in-house to the patient's tumor biopsy specimen and blood to derive high-quality DNA and RNA sequence information and identify tens to hundreds of tumor mutations.

Step 3—Neoantigen Prediction

This tumor mutation sequence data is then entered into our proprietary EDGE platform. Our evolving artificial intelligence platform then predicts the TSNA most likely to be presented on the tumor cell surface.

Step 4—Personalized Immunotherapy

We assemble the predicted TSNA into a patient-specific "cassette." The cassette is incorporated into our heterologous prime-boost personalized immunotherapy candidate, which is manufactured and filled into a vial.

Step 5—Simple Injection

The vial is then shipped to the oncologist's office where it is delivered to the patient by simple intramuscular injection. Our personalized immunotherapy candidate is designed to be administered in combination with standard checkpoint inhibitors to drive large numbers of TSNA-specific T cells to the tumor site, where they remain active.

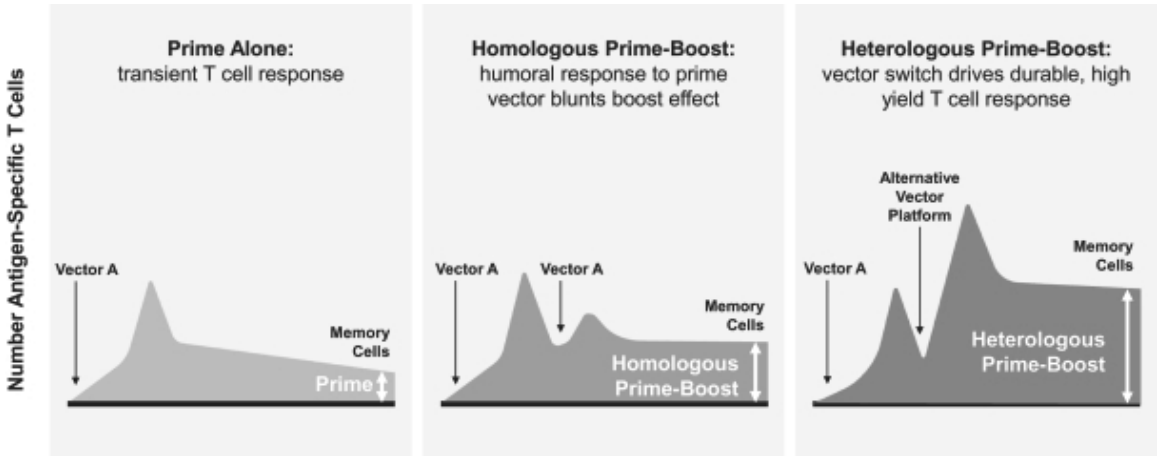
Antigen Delivery System for SLATE and GRANITE – Heterologous Prime-Boost

Our therapeutic goal with both SLATE and GRANITE is to drive a large and sustained T cell response against all TSNA presented on a patient's tumor. Cancer patients may have pre-existing memory T cells directed against some of the TSNA delivered within the neoantigen cassette in their personalized immunotherapy. Boosting such pre-activated TSNA-specific T cells requires less antigen-specific stimulation than priming naïve T cells that have not yet been activated against their respective neoantigen. Importantly, early clinical data in the field suggest that for the majority of TSNA within the immunotherapy cassette, priming naïve T cells will be required to mount a large and broad immune response. Priming naïve T cells is a multi-step process that requires a potent antigen delivery platform able to deliver cassette neoantigens in a highly immunogenic manner.

Human infectious disease vaccine experience has taught us that delivering antigens within an adenoviral vector can prime a substantial T cell response consisting of cytotoxic CD8+ T cells and CD4+ T-helper cells. We believe an adenoviral vector is one of the most potent antigen-delivery platforms to prime naïve T cells. Peptide vaccination has not been able to accomplish this goal.

We believe that continued strong immune pressure upon the tumor is likely necessary to prevent immune escape by the tumor and drive a durable clinical response. To sustain high numbers of tumor-specific T cells, the same tumor-specific antigen can be given in a different vector from that used to prime, as a boost immunization. This heterologous prime-boost concept has been shown to activate and sustain high antigen-specific T cell responses, as shown in Figure 9 below.

Figure 9. Comparison of Heterologous Prime-Boost with Homologous Prime-Boost and Prime Alone



Our Construct

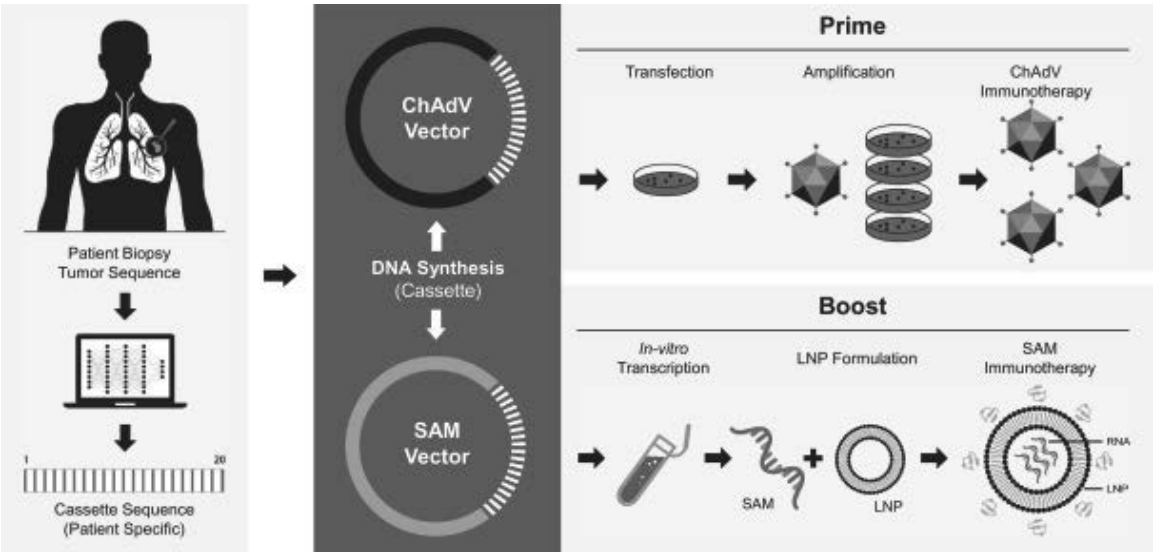
Our personalized immunotherapy candidates consist of (1) a prime vector and (2) a boost vector, both of which contain (3) a 20-neoantigen cassette:

1. *Prime Vector.* The prime vector is a chimpanzee adenovirus, or ChAdV. There is extensive clinical experience with the ChAdV vector platform in infectious disease studies over the last 20 years demonstrating that ChAdV vectors are well tolerated and consistently generate rapid and substantial CD4+ and CD8+ T cell responses that have been shown, in a Phase 2b randomized controlled trial, to protect humans against infections such as malaria.
2. *Boost Vector.* The boost is a self-amplifying mRNA, or SAM, formulated in a lipid nanoparticle, or LNP. A SAM vector comprises RNA that encodes the selected target antigens, such as TSNA, plus an RNA polymerase. After injection into muscle and uptake into host cells, the RNA is translated into protein, and the RNA polymerase starts to replicate the originally injected source RNA, amplifying the number of copies within the cells dramatically. This leads to production of large amounts of the delivered target antigens. During the RNA replication, RNA structures that are foreign to a normal cell are generated, which drives a strong danger signal to surrounding immune cells, triggering an early immune reaction (innate immune response). The presence of large quantities of antigen in an immune-stimulating environment drives profound antigen-specific T cell responses (adaptive immune responses). This approach is fundamentally distinct from using mRNA, which does not possess these attractive properties.

3. *Neoantigen Cassette.* Within each of the two vectors used for the prime and boost immunizations, we include a cassette that contains 20 neoantigens. We have designed the cassette to contain 20 TSNA based on several considerations, including TSNA prediction performance, breadth of the tumor-specific immune response but potential immune competition and manufacturing factors. For SLATE, the cassette is fixed for all patients, and contains common driver mutations which are known to be processed and presented by certain HLA molecules as neoantigens which are shared between some patients. For GRANITE, the cassette is designed and made uniquely for each patient based upon their tumor sequence data and EDGE-based TSNA predictions. Most SLATE patients' tumors will only present a single neoantigen contained within the shared cassette. In contrast, although all of the mutations in a GRANITE cassette are contained within the patient's own tumor and can activate T cell responses post immunizations, it is expected that some of the delivered mutations, while present in the tumor genome, will not be processed and presented as a tumor cell surface neoantigenic HLA-peptide complex. We expect this to be acceptable since these sequences are not wild-type (found in normal cells) and therefore only an irrelevant mutated peptide-specific immune response is expected to be elicited.

The prime and boost immunotherapy construction is depicted in Figure 10 below.

Figure 10. Prime and Boost Immunotherapy Construction



Our current manufacturing process includes Gritstone and qualified third-party contract manufacturing organization, or CMO, sites that are designed to operate under cGMP requirements. In 2019, we continued to build the internal capability to manufacture our products entirely using internal facilities and staff for reasons of process improvement, intellectual property development, economic advantage, logistical flexibility, control of drug quality and security of drug supply. In brief, this manufacturing process includes tumor sequencing and TSNA prediction (for GRANITE), TSNA cassette design and synthesis, production of TSNA cassette plasmid and subsequently ChAdV and SAM manufacture containing the TSNA cassette, lipid nanoparticle encapsulation of the SAM, and some elements of release testing. Although we have developed these capabilities, we will assess on an ongoing basis which aspects will continue to be outsourced, and these may change over time. SLATE manufacturing, as a fixed, "off-the-shelf" product, is not time-sensitive and is relatively straightforward operationally. GRANITE, on the other hand, is an "N of 1" product and is manufactured in real-time for each patient, which involves a greater logistical burden. The GRANITE manufacturing process starts when tumor samples are received by our sequencing lab in Cambridge, Massachusetts. Our EDGE platform is used to select 20 appropriate genetic sequences for neoantigen manufacturing, and these genetic sequence cassettes are inserted into plasmid backbones. The ChAdV vector, which encodes the genetic sequence in the cassette, is sent to our Pleasanton, California facility for manufacturing the prime immunotherapy, and the SAM vector, which encodes the genetic sequence in the cassette, is used for manufacturing the boost immunotherapy. This end-to-end process, from biopsy receipt to shipment of the personalized heterologous prime-boost immunotherapy to the clinical site for patient administration, initially takes approximately 16-20 weeks. This period is broadly consistent with the stated production and release times for other personalized immunotherapy approaches (mRNA or peptide) described in the literature and, importantly, acceptable for deployment in early treatment of cancer patients in the adjuvant setting where clinical urgency is lower as compared to the relapsed or refractory late stage setting in which adoptive T cell therapy may be utilized.

Our Preclinical Non-Human Primate Data

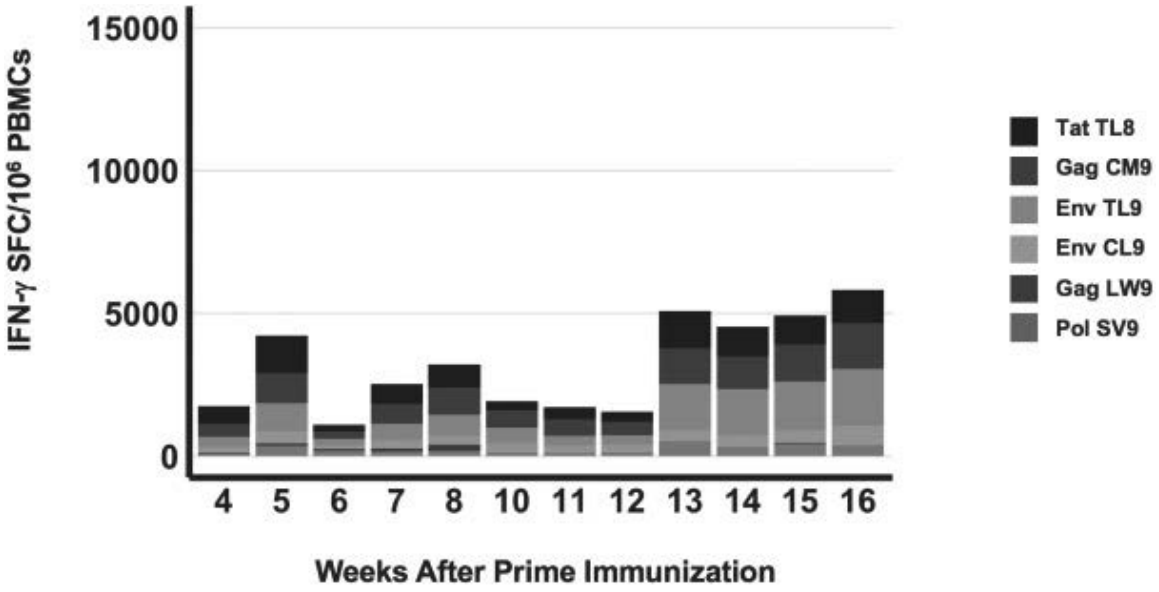
Our goal is to drive a large and sustained TSNA-specific T cell response to control tumor growth and/or eradicate the tumor. Published data from adoptive T cell therapies provide preliminary guidance on clinically efficacious T cell levels in patients. These studies suggest that T cell levels of approximately 10,000 antigen-specific T cells per milliliter of blood measured in patients four weeks post-infusion indicate clinical benefit.

We have focused our preclinical program on assessing the potency of our immunotherapy candidate in non-human primates, or NHPs, because published data suggests that NHPs' immune responses to our immunotherapy candidate will better predict human data than murine models due to the comparative similarities between NHP and human immune systems. Preclinical and clinical studies have shown that T cell responses induced in NHPs were predictive of responses in human clinical trials—the same relative potency was observed for different vaccinations in NHPs and humans. In these studies, a small 1.5- to three-fold decrease in absolute T cell response was measured when comparing NHPs to humans. By contrast, murine models, while simple, have been shown to be less likely to predict outcomes of cancer immunotherapy in humans, believed to be due to the many differences in immune system components between humans and mice.

We have completed two preclinical studies in NHPs to demonstrate the ability of our heterologous prime-boost immunotherapy approach to prime a potent immune response against the non-self model antigens delivered within the cassette. We constructed ChAdV and SAM vectors encoding viral, non-self model antigens because NHPs do not have tumors or TSNA. These antigens are derived from Simian Immunodeficiency Virus (SIV) which is the monkey-tropic version of Human Immunodeficiency Virus (HIV). We collected blood samples, which include T cells, throughout the studies pre- and post-immunization to measure the kinetics and level of T cell responses specifically directed against the model antigens. T cells were isolated from the blood and the number of antigen-specific T cells are reported as spot forming cells, or SFCs, per 10^6 peripheral blood mononuclear cells, or PBMCs, which is a measure of the number of antigen-specific cytokine secreting cells (typically T cells) in an NHP. CD8+ T cells comprise one of the critical fractions of T cells quantified with this T cell assay.

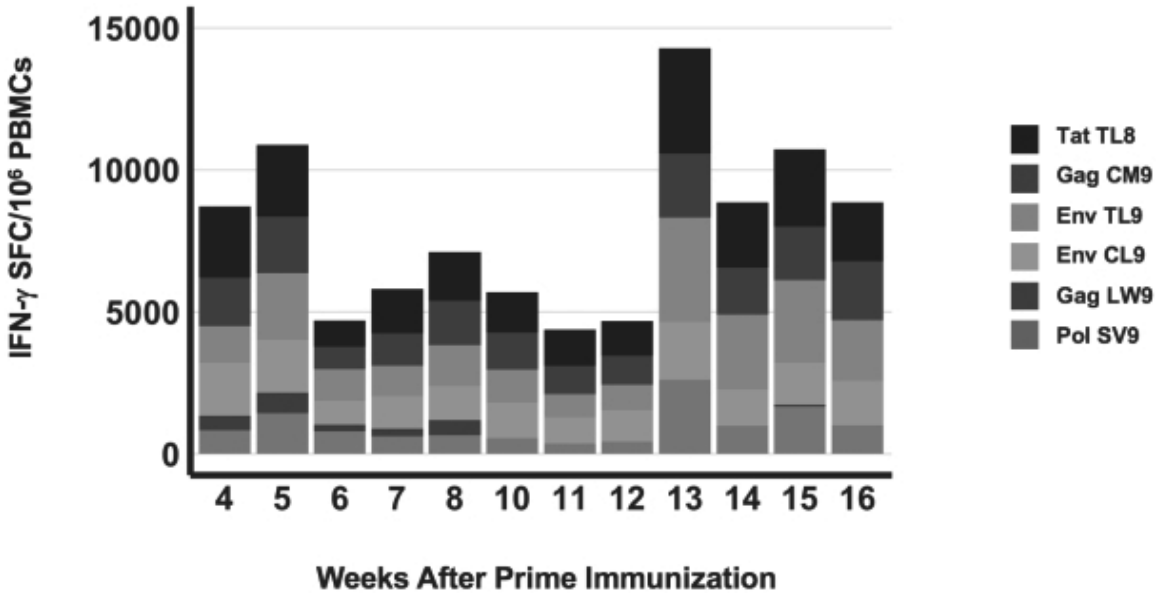
In our experiments, the NHPs immunized with ChAdV showed a rapid priming of T cell responses that peaked 14-21 days after immunization with combined immune responses to all six non-self model antigens of approximately 2,000 spot-forming cells, or SFCs, per 10^6 PBMCs. These data are consistent with immune responses reported in the literature for adenoviral vectors. Administration of a SAM boost, four weeks after the ChAdV prime, increased T cell responses approximately two-fold, with combined immune responses to all six non-self model antigens of approximately 4,000 SFCs per 10^6 PBMCs measured seven days after the SAM boost, as shown in Figure 10 below. These T cell responses increased further after a second SAM boost at week 12, to around 5,000 SFCs per 10^6 PBMCs and were maintained at these levels for four weeks without further boosts. T cell responses to each individual antigen were broadly comparable in magnitude for four of the six antigens administered. We anticipate that this breadth of T cell response against multiple antigens delivered within the cassette will be essential for the control of tumors within a patient.

Figure 11. Immune Response in NHPs to Heterologous Prime-Boost Immunotherapy Without Co-Administration of Checkpoint Inhibitors



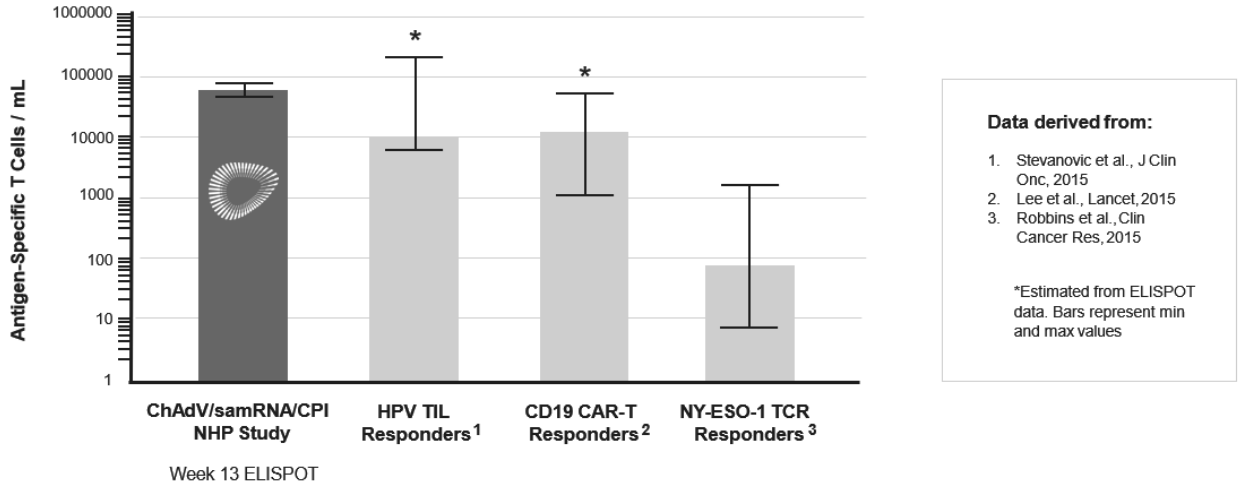
The literature suggests that the addition of immune checkpoint inhibitors increases T cell expansion when combined with a vaccine. To study this concept, we administered our immunization to NHPs in combination with the checkpoint inhibitor anti-CTLA-4. Co-administration of anti-CTLA-4 monoclonal antibodies, or mAb, with the ChAdV immunotherapy significantly increased ChAdV priming with a combined T cell response of approximately 7,500 SFCs per 10^6 PBMCs observed four weeks after immunization, as shown in Figure 12 below. The SAM boost administered four weeks after the prime immunization with anti-CTLA-4, increased the antigen specific T cell response further, reaching T cell levels greater than 10,000 SFCs per 10^6 PBMCs. A second SAM boost in combination with the anti-CTLA-4 antibody given eight weeks after the first boost immunization expanded the antigen-specific T cells further to peak levels reaching greater than 14,000 SFCs per 10^6 PBMCs one week after the boost which were maintained at levels between 9,000-10,000 SFCs per 10^6 PBMCs for several weeks. Thus, our heterologous prime-boost immunotherapy approach induced T cell numbers between 5,000-14,000 SFC per 10^6 PBMCs that were sustained over 16 weeks.

Figure 12. Immune Response in NHPs to Heterologous Prime-Boost Immunotherapy in Combination with Checkpoint Inhibitor Anti-CTLA-4



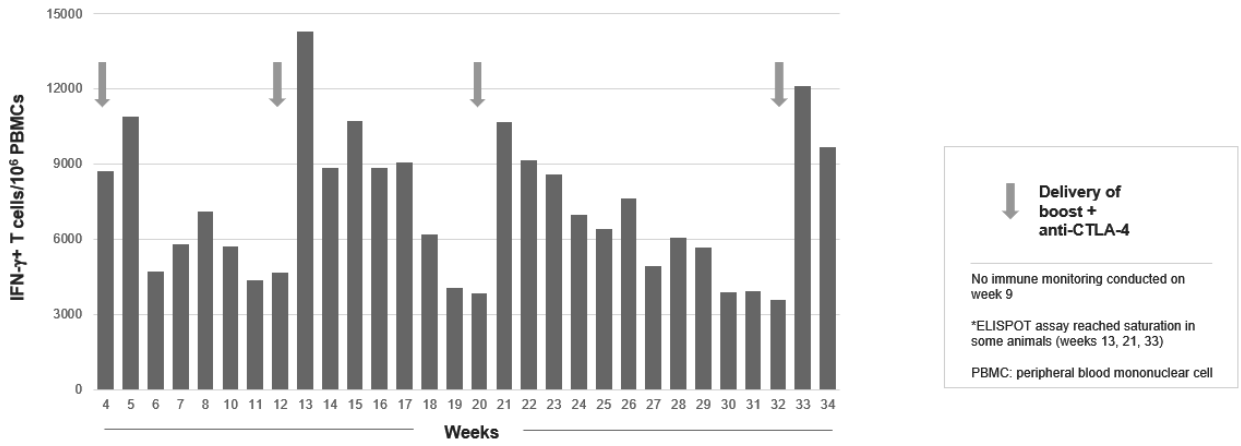
In order to compare the number of robust antigen-specific T cells induced by our heterologous prime-boost approach in NHPs directly to the literature data from adoptive T cell therapies, we converted our units of SFCs per 10^6 PBMCs to units of CD8+ T cells per milliliter of blood and plotted them against the T cell data from various clinical studies (which we also converted, where necessary, to T cells per milliliter of blood). One milliliter of blood is estimated to contain around three million PBMCs. The comparative data suggest that the antigen-specific CD8+ T cell numbers reached with our immunotherapy in NHPs (shown in the leftmost bar of Figure 13 below) is in the range of the T cell levels achieved in cancer patient clinical responders to adoptive T cell therapies (shown in the three rightmost bars in Figure 13 below), even when anticipating a 1.5- to three-fold decrease in the number of T cells induced in humans versus NHPs (as noted in the literature). Such substantial T cell numbers have not, to our knowledge, been reached with a therapeutic cancer vaccine in clinical studies to date. Furthermore, in addition to priming numerically substantial T cell responses against the cassette neoantigens, our immunotherapy regimen has been shown to induce T cells of high functional quality in NHPs, with a cytokine secretion profile seen in highly functional and cytotoxic T cells.

Figure 13. Comparison of Number of T Cells Induced by Our Immunotherapy in NHPs to Number of T Cells Observed in Clinical Responders to Adoptive T Cell Therapies



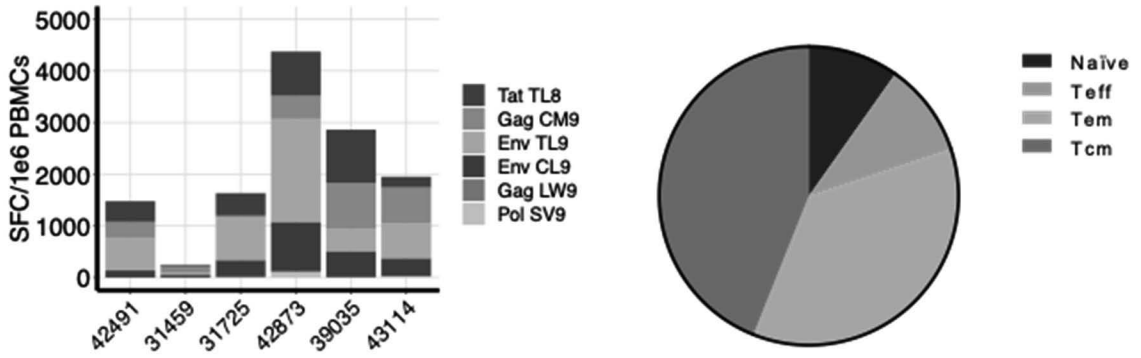
We believe that continued immune pressure upon the tumor is likely necessary to prevent immune escape by the tumor and consequently drive a durable clinical response. High T cell titers persisting for at least six months were induced by the heterologous prime-boost immunotherapy approach in combination with anti-CTLA-4, as shown in Figure 14 below.

Figure 14. Gritstone's Immunotherapy Platform ChAdV + SAM + anti-CTLA-4



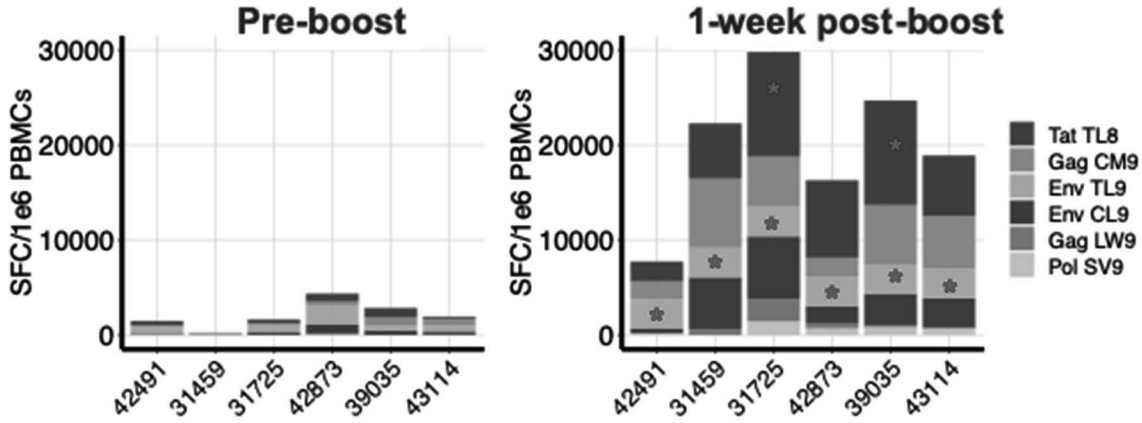
A subset of these same monkeys was studied two years after their first priming injection, to determine persistence of antigen-specific T cells and presence of T cell memory. A strong memory population of T cells was detected (Figure 15) and when the monkeys were re-boosted with SAM and ipilimumab, a very strong CD8+ SIV antigen-specific T cell boost response was elicited, such that an average of approximately 12% of peripheral CD8+ T cells were specific to our six administered antigens (Figure 16). The boosted antigen-specific CD8+ T cells demonstrated strong cytolytic activity as shown in a killing assay two weeks after the boost (Figure 17).

Figure 15. Antigen-specific T cell response in NHP 2-years post vaccination demonstrates large T cell memory population



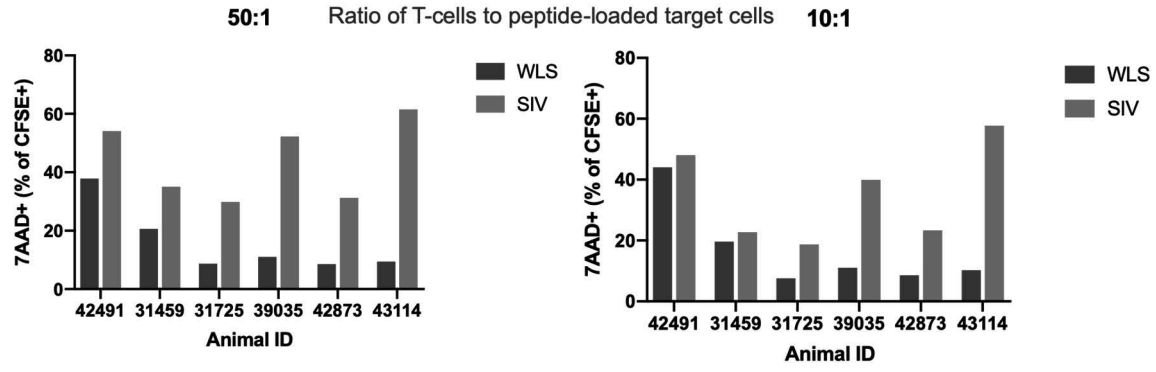
(Left) IFNγ ELISpot (spots per million PBMCs) for six SIV antigens for each animal two-years post-immunization. (Right) Percentage of each T cell population out of all antigen-specific T cells (as measured by tetramer staining) at two-years post-immunization (average of six animals). Naïve (CD45RA+CCR7+), Teff (CD45RA+CCR7-), Tem (CD45RA-CCR7-), Tcm (CD45RA-CCR7+)

Figure 16. Re-immunization of NHP 2-years post-prime results in strong increase in antigen-specific T cell response



IFNγ ELISpot (spots per million PBMCs) for six SIV antigens for each animal two-years post immunization (Left) and one-week post re-immunization with SAM and ipilimumab (Right). Red stars represent antigens that were too numerous to count and were set to the maximum detectable value.

Figure 17. Re-immunization of NHP, 2-years post-prime, expands antigen-specific T cells with cytolytic activity



Effector T cells enriched from PBMCs 2 weeks post immunization were combined at the specified ratio with peptide loaded CFSE stained PBMCs, for each animal, and incubated for six hours. Target cell death was measured by 7-AAD staining. SIV-Target cells loaded with six SIV antigens encoded by the immunotherapy, WLS - target cells loaded with negative control peptides, not encoded by the immunotherapy.

Safety

We have performed a ten-week toxicity study governed by Good Laboratory Practice, or GLP, regulations of the ChAdV and the SAM prime-boost in NHPs to assess safety. The heterologous prime-boost immunotherapy, when administered intramuscularly, was well tolerated at the clinical maximal dose of each therapy.

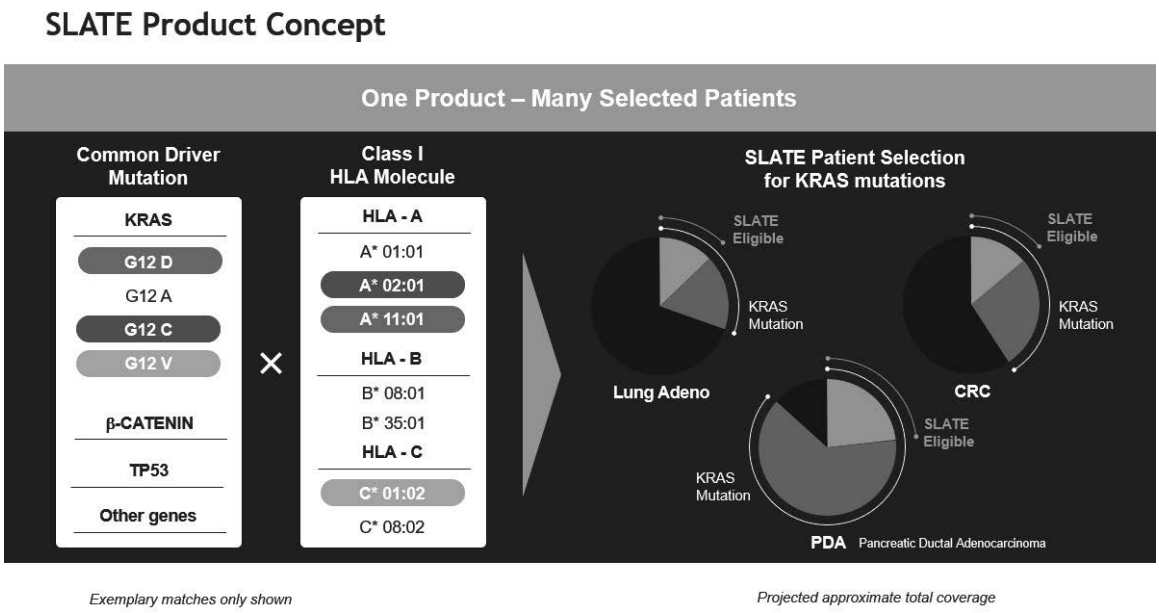
Clinical Development and Early Data

We are employing an innovative and flexible clinical study design which is similar for both SLATE and GRANITE in an effort to execute a potentially faster-to-market strategy in a rapidly evolving and competitive treatment landscape. In order to accelerate the execution of our Phase 1 and Phase 2 program, we are using a seamless Phase 1/2 trial design. A seamless design refers to an integrated Phase 1 and Phase 2 trial protocol that allows rapid transition following dosing and tolerability confirmation during the Phase 1 portion to establishing proof-of-concept in the Phase 2 cohort expansion portion without compromising patients' safety or incurring delay for analysis or approval. Data obtained from the Phase 1/2 trials will inform the design and initiation of Phase 2/3 studies with registrational intent in the metastatic and adjuvant settings in specific tumor types, for both programs. Advanced pancreatic cancer, NSCLC and MSS-colorectal cancer are the initial target indications for SLATE, since KRAS mutations are common in these tumor types, and the SLATE cassette contains a large number of KRAS mutations. There is also a cohort for patients with other solid tumor types who possess the appropriate combination of tumor mutations and HLA type. Advanced NSCLC and gastroesophageal, bladder and MSS-colorectal cancers are the initial target indications for the Phase 1 portion of our GRANITE clinical trial. These indications have been selected for several reasons, including high mutational load, response to checkpoint inhibitors, large patient populations, manufacturing time, emerging treatment landscape, regulatory pathway, the ability to combine personalized immunotherapies with immune checkpoint inhibitors and the potential opportunity to generate de novo immune responses and/or amplify existing anti-tumor T cell responses in order to improve the depth and durability of clinical responses.

Our Phase 1/2 Trial of "Off-the-Shelf", Shared Neoantigen Immunotherapy Candidate, SLATE (GO-005)

The IND for SLATE was cleared by the FDA in August 2019. GO-005, a Phase 1/2 trial, began enrolling patients in August 2019. Based on the importance of KRAS as a shared neoantigen, GO-005 is focused on enrolling patients with advanced MSS colorectal cancer, lung adenocarcinoma and pancreatic ductal adenocarcinoma in whom KRAS mutations are common. A fourth cohort of potentially eligible patients consists of those with any type of tumor that harbors one of the 20 driver mutations encoded in the SLATE cassette. The key to appropriate utilization of the "off-the-shelf" product candidate is to accurately identify patients whose tumors contain at least one of the TSNA represented within the SLATE neoantigen cassette. The widespread use of tumor mutation panel sequencing in advanced cancer has enabled the routine identification of such patients, and complementary assessment of a patient's HLA type is a standard clinical test, performed using a simple blood draw, and completed within 7-10 days by a clinical immunology laboratory. Our preliminary estimates of the addressable patient population in these diseases range from 10 to 15% of the population and above (Figure 18).

Figure 18. Examples of SLATE patient selection for KRAS mutations



The Phase 1 portion of our Phase 1/2 trial seeks to establish a dose for further investigation in the Phase 2 portion and to evaluate safety, tolerability and, importantly, immunogenicity of our lead product candidate. Efficacy signals may not be interpretable during the Phase 1 portion. Thus, we will seek to further evaluate efficacy and safety in the Phase 2 cohort expansion portion in several common solid tumor types. Like the Phase 1 portion of GO-004 (GRANITE), patients receive an initial administration of ChAdV as a prime at a fixed dose of 10^{12} viral particles throughout the study, succeeded by multiple dose levels of SAM boosts (heterologous prime-boost). Dose levels of SAM start at 30 μg (Dose Levels 1 and 2) and are escalated to 100 μg (Dose Level 3) and to 300 μg (Dose Level 4), safety permitting. All patients receive anti-PD-1 intravenously throughout the study at the approved label dose (480 mg every 4 weeks). Co-administration of a fixed, low dose of 30 mg of subcutaneous anti-CTLA-4 with ChAdV prime and SAM boosts is initiated once Dose Level 1 has been cleared. The rationale for earlier introduction of ipilimumab in SLATE's dose-escalation scheme is to optimize T cell activation and proliferation at the lowest dose of SAM and account for the fact that only one TSNA may give rise to CD8 T cells in SLATE patients compared to GRANITE's multiple, personalized TSNAs.

The manufacturing of the SLATE product is carried out using our current supply chain. The "off-the-shelf" design of the SLATE product allows us to leverage our processes developed for personalized products.

As of January 14, 2020, 4 patients have been enrolled at Dose Levels 1 and 2. Patients are aged 33 to 83 years (mean 62 years). The first three patients have NSCLC harboring the KRAS G12C mutation. The fourth patient has MSS-CRC with a KRAS Q61-H mutation. Three patients have previously been exposed to an anti PD-1 mAb. Cumulated doses across patients are four doses of ChAdV, six doses of SAM, ten doses of nivolumab and four doses of ipilimumab. Overall, the safety findings to date have been consistent with reversible, acute phase immune reaction including fever and injection site reactions. No dose-limiting toxicities have been observed to date. A summary of demographics and safety observations are presented in Table 2.

Table 2. Interim Phase 1 data showed SLATE prime/boost immunotherapy in combination with nivolumab has been well tolerated to date with adverse events indicative of an inflammatory response

SLATE Prime/Boost Immunotherapy in Combination with Nivolumab and Ipilimumab Well Tolerated To Date

Demographics	n = 4
Age (mean, range)	62 (33-83)
Gender (Female/Male)	2/2
# of doses	
ChAdV	4
SAM	6
Nivolumab (IV)	10
Ipilimumab (SC)	4
Tumor and Mutation Types	
NSCLC • KRAS G12C	3
MSS-CRC • KRAS Q61H	1
Prior anti-PD-(L)1 therapy	3

Safety	n = 4	
	Grade 1/2	Grade 3/4
Treatment-related adverse events		
Myalgia	1	0
Pruritus	1	0
SAEs		
Anemia	0	1[a]
Cervical Fracture	0	1[a]

[a] Not treatment-related

No DLTs to date

Data cut-off 14 Jan 2020

Contingent upon enrollment rate and safety findings, we expect to complete the Phase 1 portion of GO-005 in mid-2020 and initiate the Phase 2 portion in the second half of 2020, where we will administer the heterologous prime-boost regimen in combination with intravenous anti-PD-1 mAb and subcutaneous anti-CTLA-4 at the recommended Phase 2 dose established during Phase 1. The Phase 2 portion of GO-005 will consist of single-arm Phase 2 cohorts in three advanced tumor types including "cold" tumors where checkpoint inhibitors alone have trivial efficacy (such as 3d line MSS colorectal cancer), advanced pancreatic ductal adenocarcinoma in maintenance following 1st line chemotherapy and NSCLC progressing after immunotherapy with checkpoint inhibitors with stratification between primary refractory and secondary resistant patients. An interim analysis with go/no-go decision based on response rate compared to historical controls will guide further expansion in single-arm cohorts designed to support further development under the accelerated approval pathway.

We believe that neoantigen-based immunotherapy should ideally be administered in earlier lines of treatment, in the context of minimal residual disease and an optimal immune system. Depending on the safety profile observed during the Phase 1 portion of GO-005 and in parallel to single-arm cohort expansions in the Phase 2 portion of GO-005, we are considering options to conduct randomized Phase 2 trials in the (neo)adjuvant setting of unresectable or resectable lung, pancreas or colorectal (MSS) tumors at high-risk of relapse. We expect to initiate randomized Phase 2 trials in the (neo)adjuvant setting in the first half of 2021 pending authorization from health authorities after discussion of our Phase 1 data.

Of note, SLATE is designed to offer the additional opportunity to isolate tumor infiltrating CD8+ T cells from patients with objective tumor responses. One or several TCRs with demonstrated efficacy and safety in vivo against the driver mutation contained in our SLATE product candidate may be isolated and characterized. In turn, these TCRs could be used to engineer T cells from other patients whose tumor harbors the same driver mutation and HLA Class I allele, in an effort to expand the specificity of these effectors beyond our active SLATE immunotherapy approach.

Our Phase 1/2 Trial of Personalized Immunotherapy candidate, GRANITE (GO-004)

In September 2018, our IND for our "N of 1" product candidate, GRANITE, was cleared by the U.S. Food and Drug Administration, or FDA, and in December 2018, the FDA granted Fast Track designation to GRANITE for the treatment of colorectal cancer. In the fourth quarter of 2018, we initiated our first-in-human, Phase 1/2 trial, which we refer to as GO-004, with investigation of intramuscular heterologous prime-boost immunization with ChAdV and SAM in combination with mAb to PD-1 and CTLA-4. Our Phase 1/2 trial is actively enrolling newly diagnosed, advanced lung, gastroesophageal and bladder cancer patients who are receiving first-line chemotherapy treatment. Production of the immunotherapy takes place while patients are receiving their initial chemotherapy. Patients subsequently receive our experimental, personalized immunotherapy candidate in combination with checkpoint inhibitors as either maintenance therapy or second-line therapy. Patients with relapsed colorectal cancer patients with MSS tumors have trivial responses to current immunotherapies (Le at al., New England Journal of Medicine (2015)) and are also eligible for GO-004 if their tumor has been predicted to have adequate TSNA to merit inclusion in our program using our EDGE model. We

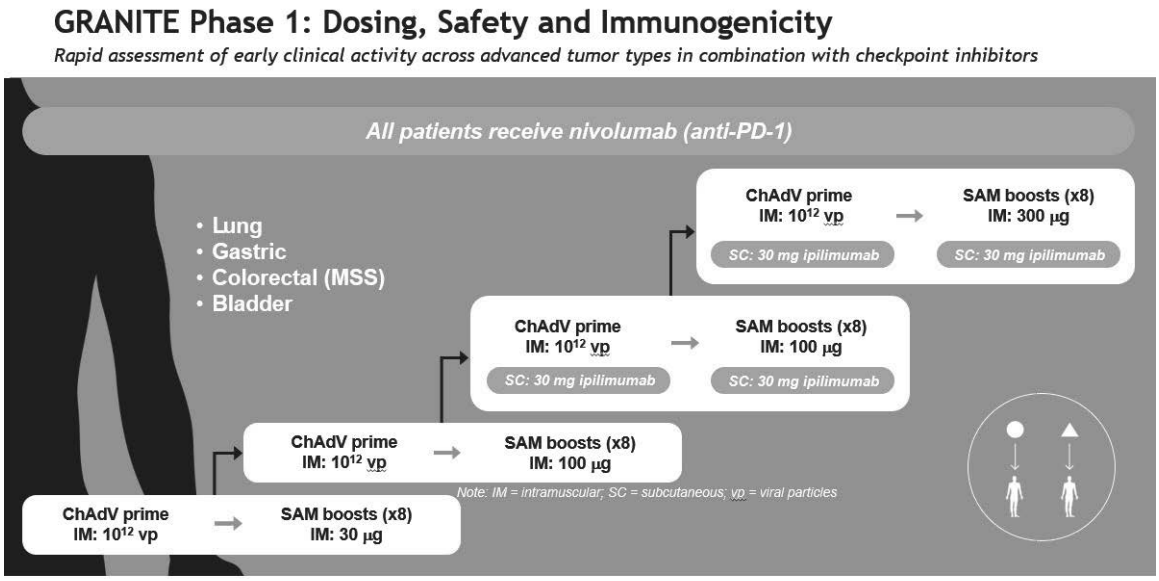
exclude patients who have large mutational loads and are well served by currently approved immunotherapy, such as melanoma patients and those with colorectal cancer with microsatellite instability. The Phase 1 portion of our Phase 1/2 trial seeks to establish a dose for further investigation in the Phase 2 portion and to evaluate safety, tolerability and, importantly, immunogenicity of GRANITE. Efficacy signals may not be interpretable during the Phase 1 portion of GO-004. Thus, we will seek to further evaluate efficacy and safety in the Phase 2 cohort expansion portion of GO-004 in several common solid tumor types.

We believe co-administration of checkpoint inhibitors with personalized immunotherapy is a rational way to augment the T cell response and potential efficacy of the therapeutic regimen. Use of mAb to PD-1 is believed to unleash T cells which have been functionally silenced in tumor tissue by local PD-1 expression. Administration of antagonistic mAb to CTLA-4, an early inhibitory marker of T cell activation, has been shown to broaden the T cell response. Local subcutaneous administration of anti-CTLA-4 provides high drug concentration in the vaccination site-draining lymph node while minimizing systemic exposure, which we believe will optimize the benefit-risk ratio of our experimental regimen. Nivolumab, an anti PD-1 mAb, and ipilimumab, an anti CTLA-4 mAb, are provided by our collaborator, BMS.

Patients in this trial receive an initial administration of ChAdV as a prime at a fixed dose of 10^{12} viral particles throughout the study, succeeded by multiple dose levels of SAM boosts (heterologous prime-boost). Dose levels of SAM start at 30 μg (Dose Level 1) and are escalated to 100 μg (Dose Levels 2 and 3) and to 300 μg (Dose Level 4), safety signals permitting. All patients receive anti-PD-1 intravenously throughout the study at the approved label dose of 480 mg every 4 weeks. Co-administration of a fixed, low dose of 30 mg of subcutaneous anti-CTLA-4 with ChAdV prime and SAM boosts is initiated once Dose Level 2 has been cleared. A total of 8 boosts are planned.

Figure 19 below illustrates the Phase 1 portion of our Phase 1/2 trial design (GO-004).

Figure 19. Phase 1 Portion of Phase 1/2 Design (GO-004)



The ongoing Phase 1 portion of GO-004 examines the safety, tolerability, dose, immunogenicity and early efficacy of the combination of the immune checkpoint inhibitors nivolumab and ipilimumab with GRANITE

As of January 6, 2020, six patients have been enrolled at Dose Levels 1 and 2. Patients are aged 50 to 76 years (mean 66 years). Tumor types include NSCLC (one patient), MSS-CRC (two patients) and GEA (three patients). One patient has previously been exposed to an anti PD-1 mAb. Cumulated doses across patients are six doses of ChAdV, 20 doses of SAM, 24 doses of nivolumab (one patient skipped two doses due to skin toxicity) and 1 dose of ipilimumab. Overall, the safety profile to date is consistent with reversible, acute phase immune reaction encompassing fever (including one patient with two transient Grade 2 severe adverse events), injection site reactions and skin rashes. One patient presented with self-limiting asymptomatic Grade 3 creatinine kinase elevation of unknown etiology. No dose-limiting toxicities have been observed to date. Summary of demographics and safety observations are presented in Table 3.

Table 3. Interim Phase 1 data showed GRANITE prime/boost immunotherapy in combination with nivolumab has been well tolerated to date with adverse events indicative of an inflammatory response

GRANITE Prime/Boost Immunotherapy in Combination with Nivolumab is Well Tolerated with AEs Indicative of an Inflammatory Response

Demographics	n = 6
Age (mean, range)	66 (50-76)
Gender (Female/Male)	2/4
# of doses	
ChAdV	6
SAM	20
Nivolumab (IV)	24
Ipilimumab (SC)	1
Tumor Types	
NSCLC	1
Microsatellite stable (MSS)-CRC	2
Gastroesophageal adenocarcinoma (GEA)	3
Prior anti-PD-(L)1 therapy	1

Data cut-off 06 Jan 2020

Safety	n = 6	
	Grade 1/2	Grade 3/4
Treatment-related adverse events		
Fever	7	0
Skin rash	2	0
Diarrhea	2	0
Fatigue	2	0
CK Elevation	0	1[a]
Injection-site reactions	1	0
SAEs		
Fever	2[b]	0
Heart Failure	0	1[c]

No DLTs to date

[a] Self-limiting, asymptomatic increase in creatine kinase
[b] Both SAEs of fever occurring in the same patient
[c] Not treatment-related

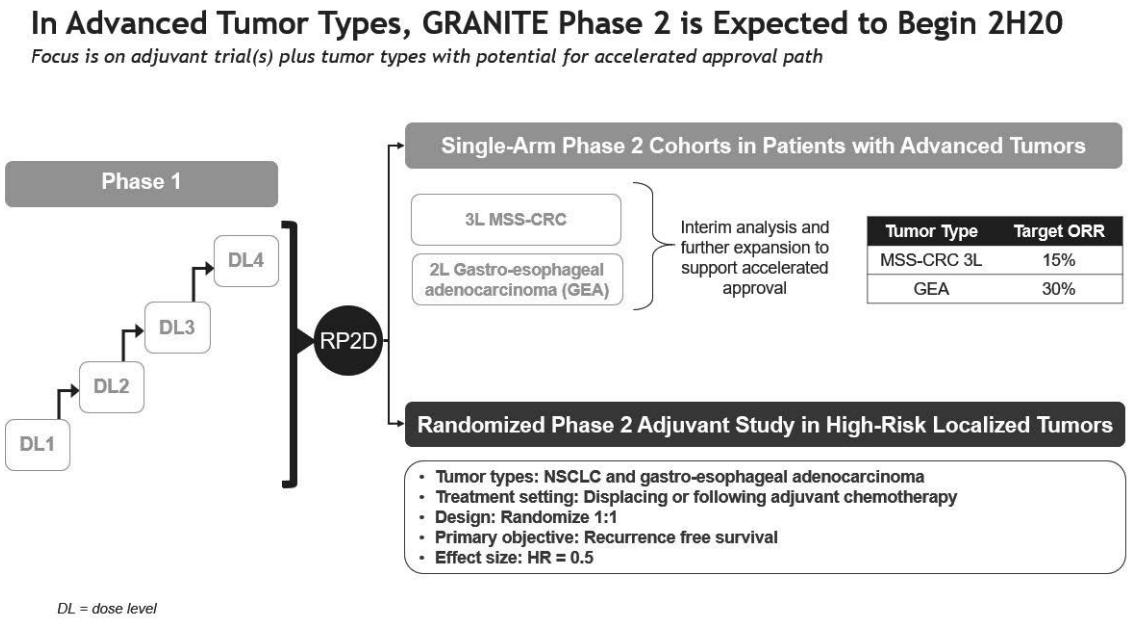
As of January 2020, immunogenicity data is available for four of the six patients treated at Dose-Levels 1 and 2. Overnight IFNγ ELISpot assays against each patient's own 20 TSNA shows neoantigen-specific CD8 T cell responses two to four weeks after priming that are further enhanced with subsequent boosts to levels ranging from 100 to 3,000 spots/10^6 PBMCs. Broad polyfunctional CD8 T cell responses to multiple neoantigens are observed including de novo priming of T cells.

Depending upon enrollment rate and safety signals, we expect to complete the Phase 1 portion of GO-004 during the third quarter of 2020. Additional immunogenicity, safety and preliminary efficacy data will be presented at a conference in 2020.

Upon completion of the Phase 1 portion of GO-004, we will aim to demonstrate proof-of-concept in the Phase 2 portion where we will administer the heterologous prime-boost regimen in combination with intravenous anti-PD-1 mAb and subcutaneous anti-CTLA-4 at the recommended Phase 2 dose established during Phase 1. The Phase 2 portion of GO-004 is expected to begin in the second half of 2020 and will consist of single-arm Phase 2 cohorts in at least two advanced tumor types including "cold" tumors where checkpoint inhibitors alone have low (such as 2d line gastroesophageal cancer) to no (such as 3d line MSS colorectal cancer) efficacy. An interim analysis with go/no-go decision based on response rate compared to historical controls will guide further expansion in single-arm cohorts, which we believe may support further development under the accelerated approval pathway.

We hypothesize that personalized immunotherapy should ideally be administered in earlier lines of treatment, in the context of minimal residual disease and an optimal immune system. Depending on the safety profile observed during the Phase 1 portion of GO-004 and in parallel to single-arm cohort expansions in the Phase 2 portion of GO-004, we are considering options to conduct Phase 2 trials in stage III unresectable tumors, such as lung cancer and/or gastroesophageal cancer, where our personalized immunotherapy candidates would be used as consolidation following first-line chemo-radiotherapy. Likewise, in patients with tumors at very high risk of relapse following complete surgical resection, such as patients with colorectal cancer or non-squamous cell carcinoma of the lung, we may use our personalized immunotherapy candidate in the adjuvant setting with the goal of preventing recurrence of their disease. In this particularly challenging setting, we plan to use circulating tumor DNA, or ctDNA, to detect the presence of remaining tumor cells following surgery and during adjuvant immunotherapy. We believe ctDNA technology will soon be accepted by investigators and health authorities as a validated surrogate endpoint of efficacy alongside well-established clinical endpoints, such as metastasis-free survival, recurrence/progression-free survival and overall survival. The specific risk-benefit profile of patients with localized, high-risk disease will likely require discussion with health authorities based on the outcome of the Phase 1 portion of our GO-004 study. Therefore, we expect to initiate our randomized Phase 2 adjuvant study in the first half of 2021.

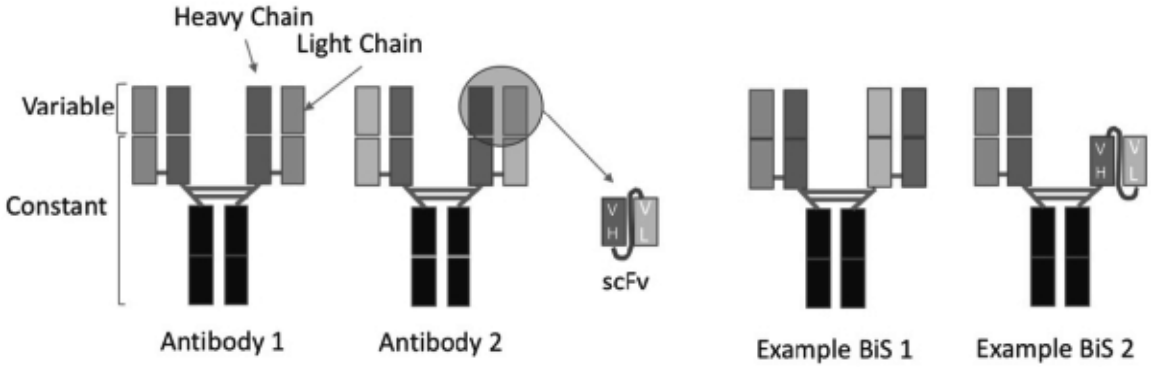
Figure 20. Potential GRANITE Phase II Design



Bispecific antibodies

Monoclonal antibodies are an important component of immune defense against disease. The most common antibody type in humans, immunoglobulin G, or IgG, evolves within a human/patient and bears two identical arms to recognize its specific target. In contrast to monoclonal antibodies, bispecific antibodies employ different antigen specificities within the two arms—one arm recognizes a tumor antigen and the other recognizes immune-effector cells. We are developing bispecific antibodies using an anti-tumor TCR-mimetic antibody arm in the form of a Fab or a single chain antibody fragment, or scFv, as the tumor-binding domain of a bispecific antibody, thus generating a suite of bispecific antibodies capable of engaging our novel targets identified by the EDGE platform, as illustrated by Figure 21 below.

Figure 21. Schematic representation of monoclonal antibodies and two exemplary bispecific formats.



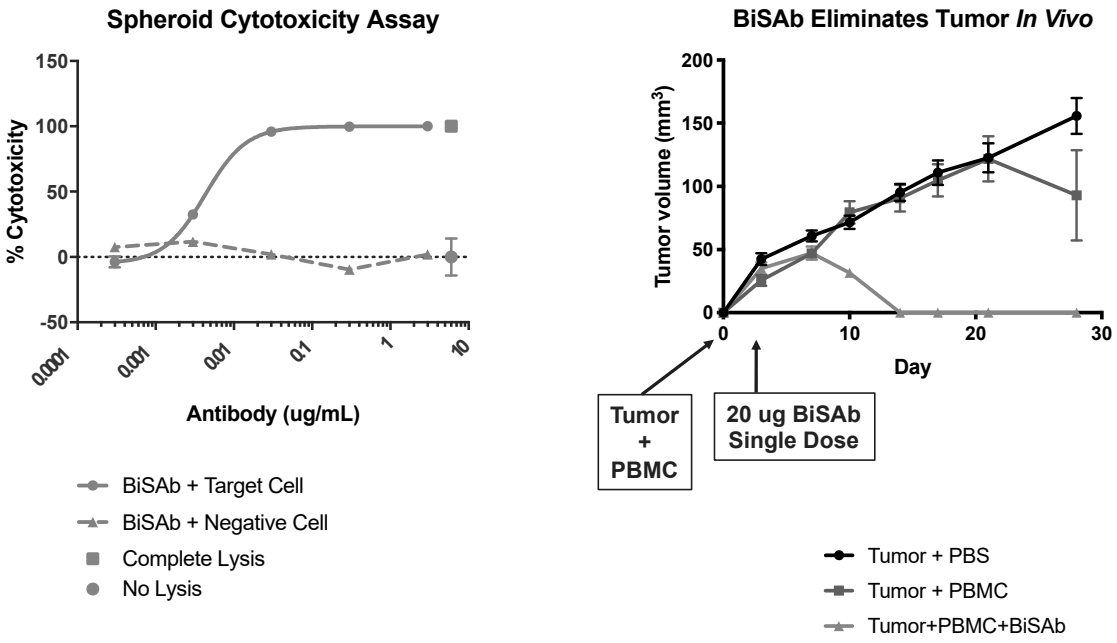
In the above figure, variable domains are indicated as well as constant domains. Heavy chain and light chain variable domains come together to form the antigen binding fragment. A schematic of an alternative engineered version of this single-chain variable fragment, or scFv, is shown. BiSpecific molecules are shown comprised of normal antibody polypeptide chain pairing as well as an example incorporating a scFv for one specificity. All of our peptide-HLA TCR-mimetic antibodies were initially identified as scFv fragments, and they can be readily formatted as these modular binding domains or as normal antibody binding arms.

While many different bispecific antibody formats have been described, no single platform has emerged as an optimal solution for all targets or therapeutic applications. Rather, “rules” governing optimal activity are determined empirically for a given target pair.

We are working to determine whether this target class has shared rules for optimal formatting and we are converging on a favored format. Critical parameters include number of binding sites for each target, spacing among the binding sites, and engineered or inherent properties to drive optimal serum half-life. Affinity for each target, as well as where specifically the bispecific antibody binds each target (epitope) are also important characteristics. We have built the capability to generate large numbers of lead candidate combinations employing our TCR mimetic antibodies formatted as scFv or as traditional antibody arms and combined with a variety of distinct targeting arms. Additionally, we are developing critical assays to evaluate the safety and potency of novel candidates. Finally, we are deploying state of the art development and formulation techniques to ensure selection of candidates with robust drug-like properties for investigation. We believe these capabilities will allow efficient selection of candidates to move forward through the optimization process.

We have generated a variety of TCR-mimetic antibodies as bispecifics with different TCR-targeting arms and have promising in vitro proof of concept data, including binding and killing of cells displaying the peptide-HLA target.

Figure 22. Cytotoxic activity of TCR-mimetic bispecifics in vitro and in vivo.



The above figure illustrates in vitro and in vivo proof of concept for an exemplary BiSAb directed against a peptide-HLA target. The left panel depicts a cytoxicity assay using an in vitro spheroid 3D tumor model. The BiSAb specifically directs T cells from the added PBMCs to the tumor cells, which are killed by the recruited T cells. The right panel shows killing of tumors in vivo in mice by primary human immune cells recruited to the tumor by the BiSAb. The tumor cells bear the target peptide-HLA complex. A single dose of 20 ug of BiSAb was sufficient to eradicate tumor cells from all animals in the presence of human PBMC.

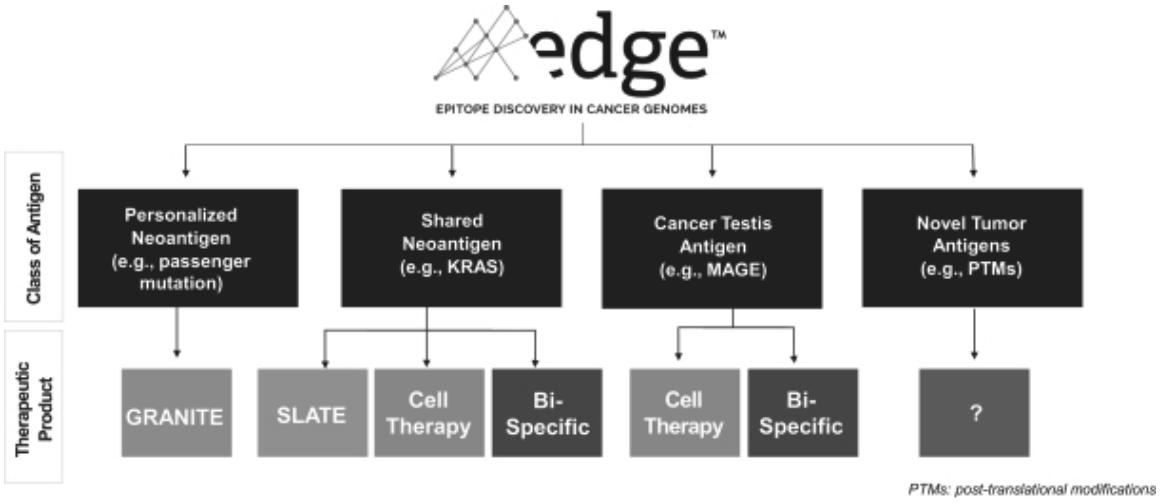
While we rapidly advance our internal candidates to manufacturing and ultimately the clinic, we also consider partnering. We recognize several advantages to partnering, including experience with proprietary effector targeting arms, experience with CMC, and assays for selection of ideal candidates. By pursuing both internal and external paths, we intend to maximize opportunities to rapidly advance to the clinic as well as to retain internal value and position for Gritstone.

Our EDGE Antigen Identification Engine—Beyond Tumor-Specific Neoantigens

Our EDGE antigen discovery platform has also identified novel, functionally tumor-specific antigens which, as opposed to most TSNA, are commonly shared between patients. A leading set of shared tumor antigens derives from cancer testis antigens, or CTA, genes that are non-mutated and normally only expressed in the testis, but which can also be expressed by some tumor tissue. The testis is an immune privileged site such that it is able to express antigens without eliciting an immune response. CTA are well established in the literature and our approach has identified many genes, and antigens from within those genes, that may represent novel shared-tumor antigens. Currently, tumor-specific CTA targets are limited; known HLA/peptide CTA are present in only a fraction of patients within any given tumor type, with some tumor types exhibiting essentially no HLA/peptide targets available in the public domain. We believe our EDGE platform has the potential to unlock these tumor types for therapeutic development by providing novel cancer immunotherapy targets that may be exploited via several therapeutic modalities.

We are developing TCRs and antibodies that specifically recognize these novel shared tumor-specific antigens and their corresponding HLA surface proteins. These targets can be addressed therapeutically using several different formats, such as adoptive T cell therapy, bispecific antibody approaches and vaccination. These programs are in early development. Our TSNA and shared tumor antigen discovery programs are shown in Figure 23 below.

Figure 23. Our TSNA and Shared Tumor Antigen Discovery Programs

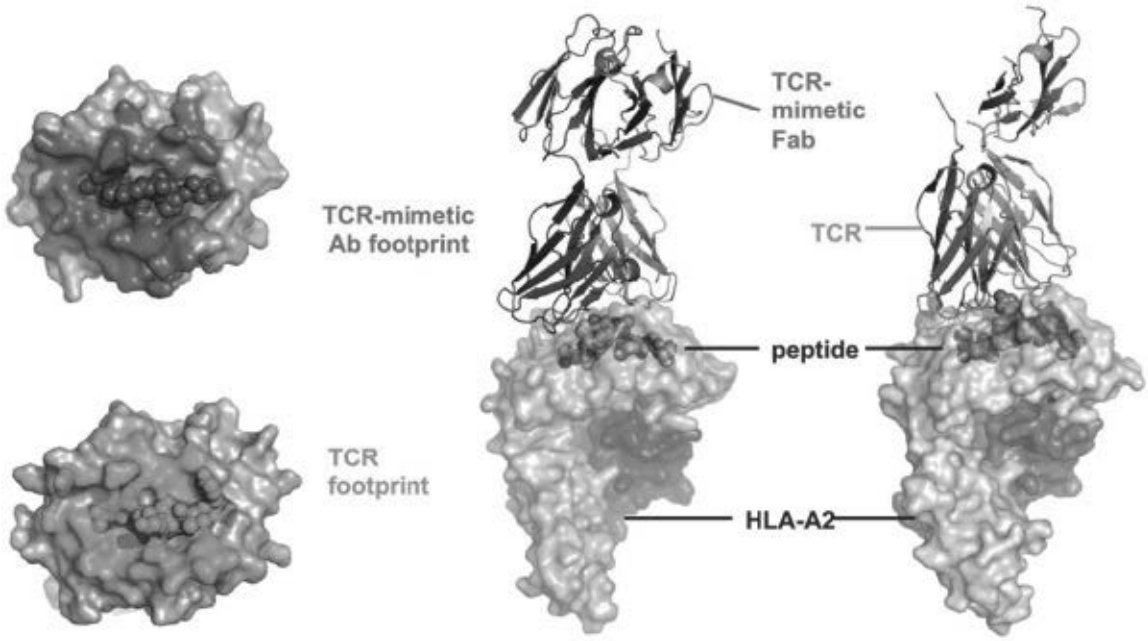


TCR-Mimetic Antibodies

While TCRs are the natural biological recognition elements on T cells for a particular HLA/peptide complex, it is possible to identify antibodies that bind with high affinity and selectivity to a particular HLA/peptide complex (Dubrovsky et al, Oncolmmunology (2016)). These have been termed TCR-mimetic antibodies. Working with a third-party contract research organization, or CRO, we have screened a highly diverse bacteriophage display library, and identified TCR-mimetic antibodies against several novel CTA HLA/peptide complexes that were identified by our proprietary EDGE platform.

During the isolation process, the library was negatively selected against a panel of closely-related peptide-HLA complexes. We identify closely-related peptides, then use EDGE to predict those potential off-target liabilities that are most likely to be displayed. As a result, we identify highly specific leads without cross-reactivity to closely related structures. The candidate antibodies identified bear many properties that make them attractive entities to move forward as components of lead biologic drugs. First, they are directed against highly tumor-specific targets, allowing development of selective drugs designed to bind only to tumor, leaving normal tissues untouched. Second, the leads exhibit good affinity, which we have further improved by directed evolution approaches as part of lead optimization. The library was comprised of single-chain versions of antibody variable domains (scFv), responsible for antigen binding. scFvs are ideal modular building blocks for combining multiple specificities into a single molecule.

Figure 24. Comparison of one of Gritstone's proprietary TCR-mimetic antibody in complex with peptide-HLA with a published TCR in complex with its cognate peptide-HLA (same HLA haplotype).



As indicated in the above figure, there are many striking similarities between the TCR-mimetic antibody and the TCR recognizing their MHC/peptide complexes, including footprint, angle of interaction, and overall surface area covered.

We have carefully defined the exact nature of TCR-mimetic antibody binding to peptide-HLA target antigens. We have individually altered each amino acid in the peptide (in the peptide-HLA complex) to establish the specificity of TCR-mimetic binding. We have also defined the footprint of TCR-mimetic antibody binding on its target using both (a) X-ray crystallography (direct visualization of binding) and (b) a "protection" assay whereby antibody binding to its target physically protects target structures from chemical modification. Figure 24 shows the high-resolution structure of one target peptide-HLA molecule in complex with one of our lead antibodies. The footprint and angle of interaction are strikingly similar between the TCR mimetic antibody and a published structure of a typical TCR bound to its cognate HLA/peptide complex. To date, multiple TCR-mimetic leads have been identified against a set of target HLA/peptide complexes for tumor-specific targets identified by our proprietary EDGE platform, that bind, similarly to the natural TCR interaction, with high affinity and specificity. We believe these candidates are an ideal starting point for building a portfolio of bispecific antibody leads.

T Cell Receptors

TCRs recognize HLA/peptides, and once we have identified CTA-derived peptides plus their HLA binding partner as tumor-specific antigens, we can proceed to the identification of matched TCRs. This is performed using healthy HLA-matched donors as a source of diverse T cells and screening these T cells against the target HLA/peptides. T cells that activate and expand in response to a target HLA/peptide will express relevant TCRs, and these can be characterized by isolation of the relevant T cells and sequencing of their TCR genes. These natural TCRs may offer advantages over alternative TCR identification approaches. We possess the internal expertise to identify HLA/peptide specific TCRs from HLA-matched donor blood, and we may partner those TCRs with established adoptive T cell therapy companies.

License and Collaborations

Strategic Collaboration with bluebird bio

In August 2018, we entered into a research collaboration and license agreement with bluebird bio, Inc., or bluebird, to utilize our EDGE platform to identify and validate tumor-specific targets and provide TCRs directed to ten selected targets for use in bluebird's cell therapy platform. Under the collaboration, we received a non-refundable up-front cash payment of $20.0 million and an additional $10.0 million in equity investment in our Series C convertible preferred stock. We are also eligible to receive up to an

aggregate of $1.2 billion in development, regulatory and commercial milestones associated with bluebird bio's resulting cell therapy products, as well as tiered, single-digit royalties on sales of the TCR immunotherapy products that utilize the TCRs discovered by us. The royalty term for each TCR immunotherapy product shall be determined on a product-by-product and country-by-country basis and will commence on the first commercial sale of each product in a country and end on the latest of: (i) expiration or termination of the last to expire valid claim of the last licensed patent that covers the product pursuant to the agreement; (ii) expiration of all periods of regulatory exclusivity for the product in such country (in respect of sales in that country); and (iii) ten years after the first commercial sale of such product in such country (in respect of sales in that country). bluebird will be solely responsible for all costs and expenses of its development, manufacturing, and commercial activities for resulting therapies.

The identification, validation, selection and development of the TCRs will be conducted during an estimated five-year research term and may be extended by an additional year under certain conditions. The collaboration will be governed by a joint steering committee with representatives from us and bluebird. We and bluebird have exchanged non-exclusive licenses to carry out the research program, and, on a selected target-by-selected target basis, we have granted bluebird an exclusive worldwide license to research, develop, and commercialize resulting cell therapy products directed to such targets, including rights to utilize TCRs discovered by us. The collaboration term ends on a country-by-country and product candidate-by-product candidate basis based on completion of all payments owed to us by bluebird thereon. Either party may terminate the agreement upon written notice to the other party in the event of the other party's uncured material breach, subject to a dispute resolution process. In addition, bluebird may terminate the agreement for convenience upon prior written notice to us.

License Agreement with Arbutus Biopharma Corporation

On October 16, 2017, we executed a license agreement with Arbutus Biopharma Corporation, or Arbutus. Certain terms of the agreement were modified by amendment in July 2018. Arbutus is a leader in LNP technology with a broad intellectual property estate and a large library of LNPs, including multiple LNPs being used in clinical development by its partners, as well as the chemistry expertise to synthesize novel LNPs with properties optimal for SAM.

Under the agreement, Arbutus grants us a worldwide, exclusive (even as to Arbutus, subject to certain limited exceptions), sublicensable, transferable license, to research, develop, manufacture, and commercialize our novel RNA-based platform for intracellular delivery of SAM encoding TSNA in combination with one or more of Arbutus' proprietary LNPs. The licensed technology includes Arbutus' portfolio of proprietary and clinically validated LNP products and associated intellectual property, and includes technology transfer of Arbutus' manufacturing know-how.

As part of our collaboration, we have identified an LNP formulation that we believe will be optimal for use in our Phase 1/2 clinical trial of GRANITE and SLATE. This LNP formulation is currently being used by third parties in human clinical trials in the United States. We have also initiated an effort to screen Arbutus' library of LNPs and evaluate novel LNPs to potentially identify an LNP that increases the potency of our SAM platform further. Our goal is to deliver a second-generation SAM immunotherapy that has the potential to serve as a homologous prime-boost immunotherapy.

Under the license agreement, we paid Arbutus an upfront payment of $5.0 million. We have also agreed to make aggregate payments of up to $73.5 million upon the achievement of specified development milestones for up to three products, and an aggregate $50.0 million in commercial milestone payments, as well as royalty payments in the low single-digits on net sales of licensed products for a royalty term lasting until the expiration of the last patent covered under the license. The last-to-expire patent is currently scheduled to expire on November 10, 2030. Pending applications will nominally expire 20 years after the filing date of the first utility application to which they claim priority. Following acceptance of our first IND in September 2018, we made the first milestone payment of $2.5 million to Arbutus. In August 2019, a milestone was met following the initial patient treatment of SLATE in our GO-005 clinical trial. We recorded $3.0 million as research and development expense in connection with the milestone. The milestone payment was made in October 2019. Further milestone payments are not expected to occur before 2021. In addition, we will reimburse Arbutus for conducting technology development and providing manufacturing and regulatory support for our product candidates.

The Arbutus license continues in effect until the last to expire royalty payment or early termination. The license is terminable by us for convenience with 60 days prior written notice, upon payment of a no-cause termination sum. We may also terminate in the event of material adverse safety data for a product, failure to achieve a primary or secondary efficacy endpoint, or if a regulatory authority takes action that prevents us from commercializing any product. Either party may terminate the agreement for material breach, and Arbutus may terminate the agreement for abandonment or if we challenge Arbutus patents.

Manufacturing

Manufacturing is a vital component of our personalized immunotherapy platform, and we are devoting significant resources to manufacturing and process development in an effort to optimize the safety and efficacy of our product candidates, as well as to reduce our per-unit manufacturing costs and time to market. The production of our personalized immunotherapy candidates requires two distinct elements for each patient: tumor biopsy analysis to determine candidate neoantigens, followed by manufacture of vectors containing a personalized cassette encoding the selected neoantigens. SLATE contains a fixed cassette with TSNA that is shared across a subset of cancer patients rather than a cassette unique to an individual patient, which is designed to provide an off-the-shelf alternative to our personalized manufactured product candidate, GRANITE. The manufacture of these vectors involves complex processes, including per-patient plasmid production, mammalian cell production of virus and RNA synthesis and lipid encapsulation. SLATE manufacturing, as a fixed, "off-the-shelf" product candidate, is not time-sensitive and is relatively straightforward operationally. GRANITE, on the other hand, is an "N of 1" product candidate and is manufactured in real-time for each patient, which involves a greater logistical burden.

Our near-term goal is to carefully manage our fixed-cost structure, maximize optionality, and drive long-term cost of goods as low as possible. We have used a hybrid approach to manufacturing our personalized immunotherapy candidates whereby certain elements of our product candidates are manufactured on an outsourced basis at CMOs, and other elements of our product candidates are manufactured internally at the 42,600 square foot manufacturing facility we established in 2017 in Pleasanton, California, all designed in compliance with cGMP. To date, we have leveraged our relationships with CMOs for preclinical studies and Phase 1/2 clinical trial supply. Doing so has significantly accelerated our ability to advance clinical trials, gain insights into the multiple manufacturing processes and establish an infrastructure for future trials.

Our manufacturing process begins with receipt of a patient's routine biopsy and blood sample at our Cambridge, Massachusetts facility, where TSNA identification is performed using the EDGE platform. The TSNA sequences generated by our platform are sent electronically to a synthetic biology CMO to generate the patient-specific TSNA cassette, which is then cloned into each of the ChAdV and SAM vectors, and amplified. Following amplification, the ChAdV vector containing the cassette is sent to our Pleasanton, California facility for ChAdV manufacture and production into vials. In parallel, the SAM vector until recently was sent to another CMO for RNA manufacture and then to a final CMO for formulation into LNP and production into vials. Currently, the entire manufacturing process, from biopsy receipt at Gritstone to the release and shipment of the personalized immunotherapy candidate to the clinical site for patient administration, takes approximately 16-20 weeks in principle. We expect this production and release timeline (and associated cost) will diminish over time due to process scaling, potential improvements in production and testing technologies and internal process expertise, internalizing production as well as potential reductions in regulatory testing requirements based on clinical experience.

To achieve this, our process development group is focused on several key initiatives. The first is investigating novel approaches to manufacturing our products, including process optimization and quality by design of each intermediate, drug substance and drug product. Additionally, we are systematically characterizing our manufacturing processes, including product intermediates and manufacturing unit operations. This characterization effort will allow us to implement process changes over the entire product lifecycle and to quickly react to evolving process technologies that can lead to reductions in per-unit manufacturing costs and shorter process cycle times. In addition, we plan to establish automated, closed-platform manufacturing processes. Such processes should give us the ability to conduct manufacturing in a lower-classified, lower cost manufacturing environment for multiple steps of our drug product manufacturing.

Our medium-term goal is to internalize the majority of the manufacturing steps to drive down both cost and production time, as well as establish full control over intellectual property and product quality. In 2019, we continued to build the internal capability to manufacture our products entirely using internal facilities and staff. We continue efforts toward the phased integration of all manufacturing into our Pleasanton, California biomanufacturing facility. The ChAdV prime production is already fully integrated into the Pleasanton facility and we have largely completed integrating the plasmid and the SAM boost production in-house. We believe that operating our own manufacturing facility will provide us with enhanced control of material supply for both clinical trials and the commercial market, will enable the more rapid implementation of process changes, and will allow for better long-term margins. Although we have developed these capabilities, we will assess which aspects will continue to be outsourced, and these may change over time.

Our manufacturing strategy is currently structured to support our U.S., E.U. and Australian development plans. We believe this manufacturing strategy developed for global distribution will enable use in other geographies. Specific supply strategies for other geographies will be developed as part of our clinical and commercial plans for such other geographies.

Commercialization Plan

Gritstone does not currently have any approved drugs, and we do not anticipate receiving marketing authorization for our early development candidates in either the United States or other worldwide regions in the near future. An internal expansion of sales, marketing, and commercial distribution capabilities would be developed once Gritstone has obtained clinical data that can support licensure following discussions with the FDA or other worldwide health authorities. If and when any of our development candidates are approved for commercialization, an infrastructure to support ongoing sales in the United States and possibly in some other regions will be created.

Competition

The biotechnology and pharmaceutical industries put significant emphasis and resources into the development of novel and proprietary therapies for cancer treatment. We face substantial competition from many different sources, including large and specialty pharmaceutical and biotechnology companies, academic research institutions and governmental agencies and public and private research institutions. We anticipate that we will continue to face increasing competition in the field of cancer therapy as new therapies, technologies, and data emerge from the field.

In addition to the current standard of care for patients, commercial and academic clinical trials are being pursued by a number of parties in the field of immunotherapy. Results from these trials have fueled continued interest in immunotherapy and our competitors include:

- In the neoantigen space, Agenus Inc., BioNTech AG in collaboration with Genentech Inc. (BioNTech announced the intended acquisition of Neon Therapeutics, a former competitor, in January 2020), Moderna Therapeutics, Inc. in collaboration with Merck & Co. Inc., Advaxis Immunotherapies, Achilles Therapeutics, NousCom AG, ISA Pharmaceuticals BV, CureVac AG in collaboration with Eli Lilly and Company, Genocea Biosciences Inc., Vaccibody AS and PACT Pharma, Inc., or PACT.
- In the bispecific antibody space, Amgen, Roche, Regeneron Pharmaceuticals, inc., MacroGenics, Inc., Xencor Inc., Zymeworks Inc., F-Star Biotechnology Ltd., Novimmune SA, Genmab A/S, Five Prime Therapeutics, Inc., Merus N.V., Immunocore Ltd, Eureka Therapeutics and Immatics Biotechnologies GmbH.
- In the engineered cell therapy and TCR space, Novartis, Juno Therapeutics (acquired by Celgene Corporation), Kite Pharma (acquired by Gilead Sciences, Inc.), bluebird bio, Inc., Medigene AG, Adaptimmune Therapeutics plc, Amgen Inc., Atara Biotherapeutics, Inc., Autolus Limited, Cellectis S.A., PACT, Neon, Mustang Bio, Inc., Iovance Biotherapeutics, Inc., TCR^2 Therapeutics Inc., Editas Medicine, Inc., Unum Therapeutics Inc., Intrexon Corporation, CRISPR Therapeutics AG and Bellicum Pharmaceuticals, Inc.

Many of our competitors, either alone or with their strategic partners, have significantly greater financial resources and expertise in research and development, manufacturing, preclinical testing, conducting clinical trials, and marketing approved products than we do. Mergers and acquisitions in the pharmaceutical, biotechnology and gene therapy industries may result in even more resources being concentrated among a smaller number of our competitors. Smaller or early-stage companies may also prove to be significant competitors, particularly through collaborative arrangements with established companies. These competitors also compete with us in recruiting and retaining qualified scientific and management personnel and establishing clinical trial sites and patient registration for clinical trials, as well as in acquiring technologies complementary to, or necessary for, our programs.

Our commercial opportunity could be reduced or eliminated if our competitors develop and commercialize products that are safer, more effective, have fewer or less severe side effects, are more convenient or are less expensive than any products that we may develop. Our competitors also may obtain FDA or other regulatory approval for their products more rapidly than we may obtain approval for ours, which could result in our competitors establishing a strong market position before we are able to enter the market. The key competitive factors affecting the success of all of our programs are likely to be their efficacy, safety, cost and convenience.

Intellectual Property

Our commercial success depends in part on our ability to obtain and maintain proprietary protection for our products and services, to operate without infringing the proprietary rights of others, and to prevent others from infringing our proprietary rights. We rely on a combination of patents and trade secrets, as well as contractual protections, to establish and protect our intellectual property rights. We seek to protect our proprietary position by, among other things, filing patent applications in the United States and internationally. Our patent estate includes patent applications with claims relating to our products, methods, and manufacturing processes, and broader claims for potential future products and developments. As of December 31, 2019, our solely-owned patent portfolio includes, on a worldwide basis, 134 pending patent applications and one issued patent relating to our products, methods, and

manufacturing processes, including 23 pending patent applications in the United States, 111 pending patent applications filed internationally, and one issued U.S. patent relating to the use of a predictive model to identify neoantigens, particularly where the predictive model was trained using mass spectrometry data.

As of December 31, 2019, our solely-owned patent estate includes a portfolio of pending patent applications related to our neoantigen-based platform; a portfolio of pending patent applications related to our shared antigen-based platform, including our bispecific antibody platform and TCRs. Details regarding these portfolios are provided below.

As of December 31, 2019, our solely-owned patent portfolio related to our neoantigen-based platform includes 18 pending U.S. patent applications and 107 ex-U.S. patent applications pending in countries including Australia, Brazil, Canada, China, Colombia, the European Patent Office, Hong Kong, India, Indonesia, Israel, , Japan, , Malaysia, Mexico, , New Zealand, Peru, Philippines, Russia, Singapore, South Africa, South Korea and Taiwan with claims related to neoantigen identification and related uses and manufacture. Any patents that may issue from these pending patent applications are expected to expire between 2036 and 2040, absent any patent term adjustments or extensions.

As of December 31, 2019, our solely-owned patent portfolio related to our shared antigen-based platform, including our bispecific antibody platform and TCRs, includes five pending U.S. patent applications and four pending foreign patent applications with claims related to shared antigens, shared antigen-binding proteins, and their related uses and manufacture. Any patents that may issue from these pending patent applications are expected to expire between 2038 and 2040, absent any patent term adjustments or extensions. In addition, in the ordinary course of our business, we also enter into agreements with other third parties for non-exclusive rights to intellectual property directed to other technologies that are ancillary to our business, including laboratory information management software and research and development tools.

In addition to patents, we have filed for trademark registration with the United States Patent and Trademark Office, or the USPTO, as well as certain other international trademark agencies, for “Gritstone,” “Granite”, “Slate” and our logo. Furthermore, we rely upon trade secrets, know-how and continuing technological innovation to develop and maintain our competitive position.

In some instances, we submit patent applications directly with the USPTO as provisional patent applications. Provisional applications for patents were designed to provide a lower-cost first patent filing in the United States. Corresponding non-provisional patent applications must be filed not later than 12 months after the provisional application filing date. The corresponding non-provisional application benefits in that the priority date(s) of the patent application is/are the earlier provisional application filing date(s), and the patent term of the finally issued patent is calculated from the later non-provisional application filing date. This system allows us to obtain an early priority date, add material to the patent application(s) during the priority year, obtain a later start to the patent term and to delay prosecution costs, which may be useful in the event that we decide not to pursue examination in an application. We file U.S. non-provisional applications and Patent Cooperation Treaty, or PCT, applications that claim the benefit of the priority date of earlier filed provisional applications, when applicable. The PCT system allows a single application to be filed within 12 months of the original priority date of the patent application, and to designate all of the 152 PCT member states in which national patent applications can later be pursued based on the international patent application filed under the PCT. The PCT searching authority performs a patentability search and issues a non-binding patentability opinion which can be used to evaluate the chances of success for the national applications in foreign countries prior to having to incur the filing fees. Although a PCT application does not issue as a patent, it allows the applicant to seek protection in any of the member states through national-phase applications.

At the end of the period of two and a half years from the first priority date of the patent application, separate patent applications can be pursued in any of the PCT member states either by direct national filing or, in some cases by filing through a regional patent organization, such as the European Patent Organization. The PCT system delays expenses, allows a limited evaluation of the chances of success for national/regional patent applications and enables substantial savings where applications are abandoned within the first two and a half years of filing.

For all patent applications, we determine claiming strategy on a case-by-case basis. Advice of counsel and our business model and needs are always considered. We file patents containing claims for protection of all useful applications of our proprietary technologies and any products, as well as all new applications and/or uses we discover for existing technologies and products, assuming these are strategically valuable. We continuously reassess the number and type of patent applications, as well as the pending and issued patent claims to ensure that maximum coverage and value are obtained for our processes, and compositions, given existing patent office rules and regulations. Further, claims may be modified during patent prosecution to meet our intellectual property and business needs.

We recognize that the ability to obtain patent protection and the degree of such protection depends on a number of factors, including the extent of the prior art, the novelty and non-obviousness of the invention, and the ability to satisfy the enablement requirement of the patent laws. The patent positions of biotechnology companies like ours are generally uncertain and involve

complex legal, scientific and factual questions. In addition, the coverage claimed in a patent application can be significantly reduced before the patent is issued, and its scope can be reinterpreted or further altered even after patent issuance. Consequently, we may not obtain or maintain adequate patent protection for any of our product candidates or for our technology platform. We cannot predict whether the patent applications we are currently pursuing will issue as patents in any particular jurisdiction or whether the claims of any issued patents will provide sufficient proprietary protection from competitors. Any patents that we hold may be challenged, circumvented or invalidated by third parties.

Our commercial success will also depend in part on not infringing the proprietary rights of third parties. In addition, we have licensed rights under proprietary technologies of third parties to develop, manufacture and commercialize specific aspects of our products. It is uncertain whether the issuance of any third party patent would require us to alter our development or commercial strategies, alter our processes, obtain licenses or cease certain activities. The expiration of patents or patent applications licensed from third parties or our breach of any license agreements or failure to obtain a license to proprietary rights that we may require to develop or commercialize our future technology may have a material adverse impact on us. If third parties prepare and file patent applications in the United States that also claim technology to which we have rights, we may have to participate in interference proceedings in the USPTO to determine priority of invention.

We further own trade secrets relating to our technology, and we maintain the confidentiality of proprietary information to protect aspects of our business that are not amenable to, or that we do not consider appropriate for, patent protection. We seek to protect our trade secrets and know-how by entering into confidentiality agreements with third parties, consultants and employees who have access to such trade secrets and know-how. These agreements provide that all confidential information concerning our business or financial affairs developed or made known to the individual during the course of the individual's relationship with us are to be kept confidential and not disclosed to third parties except in specific circumstances. In addition, we enter into employment agreements that require employees to assign to us any inventions, trade secrets or know-how that they develop while employed by us. Although we take steps to protect our proprietary information and trade secrets, including through agreements with our employees and consultants, these agreements may be breached, or third parties may independently develop substantially equivalent proprietary information and techniques or otherwise gain access to our trade secrets or disclose our technology. Thus, we may not be able to meaningfully protect our trade secrets. To the extent that our employees, consultants, scientific advisors or other contractors use intellectual property owned by others in their work for us, disputes may arise as to the rights in related or resulting know how and inventions.

For a more comprehensive discussion of the risks related to our intellectual property, please see "Risk Factors—Risks Related to Intellectual Property."

Government Regulation

The FDA and other regulatory authorities at federal, state, and local levels, as well as in foreign countries, extensively regulate, among other things, the research, development, testing, manufacture, quality control, import, export, safety, effectiveness, labeling, packaging, storage, distribution, record keeping, approval, advertising, promotion, marketing, post-approval monitoring, and post-approval reporting of biologics such as those we are developing. We, along with third-party contractors, will be required to navigate the various preclinical, clinical and commercial approval requirements of the governing regulatory agencies of the countries in which we wish to conduct studies or seek approval or licensure of our product candidates.

In the United States, the FDA regulates biologic products under both the Federal Food, Drug and Cosmetic Act and the Public Health Service Act and their respective implementing regulations. Our product candidates are subject to regulation by the FDA as biologics. Biologics require the submission of a biologics license application, or BLA, and licensure, which constitutes approval, by the FDA before being marketed in the United States. None of our product candidates has been approved by the FDA for marketing in the United States, and we currently have no BLAs pending. Failure to comply with applicable FDA or other requirements at any time during product development, clinical testing, the approval process or after approval may result in administrative or judicial sanctions. These sanctions could include the FDA's refusal to approve pending applications, suspension or revocation of approved applications, warning letters, product recalls, product seizures, total or partial suspensions of manufacturing or distribution, injunctions, fines, civil penalties or criminal prosecution.

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

- completion of preclinical laboratory tests and animal studies performed in accordance with the FDA's GLP regulations;
- submission to the FDA of an IND, which must become effective before clinical trials may begin;
- approval by an independent Institutional Review Board, or IRB, or ethics committee at each clinical site before the trial is commenced;

- performance of adequate and well-controlled human clinical trials in accordance with FDA's good clinical practice, or GCP, regulations to establish the safety, purity and potency of the proposed biologic product candidate for its intended purpose;
- preparation of and submission to the FDA of a BLA after completion of all pivotal clinical trials;
- satisfactory completion of an FDA Advisory Committee review, if applicable;
- a determination by the FDA within 60 days of its receipt of a BLA to file the application for review;
- satisfactory completion of an FDA pre-approval inspection of the manufacturing facility or facilities at which the proposed product is produced to assess compliance with cGMP and to assure that the facilities, methods and controls are adequate to preserve the biological product's continued safety, purity and potency, and of selected clinical investigation sites to assess compliance with GCP regulations; and
- FDA review and approval of the BLA to permit commercial marketing of the product for particular indications for use in the United States.

Preclinical and Clinical Development

Prior to beginning the first clinical trial with a product candidate, we must submit an IND to the FDA. An IND is a request for authorization from the FDA to administer an investigational new drug product to humans. The central focus of an IND submission is on the general investigational plan and the protocol(s) for clinical studies. The IND also includes results of animal and in vitro studies assessing the toxicology, pharmacokinetics, pharmacology, and pharmacodynamic characteristics of the product; chemistry, manufacturing, and controls information; and any available human data or literature to support the use of the investigational product. An IND must become effective before human clinical trials may begin. The IND automatically becomes effective 30 days after receipt by the FDA, unless the FDA, within the 30-day time period, raises safety concerns or questions about the proposed clinical trial. In such a case, the IND may be placed on clinical hold and the IND sponsor and the FDA must resolve any outstanding concerns or questions before the clinical trial can begin. Submission of an IND therefore may or may not result in FDA authorization to begin a clinical trial.

In addition to the submission of an IND to the FDA before initiation of a clinical trial in the United States, certain human clinical trials involving recombinant or synthetic nucleic acid molecules had historically been subject to review by the Recombinant DNA Advisory Committee, or RAC, of the National institutes of Health, or NIH, Office of Biotechnology Activities, pursuant to the NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules, or NIH Guidelines. On April 25, 2019, the NIH revised the NIH Guidelines to remove protocol submission and reporting requirements and to eliminate the role of the RAC in human gene transfer research. The previous RAC has been renamed the Novel and Exceptional Technology and Research Advisory Committee (NExTRAC), which will advise the NIH Director on the scientific, safety, ethical and social issues associated with emerging biotechnologies. These trials will remain subject to the FDA's oversight and other clinical trial regulations, and oversight at the local level will continue as otherwise set forth in the NIH Guidelines. Specifically, under the NIH Guidelines, supervision of human gene transfer trials includes evaluation and assessment by an institutional biosafety committee, or IBC, a local institutional committee that reviews and oversees research utilizing recombinant or synthetic nucleic acid molecules at that institution. The IBC assesses the safety of the research and identifies any potential risk to public health or the environment, and such review may result in some delay before initiation of a clinical trial. While the NIH Guidelines are not mandatory unless the research in question is being conducted at or sponsored by institutions receiving NIH funding of recombinant or synthetic nucleic acid molecule research, many companies and other institutions not otherwise subject to the NIH Guidelines voluntarily follow them. Thus, companies are still subject to significant regulatory oversight by the FDA, IRBs and, if applicable, the IBC of each institution at which it conducts clinical trials.

Clinical trials involve the administration of the investigational product to human subjects under the supervision of qualified investigators in accordance with GCPs, which include the requirement that all research subjects provide their informed consent for their participation in any clinical study. Clinical trials are conducted under protocols detailing, among other things, the objectives of the study, the parameters to be used in monitoring safety and the effectiveness criteria to be evaluated. Generally, a separate submission to the existing IND must be made for each successive clinical trial conducted during product development and for any subsequent protocol amendments. Furthermore, an independent IRB for each site proposing to conduct the clinical trial must review and approve the plan for any clinical trial and its informed consent form before the clinical trial begins at that site, and must monitor the study until completed. Regulatory authorities, the IRB or the sponsor may suspend a clinical trial at any time on various grounds, including a finding that the subjects are being exposed to an unacceptable health risk or that the trial is unlikely to meet its stated objectives. Some studies also include oversight by an independent group of qualified experts organized by the clinical study sponsor, known as a data safety monitoring board, which provides authorization for whether or not a study may move forward at designated check points based on access to certain data from the study and may halt the clinical trial if it determines that there is an unacceptable

safety risk for subjects or other grounds, such as no demonstration of efficacy. There are also requirements governing the reporting of ongoing clinical studies and clinical study results to public registries.

For purposes of BLA approval, human clinical trials are typically conducted in three sequential phases that may overlap.

- Phase 1—The investigational product is initially introduced into healthy human subjects or patients with the target disease or condition. These studies are designed to test the safety, dosage tolerance, absorption, metabolism and distribution of the investigational product in humans, the side effects associated with increasing doses, and, if possible, to gain early evidence on effectiveness.
- Phase 2—The investigational product is administered to a limited patient population with a specified disease or condition to evaluate the preliminary efficacy, optimal dosages and dosing schedule and to identify possible adverse side effects and safety risks. Multiple Phase 2 clinical trials may be conducted to obtain information prior to beginning larger and more expensive Phase 3 clinical trials.
- Phase 3—The investigational product is administered to an expanded patient population to further evaluate dosage, to provide statistically significant evidence of clinical efficacy and to further test for safety, generally at multiple geographically dispersed clinical trial sites. These clinical trials are intended to establish the overall risk/benefit ratio of the investigational product and to provide an adequate basis for product approval.

In some cases, the FDA may require, or companies may voluntarily pursue, additional clinical trials after a product is approved to gain more information about the product. These so-called Phase 4 studies may be made a condition to approval of the BLA. Concurrent with clinical trials, companies may complete additional animal studies and develop additional information about the biological characteristics of the product candidate, and must finalize a process for manufacturing the product in commercial quantities in accordance with cGMP requirements. The manufacturing process must be capable of consistently producing quality batches of the product candidate and, among other things, must develop methods for testing the safety, purity and potency. Additionally, appropriate packaging must be selected and tested and stability studies must be conducted to demonstrate that the product candidate does not undergo unacceptable deterioration over its shelf life.

BLA Submission and Review

Assuming successful completion of all required testing in accordance with all applicable regulatory requirements, the results of product development, nonclinical studies and clinical trials are submitted to the FDA as part of a BLA requesting approval to market the product for one or more indications. The BLA must include all relevant data available from pertinent preclinical and clinical studies, including negative or ambiguous results as well as positive findings, together with detailed information relating to the product's chemistry, manufacturing, controls, and proposed labeling, among other things. The submission of a BLA requires payment of a substantial application user fee to FDA, unless a waiver or exemption applies.

Once a BLA has been submitted, the FDA's goal is to review standard applications within ten months after it accepts the application for filing, or, if the application qualifies for priority review, six months after the FDA accepts the application for filing. In both standard and priority reviews, the review process is often significantly extended by FDA requests for additional information or clarification. The FDA reviews a BLA to determine, among other things, whether a product is safe, pure and potent and the facility in which it is manufactured, processed, packed, or held meets standards designed to assure the product's continued safety, purity and potency. The FDA may convene an advisory committee to provide clinical insight on application review questions. Before approving a BLA, the FDA will typically inspect the facility or facilities where the product is manufactured. The FDA will not approve an application 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 compliance with GCP. If the FDA determines that the application, manufacturing process or manufacturing facilities are not acceptable, it will outline the deficiencies in the submission and often will request additional testing or information. Notwithstanding the submission of any requested additional information, the FDA ultimately may decide that the application does not satisfy the regulatory criteria for approval.

After the FDA evaluates a BLA and conducts inspections of manufacturing facilities where the investigational product will be produced, the FDA may issue an approval letter or a Complete Response letter. An approval letter authorizes commercial marketing of the product with specific prescribing information for specific indications. A Complete Response letter will describe all of the deficiencies that the FDA has identified in the BLA, except that where the FDA determines that the data supporting the application are inadequate to support approval, the FDA may issue the Complete Response letter without first conducting required inspections, testing submitted product lots, and/or reviewing proposed labeling. In issuing the Complete Response letter, the FDA may recommend actions that the applicant might take to place the BLA in condition for approval, including requests for additional information or

clarification. The FDA may delay or refuse approval of a BLA if applicable regulatory criteria are not satisfied, require additional testing or information and/or require post-marketing testing and surveillance to monitor safety or efficacy of a product.

If regulatory approval of a product is granted, such approval will be granted for particular indications and may entail limitations on the indicated uses for which such product may be marketed. For example, the FDA may approve the BLA with a Risk Evaluation and Mitigation Strategy, or REMS, to ensure the benefits of the product outweigh its risks. A REMS is a safety strategy to manage a known or potential serious risk associated with a product and to enable patients to have continued access to such medicines by managing their safe use. A REMS program may be required to include various elements, such as a medication guide or patient package insert, a communication plan to educate healthcare providers of the drug's risks, or other elements to assure safe use, such as limitations on who may prescribe or dispense the drug, dispensing only under certain circumstances, special monitoring and the use of patient registries. The FDA also may condition approval on, among other things, changes to proposed labeling or the development of adequate controls and specifications. Once approved, the FDA may withdraw the product approval if compliance with pre- and post-marketing requirements is not maintained or if problems occur after the product reaches the marketplace. The FDA may require one or more Phase 4 post-market studies and surveillance to further assess and monitor the product's safety and effectiveness after commercialization, and may limit further marketing of the product based on the results of these post-marketing studies.

Expedited Development and Review Programs

The FDA offers a number of expedited development and review programs for qualifying product candidates. For example, the FDA granted GRANITE fast track designation for treatment of colorectal cancer in December 2018. The fast track program is intended to expedite or facilitate the process for reviewing new products that meet certain criteria. Specifically, new products are eligible for fast track designation if they are intended to treat a serious or life-threatening disease or condition and demonstrate the potential to address unmet medical needs for the disease or 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 fast track product has opportunities for frequent interactions with the review team during product development and, once a BLA is submitted, the product may be eligible for priority review. A fast track product may also be eligible for rolling review, where the FDA may consider for review sections of the BLA on a rolling basis before the complete application is submitted, if the sponsor provides a schedule for the submission of the sections of the BLA, the FDA agrees to accept sections of the BLA and determines that the schedule is acceptable, and the sponsor pays any required user fees upon submission of the first section of the BLA.

A product intended to treat a serious or life-threatening disease or condition may also be eligible for breakthrough therapy designation to expedite its development and review. A product can receive breakthrough therapy designation if preliminary clinical evidence indicates that the product may demonstrate substantial improvement over existing therapies on one or more clinically significant endpoints, such as substantial treatment effects observed early in clinical development. The designation includes all of the fast track program features, as well as more intensive FDA interaction and guidance beginning as early as Phase 1 and an organizational commitment to expedite the development and review of the product, including involvement of senior managers.

Any marketing application for a biologic submitted to the FDA for approval, including a product with a fast track designation and/or breakthrough therapy designation, may be eligible for other types of FDA programs intended to expedite the FDA review and approval process, such as priority review and accelerated approval. A product is eligible for priority review if it has the potential to provide a significant improvement in the treatment, diagnosis or prevention of a serious disease or condition compared to marketed products. For products containing new molecular entities, priority review designation means the FDA's goal is to take action on the marketing application within six months of the 60-day filing date, compared with ten months under standard review.

Additionally, products studied for their safety and effectiveness in treating serious or life-threatening diseases or conditions may receive accelerated approval upon a determination that the product has an effect on a surrogate endpoint that is reasonably likely to predict clinical benefit, or on a clinical endpoint that can be measured earlier than irreversible morbidity or mortality, that is reasonably likely to predict an effect on irreversible morbidity or mortality or other clinical benefit, taking into account the severity, rarity, or prevalence of the condition and the availability or lack of alternative treatments. As a condition of accelerated approval, the FDA will generally require the sponsor to perform adequate and well-controlled post-marketing clinical studies to verify and describe the anticipated effect on irreversible morbidity or mortality or other clinical benefit. 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.

In 2017, FDA established a new regenerative medicine advanced therapy, or RMAT, designation as part of its implementation of the 21st Century Cures Act, which was signed into law in December 2016. To qualify for RMAT designation, the product candidate must meet the following criteria: (1) it qualifies as a RMAT, which is defined as a cell therapy, therapeutic tissue engineering product, human cell and tissue product, or any combination product using such therapies or products, with limited exceptions; (2) it is intended

to treat, modify, reverse, or cure a serious or life-threatening disease or condition; and (3) preliminary clinical evidence indicates that the drug has the potential to address unmet medical needs for such a disease or condition. Like fast track and breakthrough therapy designation, RMAT designation provides potential benefits that include more frequent meetings with FDA to discuss the development plan for the product candidate and eligibility for rolling review and priority review. Products granted RMAT designation may also be eligible for accelerated approval on the basis of a surrogate or intermediate endpoint reasonably likely to predict long-term clinical benefit, or reliance upon data obtained from a meaningful number of sites, including through expansion to additional sites. Once approved, when appropriate, the FDA can permit fulfillment of post-approval requirements under accelerated approval through the submission of clinical evidence, clinical studies, patient registries, or other sources of real world evidence such as electronic health records; through the collection of larger confirmatory datasets; or through post-approval monitoring of all patients treated with the therapy prior to approval.

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

Orphan Drug Designation

Under the Orphan Drug Act, the FDA may grant orphan designation to a drug or biologic intended to treat a rare disease or condition, which is a disease or condition that affects fewer than 200,000 individuals in the United States, or if it affects more than 200,000 individuals in the United States, there is no reasonable expectation that the cost of developing and making available a drug or biologic for this type of disease or condition will be recovered from sales in the United States for that drug or biologic. Orphan drug designation must be requested before submitting a BLA. After the FDA grants orphan drug designation, the generic identity of the therapeutic agent and its potential orphan use are disclosed publicly by the FDA. The orphan drug designation does not convey any advantage in, or shorten the duration of, the regulatory review or approval process.

If a product that has orphan drug designation subsequently receives the first FDA approval for the disease for which it has such designation, the product is entitled to orphan drug exclusive approval (or exclusivity), which means that the FDA may not approve any other applications, including a full BLA, to market the same biologic for the same indication for seven years, except in limited circumstances, such as a showing of clinical superiority to the product with orphan drug exclusivity. Orphan drug exclusivity does not prevent FDA from approving a different drug or biologic for the same disease or condition, or the same drug or biologic for a different disease or condition. Among the other benefits of orphan drug designation are tax credits for certain research and a waiver of the BLA application fee.

A designated orphan drug may not receive orphan drug exclusivity if it is approved for a use that is broader than the indication for which it received orphan designation. In addition, exclusive marketing rights in the United States may be lost if the FDA later determines that the request for designation was materially defective or if the manufacturer is unable to assure sufficient quantities of the product to meet the needs of patients with the rare disease or condition.

Post-Approval Requirements

Any products manufactured or distributed by us pursuant to FDA approvals are subject to pervasive and continuing regulation by the FDA, including, among other things, requirements relating to record-keeping, reporting of adverse experiences, periodic reporting, product sampling and distribution, and advertising and promotion of the product. After approval, most changes to the approved product, such as adding new indications or other labeling claims, are subject to prior FDA review and approval. There also are continuing user fee requirements, under which FDA assesses an annual program fee for each product identified in an approved BLA. Biologic manufacturers and their subcontractors 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, which impose certain procedural and documentation requirements upon us and our third-party manufacturers. Changes to the manufacturing process are strictly regulated, and, depending on the significance of the change, may require prior FDA approval before being implemented. FDA regulations also require investigation and correction of any deviations from cGMP and impose reporting requirements upon us and any third-party manufacturers that we may decide to use. Accordingly, manufacturers must continue to expend time, money and effort in the area of production and quality control to maintain compliance with cGMP and other aspects of regulatory compliance.

The FDA may withdraw approval if compliance with regulatory requirements and standards is not maintained or if problems occur after the product reaches the market. Later discovery of previously unknown problems with a product, including adverse events of unanticipated severity or frequency, or with manufacturing processes, or failure to comply with regulatory requirements, may result in revisions to the approved labeling to add new safety information; imposition of post-market studies or clinical studies to assess new

safety risks; or imposition of distribution restrictions or other restrictions under a REMS program. Other potential consequences include, among other things:

- restrictions on the marketing or manufacturing of a product, complete withdrawal of the product from the market or product recalls;
- fines, warning letters or holds on post-approval clinical studies;
- refusal of the FDA to approve pending applications or supplements to approved applications, or suspension or revocation of existing product approvals;
- product seizure or detention, or refusal of the FDA to permit the import or export of products; or
- injunctions or the imposition of civil or criminal penalties.

The FDA closely regulates the marketing, labeling, advertising and promotion of biologics. A company can make only those claims relating to safety and efficacy, purity and potency that are approved by the FDA and in accordance with the provisions of the approved label. The FDA and other agencies actively enforce the laws and regulations prohibiting the promotion of off-label uses. Failure to comply with these requirements can result in, among other things, adverse publicity, warning letters, corrective advertising and potential civil and criminal penalties. Physicians may prescribe legally available products for uses that are not described in the product's labeling and that differ from those tested by us and approved by the FDA. Such off-label uses are common across medical specialties. Physicians may believe that such off-label uses are the best treatment for many patients in varied circumstances. The FDA does not regulate the behavior of physicians in their choice of treatments. The FDA does, however, restrict manufacturer's communications on the subject of off-label use of their products.

Biosimilars and Reference Product Exclusivity

The Patient Protection and Affordable Care Act, as amended by the Health Care and Education Reconciliation Act, or collectively, the ACA, signed into law in 2010, includes a subtitle called the Biologics Price Competition and Innovation Act of 2009, or BPCIA, which created an abbreviated approval pathway for biological products that are biosimilar to or interchangeable with an FDA-approved reference biological product. To date, a number of biosimilars have been licensed under the BPCIA, and numerous biosimilars have been approved in Europe. The FDA has issued several guidance documents outlining an approach to review and approval of biosimilars.

Biosimilarity, which requires that there be no clinically meaningful differences between the biological product and the reference product in terms of safety, purity, and potency, can be shown through analytical studies, animal studies, and a clinical study or studies. Interchangeability requires that a product is biosimilar to the reference product and the product must demonstrate that it can be expected to produce the same clinical results as the reference product in any given patient and, for products that are administered to a patient more than once, the biologic and the reference biologic may be alternated or switched after one has been previously administered without increasing safety risks or risks of diminished efficacy relative to exclusive use of the reference biologic. Complexities associated with the larger, and often more complex, structures of biological products, as well as the processes by which such products are manufactured, pose significant hurdles to implementation of the abbreviated approval pathway that are still being worked out by the FDA.

Under the BPCIA, an application for a biosimilar product may not be submitted to the FDA until four years following the date that the reference product was first licensed by the FDA. In addition, the FDA may not approve a biosimilar product until 12 years from the date on which the reference product was first licensed. During this 12-year period of exclusivity, another company may still market a competing version of the reference product if the FDA approves a full BLA containing that applicant's own preclinical data and data from adequate and well-controlled clinical trials to demonstrate the safety, purity and potency of the competing product. The BPCIA also created certain exclusivity periods for biosimilars approved as interchangeable products. At this juncture, it is unclear whether products deemed "interchangeable" by the FDA will, in fact, be readily substituted by pharmacies, which are governed by state pharmacy law.

The BPCIA is complex and continues to be interpreted and implemented by the FDA. In addition, government proposals have sought to reduce the 12-year reference product exclusivity period. Other aspects of the BPCIA, some of which may impact the BPCIA exclusivity provisions, have also been the subject of recent litigation. As a result, the ultimate implementation and impact of the BPCIA is subject to significant uncertainty.

Other Healthcare Laws and Compliance Requirements

Pharmaceutical companies are subject to additional healthcare regulation and enforcement by the federal government and by authorities in the states and foreign jurisdictions in which they conduct their business. Such laws include, without limitation: the U.S. federal Anti-Kickback Statute, which prohibits, among other things, persons and entities from knowingly and willfully soliciting, receiving, offering or paying remuneration, to induce, or in return for, either the referral of an individual, or the purchase or recommendation of an item or service for which payment may be made under any federal healthcare program; federal civil and criminal false claims laws and civil monetary penalty laws, which prohibit, among other things, individuals or entities from knowingly presenting, or causing to be presented, claims for payment to the federal government, including federal healthcare programs, that are false or fraudulent; HIPAA, which created additional federal criminal statutes which prohibit, among other things, executing a scheme to defraud any healthcare benefit program and making false statements relating to healthcare matters, and which, as amended by HITECH, also imposes certain requirements on HIPAA covered entities and their business associates relating to the privacy, security and transmission of individually identifiable health information; the U.S. federal Physician Payments Sunshine Act, 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, with specific exceptions, to annually report to the federal government, information related to payments or other transfers of value made to physicians, certain other health care professionals beginning in 2022, and teaching hospitals, as well as ownership and investment interests held by physicians and their immediate family members; and U.S. state and foreign law equivalents of each of the above federal laws, which, in some cases, differ from each other in significant ways, and may not have the same effect, thus complicating compliance efforts. If their operations are found to be in violation of any of such laws or any other governmental regulations that apply, they may be subject to penalties, including, without limitation, civil, criminal and administrative penalties, damages, fines, exclusion from government-funded healthcare programs, such as Medicare and Medicaid or similar programs in other countries or jurisdictions, integrity oversight and reporting obligations to resolve allegations of non-compliance, disgorgement, individual imprisonment, contractual damages, reputational harm, diminished profits and the curtailment or restructuring of our operations.

Coverage and Reimbursement

Significant uncertainty exists as to the coverage and reimbursement status of any pharmaceutical or biological product for which we obtain regulatory approval. Sales of any product depend, in part, on the extent to which such product will be covered by third-party payors, such as federal, state, and foreign government healthcare programs, commercial insurance and managed healthcare organizations, and the level of reimbursement for such product by third-party payors. Decisions regarding the extent of coverage and amount of reimbursement to be provided are made on a plan-by-plan basis. For products administered under the supervision of a physician, obtaining coverage and adequate reimbursement may be particularly difficult because of the higher prices often associated with such drugs. Additionally, separate reimbursement for the product itself or the treatment or procedure in which the product is used may not be available, which may impact physician utilization.

In addition, the U.S. government, state legislatures and foreign governments have continued implementing cost-containment programs, including price controls, restrictions on coverage and reimbursement and requirements for substitution of generic products. Third-party payors are increasingly challenging the prices charged for medical products and services, examining the medical necessity and reviewing the cost effectiveness of pharmaceutical or biological products, medical devices and medical services, in addition to questioning safety and efficacy. Adoption of price controls and cost-containment measures, and adoption of more restrictive policies in jurisdictions with existing controls and measures, could further limit sales of any product. Decreases in third-party reimbursement for any product or a decision by a third-party payor not to cover a product could reduce physician usage and patient demand for the product. No regulatory authority has granted approval for a personalized cancer immunotherapy based on a vaccine approach, and there is no model for reimbursement of this type of product.

Healthcare Reform

The United States and some foreign jurisdictions are considering or have enacted a number of reform proposals to change the healthcare system. There is significant interest in promoting changes in healthcare systems with the stated goals of containing healthcare costs, improving quality or expanding access. In the United States, the pharmaceutical industry has been a particular focus of these efforts and has been significantly affected by federal and state legislative initiatives, including those designed to limit the pricing, coverage, and reimbursement of pharmaceutical and biopharmaceutical products, especially under government-funded health care programs, and increased governmental control of drug pricing.

In March 2010, the ACA was signed into law, which substantially changed the way healthcare is financed by both governmental and private insurers in the United States, and significantly affected the pharmaceutical industry. The ACA contains a number of provisions of particular import to the pharmaceutical and biotechnology industries, including, but not limited to, those

governing enrollment in federal healthcare programs, a new methodology by which rebates owed by manufacturers under the Medicaid Drug Rebate Program are calculated for drugs that are inhaled, infused, instilled, implanted or injected, and annual fees based on pharmaceutical companies' share of sales to federal health care programs. Since its enactment, there have been judicial, Congressional, and executive branch challenges to certain aspects of the ACA, and we expect there will be additional challenges and amendments to the ACA in the future. For example, the Tax Act was enacted, which, among other things, removes penalties for not complying with ACA's individual mandate to carry health insurance. Since the enactment of the Tax Act, there have been additional amendments to certain provisions of the ACA. On December 14, 2018, a U.S. District Court Judge in the Northern District of Texas, ruled that the individual mandate is a critical and 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. On December 18, 2019, the U.S. Court of Appeals for the 5th Circuit upheld the District Court's decision that the individual mandate was unconstitutional but remanded the case back to the District Court to determine whether the remaining provisions of the ACA are invalid as well. It is unclear how these decisions, subsequent appeals, if any, and other efforts to challenge, repeal or replace the ACA will impact the ACA.

Other legislative changes have been proposed and adopted since the ACA was enacted, including aggregate reductions of Medicare payments to providers of 2% per fiscal year and reduced payments to several types of Medicare providers. These reductions went into effect on April 1, 2013 and, due to subsequent legislative amendments to the statute will remain in effect through 2029 unless additional Congressional action is taken.

Moreover, there has recently been heightened governmental scrutiny over the manner in which 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. While some proposed measures will require authorization through additional legislation to become effective, Congress and the Trump administration have each indicated that it will continue to seek new legislative and/or administrative measures to control drug costs At the state level, legislatures have increasingly passed legislation and implemented regulations designed to control pharmaceutical 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.

Additionally, on May 30, 2018, the Trickett Wendler, Frank Mongiello, Jordan McLinn, and Matthew Bellina Right to Try Act of 2017, or the Right to Try Act, was signed into law. The law, among other things, provides a federal framework for certain patients to access certain investigational new drug products that have completed a Phase I clinical trial and that are undergoing investigation for FDA approval. Under certain circumstances, eligible patients can seek treatment without enrolling in clinical trials and without obtaining FDA permission under the FDA expanded access program. There is no obligation for a pharmaceutical manufacturer to make its drug products available to eligible patients as a result of the Right to Try Act.

Our Interactions with the FDA

EDGE Medical Device Development

In two separate FDA interactions, the FDA advised us that our machine learning software will not be subject to medical device diagnostic regulations. In August 2016, the FDA's Center for Devices and Radiological Health, or CDRH, determined that the TSNA prediction software is a Non-Significant Risk, or NSR, device, and that an investigational device exemption, or IDE, submission is not required to conduct clinical studies with our product candidate. In April 2017, the FDA's Center for Biologics Evaluation and Research, or CBER, confirmed that medical device diagnostic regulations do not apply to our testing and processing of the patient-specific TSNA, and that quality requirements could be met through compliance with biologic cGMPs. Based on these interactions, we believe no additional device-related regulatory submissions (such as an IDE or pre-market approval application (PMA)) or device development activities are required and our TSNA prediction software procedure will be regulated as part of our cGMP manufacturing process.

GRANITE Development Program

Preclinical Safety

To address the personalized nature of our therapy in a Pre-Pre-IND interaction with the FDA's CBER Office of Tissues and Advanced Therapies, or OTAT, the FDA advised us that a single toxicological animal study with a representative vector could be able to support preclinical safety for purposes of IND submission. Subsequent to this discussion, we submitted proposed protocols for GLP

toxicology and biodistribution studies for OTAT's review in connection with a Pre-IND meeting, and OTAT agreed that a single GLP toxicology study could support IND submission. In this GLP toxicology study, we administered our ChAdV and the SAM vectors to Indian Rhesus macaques. The heterologous prime-boost immunotherapy approach when administered intramuscularly was well tolerated at the clinical maximal dose of each platform, with some animals presenting flu-like symptoms. Preclinical chemistry findings include a transient increase in select cytokines, which resolved rapidly.

Clinical Regulatory

In our GRANITE Pre-IND meeting with OTAT, the FDA previewed Clinical Protocol GO-004 and confirmed that the overall design appeared reasonable, while providing comments on the study populations and dose determination which we have incorporated into the protocol. OTAT also agreed with our dose limiting toxicity assessment criteria, while reserving comment on the starting dose and dose escalation pending the completion of planned preclinical studies. We intend to include these elements in the protocol, which may permit a faster progression and fewer patients to reach the clinical protocol's combination cohort (Phase 1, Part C).

Regulatory Chemistry, Manufacturing & Controls

In a Type-C Facilities meeting with the FDA's CBER Division of Manufacturing and Product Quality, or DMPQ, we obtained FDA feedback on our proposed design for the multi-use clinical manufacturing facility in Pleasanton, California. Importantly, the FDA concurred with our plan to build a facility designed to accommodate manufacture of multiple patient-specific lots in parallel within the same manufacturing suite, which we expect will provide a substantial increase in scalability within a smaller allocation of cleanrooms.

At our subsequent GRANITE Pre-IND meeting with OTAT, the FDA concurred with our proposed use of select rapid release testing methods in which we proposed replacing standard cell-culture based tests with faster polymerase chain reaction methods. As discussed with the FDA, we submitted qualification of these methods in our IND submission for GRANITE. The FDA also found our proposed stability program to be generally acceptable to support the proposed Phase 1 clinical study of GRANITE, where only one representative patient lot per year will be placed on product stability during conduct of the clinical program.

In support of transitioning the GRANITE manufacturing process from external contract manufacturing organizations to Gritstone's Pleasanton manufacturing facility, an IND amendment has been submitted to the FDA outlining the Chemistry, Manufacturing, and Controls documentation changes for the ChAdV and SAM products. These revisions include a plasmid backbone change for the SAM vector and a process improvement for the SAM drug substance. These updates have been implemented and are currently being utilized in Gritstone's Pleasanton manufacturing facility.

GRANITE Regulatory Milestones

The FDA cleared our IND for GRANITE in September 2018. In December 2018, the FDA granted Fast Track designation to GRANITE for the treatment of colorectal cancer.

SLATE Development Program

Preclinical Safety

In pre-IND communications with the FDA, following a justification of comparability of ChAdV and SAM products, Gritstone received feedback that pre-clinical pharmacology, pharmacokinetic, and toxicology studies conducted in support of the GRANITE IND, could be used to support the safety of the clinical study proposed under the SLATE IND. In follow-up, the Agency requested additional safety pharmacology information on the general anticipated immunogenicity and auto-reactivity elicited with each of the 20 neoantigens expressed in the SLATE cassette, as well as the impact of order and orientation of the neoantigens within the expression cassette.

Clinical Regulatory

In our SLATE Pre-IND communication with OTAT, the FDA previewed Clinical Protocol GO-005 and confirmed that the overall design appeared reasonable and requested we add language to clarify our proposed dose escalation and stopping rules. The FDA had additional questions on our proposed Next Generation Sequencing method to screen patients for their human leukocyte antigen (HLA) type and communicated that this novel method may be viewed as a companion diagnostic.

Regulatory Chemistry, Manufacturing & Controls

In review of the SLATE IND, much of the manufacturing process is similar to that used in the GRANITE IND, therefore, the Agency feedback focused primarily on the quality of the reagents, drug product characterization and release, and ongoing stability requests. The FDA inquired on the status of certain research-grade reagents and reminded Gritstone of the need to progress to GMP grade materials in the manufacture drug product by the time of BLA approval and commercial licensure. In order to retain consistency in the manufactured drug product across SLATE batches, we were asked to amend the specification of certain release assays' criteria and continue the development of quantitative potency assays for the ChAdV and SAM products prior to approval, and we were asked to summarize our QC plan to prevent, detect, and correct deficiencies that may compromise product integrity or function, or that may lead to the possible transmission of adventitious infectious agents. Additionally, the Agency provided guidance on the proposed method for qualifying Gritstone's proposed accelerated adventitious agent release assay.

SLATE Regulatory Milestones

The FDA cleared our IND for SLATE in June 2019.

Financial Information About Segments

We manage our operations as a single reportable segment for the purposes of assessing performance and making operating decisions. See "Note 2. Summary of Significant Accounting Policies" in the notes to the financial statements included elsewhere in this Annual Report on Form 10-K.

Employees

As of December 31, 2019, we had 174 full-time employees, including a total of 39 employees with M.D. or Ph.D. degrees. Within our workforce, 147 employees are engaged in research and development, 64 in manufacturing and quality, and 27 are engaged in business development, finance, legal, human resources, facilities, information technology and general management and administration. None of our employees are represented by labor unions or covered by collective bargaining agreements. We consider our relationship with our employees to be good.

Corporate Information

We were founded in August 2015 as a Delaware corporation. Our principal executive offices are located at 5959 Horton Street, Suite 300, Emeryville, California 94608, and our telephone number is (510) 871-6100. Our website address is www.gritstoneoncology.com. The information on, or that can be accessed through, our website is not part of this report and is not incorporated by reference herein. We have included our website address as an inactive textual reference only. We also use our website as a means of disclosing material non-public information and for complying with our disclosure obligations under Regulation FD.

We file electronically with the SEC our annual reports on Form 10-K, quarterly reports on Form 10-Q and current reports on Form 8-K pursuant to Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended, or the Exchange Act. We make available on our website at www.gritstoneoncology.com, free of charge, copies of these reports, as soon as reasonably practicable after we electronically file such material with, or furnish it to, the SEC. The public may read or copy any materials we file with the SEC at the SEC's Public Reference Room at 100 F Street NE, Washington, D.C. 20549. The public may obtain information on the operation of the Public Reference Room by calling the SEC at 1- 800-SEC-0330. The SEC maintains a website that contains reports, proxy and information statements, and other information regarding issuers that file electronically with the SEC. The address of that website is www.sec.gov. The information in or accessible through the SEC and our website or social media sites does not constitute part of this Annual Report on Form 10-K or any other report or document we file with the SEC, and any references to our website and social media sites are intended to be inactive textual references only.

We use Gritstone Oncology, Inc.®, the Gritstone Oncology logo, and other marks as trademarks in the United States and other countries. This Annual Report on Form 10-K contains references to our trademarks and service marks and to those belonging to other entities. Solely for convenience, trademarks and trade names referred to in this Annual Report on Form 10-K, including logos, artwork and other visual displays, may appear without the ® or ™ symbols, but such references are not intended to indicate in any way that we will not assert, to the fullest extent under applicable law, our rights or the rights of the applicable licensor to these trademarks and trade names. We do not intend our use or display of other entities' trade names, trademarks or service marks to imply a relationship with, or endorsement or sponsorship of us by any other entity.

Item 1A. Risk Factors.

Investing in our common stock involves a high degree of risk. You should carefully consider the risks described below, as well as the other information in this Annual Report on Form 10-K, including our financial statements and the related notes and "Management's Discussion and Analysis of Financial Condition and Results of Operations," before deciding whether to invest in our common stock. The occurrence of any of the events or developments described below could have a material adverse effect on our business, results of operations, financial condition, prospects and stock price. In such an event, the market price of our common stock could decline, and you may lose all or part of your investment. Additional risks and uncertainties not presently known to us or that we currently deem immaterial may also impair our business operations.

Risks Related to Our Limited Operating History, Financial Condition and Capital Requirements

We are an early-stage biopharmaceutical company with a limited operating history and no products approved for commercial sale. We have incurred significant losses since our inception, and we anticipate that we will continue to incur significant losses for the foreseeable future, which, together with our limited operating history, makes it difficult to assess our future viability.

Biopharmaceutical product development is a highly speculative undertaking and involves a substantial degree of risk. We are an early-stage biopharmaceutical company, and we have only a limited operating history upon which you can evaluate our business and prospects. We have no products approved for commercial sale, have not generated any revenue from product sales and have incurred losses in each year since our inception in August 2015. In addition, we have limited experience and have not yet demonstrated an ability to successfully overcome many of the risks and uncertainties frequently encountered by companies in new and rapidly evolving fields, particularly in the biopharmaceutical industry. We initiated our Phase 1/2 clinical trials, GO-004 for our first personalized cancer immunotherapy candidate, GRANITE, in the fourth quarter of 2018 and GO-005 for our off-the-shelf cancer immunotherapy candidate, SLATE, in the third quarter of 2019.

We have had significant operating losses since our inception. Our net losses for the years ended December 31, 2019, 2018 and 2017 were approximately $94.4 million, $64.8 million and $41.4 million, respectively. As of December 31, 2019, we had an accumulated deficit of $221.0 million. 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. Our SLATE, GRANITE, and BiSAb programs will require substantial additional development time and resources before we would be able to apply for or receive regulatory approvals and begin generating revenue from product sales. In addition, we expect to incur additional costs associated with operating as a public company. We also do not yet have a sales organization or commercial infrastructure and, accordingly, if our product candidates are approved, we will incur significant expenses to develop a sales organization or commercial infrastructure in advance of generating any commercial product sales. We expect to continue to incur losses for the foreseeable future, and we anticipate these losses will increase as we continue to develop SLATE, GRANITE, the BiSAb program and any future product candidates, conduct clinical trials and pursue research and development activities. Even if we achieve profitability in the future, we may not be able to sustain profitability in subsequent periods. Our prior losses, combined with expected future losses, have had and will continue to have an adverse effect on our stockholders' equity and working capital.

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

Since our inception, we have invested a significant portion of our efforts and financial resources in research and development activities for tumor-specific cancer immunotherapies, and working to establish our in-house manufacturing capabilities. Preclinical studies and clinical trials and additional research and development activities will require substantial funds to complete. As of December 31, 2019, we had capital resources consisting of cash, cash equivalents and marketable securities of $127.8 million. We believe that we will continue to expend substantial resources for the foreseeable future in connection with the development of SLATE, GRANITE, our BiSAb program, and any other future cancer immunotherapy candidates we may choose to pursue, as well as the continued development of our manufacturing capabilities and other corporate uses. Specifically, in the near term, we expect to incur substantial expenses as we advance SLATE and GRANITE through clinical development, seek regulatory approval, prepare for and, if approved, proceed to commercialization, continue our research and development efforts and invest in our manufacturing facility. These expenditures will include costs associated with conducting preclinical studies and clinical trials, obtaining regulatory approvals, and manufacturing and supply, as well as marketing and selling any products approved for sale. In addition, other unanticipated costs may arise. Because the outcome of any preclinical study or clinical trial is highly uncertain, we cannot reasonably estimate the actual amounts necessary to successfully complete the development and commercialization of SLATE, GRANITE or any future immunotherapy product candidates.

We believe that our existing cash, cash equivalents and marketable securities will be sufficient to fund our planned operations for at least 12 months and through preliminary safety and efficacy data for both Phase 1/2 clinical trials for SLATE and GRANITE. However, our operating plans and other demands on our capital resources may change as a result of many factors currently unknown to us, and we may need to seek additional funds sooner than planned, through public or private equity or debt financings or other sources, such as strategic collaborations. Such financing may result in dilution to stockholders, imposition of burdensome debt covenants and repayment obligations, or other restrictions that may affect our business. If we raise additional funds through licensing or collaboration arrangements with third parties, we may have to relinquish valuable rights to our product candidates, or grant licenses on terms that are not favorable to us. In addition, we may seek additional capital due to favorable market conditions or strategic considerations even if we believe we have sufficient funds for our current or future operating plans. Attempting to secure additional financing may divert our management from our day-to-day activities, which may adversely affect our ability to develop our product candidates. In addition, we cannot guarantee that future financing will be available in sufficient amounts or on terms acceptable to us, if at all.

Our future capital requirements depend on many factors, including:

- the scope, progress, results and costs of conducting studies and clinical trials for our SLATE product candidate series, including the Phase 1/2 clinical trial for SLATE, which we initiated in the third quarter of 2019;
- the scope, progress, results and costs of developing our tumor-specific immunotherapy product candidates, and conducting preclinical studies and clinical trials, including our Phase 1/2 clinical trial for GRANITE, which we initiated in the fourth quarter of 2018;
- the scope, progress, results and costs of conducting drug discovery, preclinical studies and clinical trials for our BiSAb program, for which we expect to select a product candidate in the second half of 2020;
- the timing of, and the costs involved in, obtaining regulatory approvals for our tumor-specific immunotherapy candidates;
- the number and characteristics of any additional product candidates we develop or acquire;
- the timing and amount of any milestone, royalty or other payments we are required to make pursuant to any current or future collaboration or license agreement;
- the cost of manufacturing our tumor-specific immunotherapies we successfully commercialize, including the cost of scaling up our internal manufacturing operations;
- the cost of building a sales force in anticipation of product commercialization;
- the cost of commercialization activities, including legal, compliance, marketing, sales and distribution costs;
- our ability to maintain existing, and establish new, strategic collaborations, licensing or other arrangements and the financial terms of any such agreements, including the timing and amount of any future milestone, royalty or other payments due under any such agreement;
- any product liability or other lawsuits related to our products;
- the expenses needed to attract, hire and retain skilled personnel;
- the costs associated with being a public company;
- the costs involved in preparing, filing, prosecuting, maintaining, defending and enforcing our intellectual property portfolio; and
- the timing, receipt and amount of sales of any future approved products, if any.
- Additional funds may not be available when we need them, on terms that are acceptable to us, or at all. If adequate funds are not available to us on a timely basis, we may be required to:
- delay, limit, reduce or terminate preclinical studies, clinical trials or other research and development activities or eliminate one or more of our development programs altogether; or
- delay, limit, reduce or terminate our efforts to establish manufacturing and sales and marketing capabilities or other activities that may be necessary to commercialize our tumor-specific immunotherapy candidates, or reduce our flexibility in developing or maintaining our sales and marketing strategy.

We also could be required to seek funds through arrangements with collaborators or others that may require us to relinquish rights or jointly own some aspects of our technologies or product candidates that we would otherwise pursue on our own. We do not expect to realize revenue from sales of products or royalties from licensed products in the foreseeable future, if at all, and unless and until a product candidate is clinically tested, approved for commercialization and successfully marketed. To date, we have primarily

financed our operations through the sale of equity securities. We will be required to seek additional funding in the future and currently intend to do so through collaborations, public or private equity offerings or debt financings, credit or loan facilities or a combination of one or more of these funding sources. Our ability to raise additional funds will depend on financial, economic and other factors, many of which are beyond our control. Additional funds may not be available to us on acceptable terms or at all. If we raise additional funds by issuing equity securities, our stockholders will suffer dilution and the terms of any financing may adversely affect the rights of our stockholders. In addition, as a condition to providing additional funds to us, future investors may demand, and may be granted, rights superior to those of existing stockholders. Debt financing, if available, is likely to involve restrictive covenants limiting our flexibility in conducting future business activities, and, in the event of insolvency, debt holders would be repaid before holders of our equity securities received any distribution of our corporate assets.

Our operating results may fluctuate significantly, which makes our future operating results difficult to predict and could cause our operating results to fall below expectations.

Our quarterly and annual operating results may fluctuate significantly, which makes it difficult for us to predict our future operating results. These fluctuations may occur due to a variety of factors, many of which are outside of our control and may be difficult to predict, including:

- the timing and cost of, and level of investment in, research, development and commercialization activities, which may change from time to time;
- the timing of receipt of approvals from regulatory authorities in the United States and internationally;
- the timing and status of enrollment for our clinical trials;
- the cost of manufacturing, as well as building out our supply chain, which may vary depending on the quantity of production, the cost of continuing to establish and scale up our internal manufacturing capabilities, and the terms of any agreements we enter into with third-party suppliers;
- timing and amount of any milestone, royalty or other payments due under any current or future collaboration or license agreement;
- coverage and reimbursement policies with respect to our tumor-specific immunotherapy product candidates, if approved, and potential future drugs that compete with our products;
- expenditures that we may incur to acquire, develop or commercialize additional products and technologies;
- the level of demand for our cancer immunotherapy products, if approved, which may vary significantly over time;
- the timing and success or failure of preclinical studies and clinical trials for our product candidates or competing product candidates, or any other change in the competitive landscape of our industry, including consolidation among our competitors or partners; and
- future accounting pronouncements or changes in our accounting policies.

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

This variability and unpredictability could also result in our failing to meet the expectations of industry or financial analysts or investors for any period. If our revenue or operating results fall below the expectations of analysts or investors or below any forecasts we may provide to the market, or if the forecasts we provide to the market are below the expectations of analysts or investors, the price of our common stock could decline substantially. Such a stock price decline could occur even when we have met any previously publicly stated revenue or earnings guidance we may provide.

Risks Related to Our Business

Our business is dependent on the successful development, regulatory approval and commercialization of our "off-the-shelf" immunotherapy product candidate, SLATE, and our personalized immunotherapy product candidate, GRANITE, both of which are in early stage clinical trials.

We have no products approved for sale. Both SLATE and GRANITE are in the early stages of clinical trials. As such, we face significant translational risk with SLATE and GRANITE specifically and our tumor-specific immunotherapy approach generally. The success of our business, including our ability to finance our company and generate any revenue in the future, will primarily depend on the successful development, regulatory approval and commercialization of SLATE and GRANITE, as well as other product candidates

derived from our tumor-specific immunotherapy approach, which may never occur. In the future, we may also become dependent on other product candidates that we may develop or acquire; however, our product candidates based on our tumor-specific immunotherapy approach have only been tested in a small number of humans and given our early stage of development, it may be many years, if at all, before we have demonstrated the safety and efficacy of a personalized immunotherapy treatment sufficient to warrant approval for commercialization.

We have not previously submitted a biologics license application, or BLA, to the FDA or similar regulatory approval filings to comparable foreign authorities, for any product candidate, and we cannot be certain that our product candidates will be successful in clinical trials or receive regulatory approval. Further, SLATE, GRANITE or any future product candidates may not receive regulatory approval even if they are successful in clinical trials. If we do not receive regulatory approvals for our product candidates, we may not be able to continue our operations. Even if we successfully obtain regulatory approvals to market a product candidate, our revenue will be dependent, in part, upon the size of the markets in the territories for which we gain regulatory approval and have commercial rights. If the markets or patient subsets that we are targeting are not as significant as we estimate, we may not generate significant revenues from sales of such products, if approved.

We plan to seek regulatory approval to commercialize our product candidates both in the United States and in selected foreign countries. While the scope of regulatory approval generally is similar in other countries, in order to obtain separate regulatory approval in other countries we must comply with numerous and varying regulatory requirements of such countries regarding safety and efficacy. Other countries also have their own regulations governing, among other things, clinical trials and commercial sales, as well as pricing and distribution of our product candidates, and we may be required to expend significant resources to obtain regulatory approval and to comply with ongoing regulations in these jurisdictions.

The clinical and commercial success of our current and any future product candidates will depend on a number of factors, including the following:

- our ability to raise any additional required capital on acceptable terms, or at all;
- our ability to complete IND-enabling studies and successfully submit an IND for future product candidates;
- timely completion of our preclinical studies and clinical trials, which may be significantly slower, or cost more, than we currently anticipate and will depend substantially upon the performance of third-party contractors;
- whether we are required by the FDA or similar foreign regulatory agencies to conduct additional clinical trials or other studies beyond those planned to support approval of our product candidates;
- acceptance of our proposed indications and primary endpoint assessments relating to the proposed indications of our product candidates by the FDA and similar foreign regulatory authorities;
- our ability to consistently manufacture on a timely basis our personalized and “off-the-shelf” immunotherapy candidates;
- our ability, and the ability of any third parties with whom we contract, to remain in good standing with regulatory agencies and develop, validate and maintain commercially viable manufacturing processes that are compliant with current good manufacturing practices, or cGMPs;
- our ability to demonstrate to the satisfaction of the FDA and similar foreign regulatory authorities the safety, efficacy and acceptable risk-benefit profile of our product candidates;
- the prevalence, duration and severity of potential side effects or other safety issues experienced with our product candidates or future approved products, if any;
- the timely receipt of necessary marketing approvals from the FDA and similar foreign regulatory authorities;
- achieving and maintaining, and, where applicable, ensuring that our third-party contractors achieve and maintain, compliance with our contractual obligations and with all regulatory requirements applicable to our lead product candidates or any future product candidates or approved products, if any;
- the willingness of physicians, operators of hospitals and clinics and patients to utilize or adopt our personalized cancer immunotherapy approach;
- our ability to successfully develop a commercial strategy and thereafter commercialize SLATE, GRANITE or any future product candidates in the United States and internationally, if approved for marketing, sale and distribution in such countries and territories, whether alone or in collaboration with others;
- the availability of coverage and adequate reimbursement from managed care plans, private insurers, government payors (such as Medicare and Medicaid) and other third-party payors for any of our product candidates that may be approved;

- the convenience of our treatment or dosing regimen;
- acceptance by physicians, payors and patients of the benefits, safety and efficacy of our product candidates or any future product candidates, if approved, including relative to alternative and competing treatments;
- patient demand for our current or future product candidates, if approved;
- our ability to establish and enforce intellectual property rights in and to our product candidates; and
- our ability to avoid third-party patent interference, intellectual property challenges or intellectual property infringement claims.

These factors, many of which are beyond our control, could cause us to experience significant delays or an inability to obtain regulatory approvals or commercialize our current or future product candidates. Even if regulatory approvals are obtained, we may never be able to successfully commercialize any product candidates. Accordingly, we cannot provide assurances that we will be able to generate sufficient revenue through the sale of our product candidates or any future product candidates to continue our business or achieve profitability.

Our tumor-specific cancer immunotherapy approach is based on novel ideas and technologies that are unproven and may not result in marketable products, which exposes us to unforeseen risks and makes it difficult for us to predict the time and cost of product development and potential for regulatory approval.

We are using our proprietary EDGE tumor-antigen prediction platform to develop tumor-specific immunotherapy product candidates to treat cancer. Our foundational science and product development approach are based on our ability to predict the presence of a patient's tumor-specific neoantigens, or TSNA, and develop a TSNA-directed therapy that will elicit a meaningful T cell response. We believe that this approach may offer an improved therapeutic effect by driving an intense, focused T cell attack selectively upon a patient's tumor. However, this approach to treating cancer is novel and the scientific research that forms the basis of our efforts to predict the presence of TSNA and to develop TSNA-directed cancer immunotherapy candidates is both preliminary and limited. The results of our preclinical animal studies may not translate into humans. For example, our prediction model may fail to accurately predict the presence of TSNA, resulting in little or no T cell activity, or our therapy may fail to elicit a significant or durable enough T cell response to effectively destroy a tumor. As such, we cannot assure you that even if we are able to develop personalized cancer immunotherapy candidates capable of recognizing TSNA and eliciting a T cell response, that such therapy would safely and effectively treat cancers. We may spend substantial funds attempting to develop this approach and never succeed in developing a marketable therapeutic.

No regulatory authority has granted approval for a cancer immunotherapy based on a heterologous prime-boost approach. As such, we believe the FDA has limited experience with evaluating our approach, which may increase the complexity, uncertainty and length of the regulatory approval process for our product candidates. We may never receive approval to market and commercialize any product candidate. Even if we obtain regulatory approval, the approval may be for targets, disease indications, lines of therapy 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 may be required to perform additional or unanticipated clinical trials to obtain approval or be subject to post-marketing testing requirements to maintain regulatory approval. If our personalized immunotherapy candidates prove to be ineffective, unsafe or commercially unviable, our entire technology platform and pipeline would have little, if any, value, which would have a material and adverse effect on our business, financial condition, results of operations and prospects.

In addition, the regulatory approval process and clinical trial requirements for novel product candidates can be more expensive and take longer than for other, better known or more extensively studied product candidates. For example, regulatory requirements governing cell therapy and gene therapy products have changed frequently and may continue to change in the future. In addition to the submission of an IND to the FDA, before initiation of a clinical trial in the United States, certain human clinical trials subject to the National Institutes of Health, or NIH, Guidelines for Research Involving Recombinant DNA Molecules, or NIH Guidelines were historically subject to review by the Recombinant DNA Advisory Committee, or RAC. On April 25, 2019, the NIH revised the NIH Guidelines to remove protocol submission and reporting requirements and to eliminate the role of the RAC in human gene transfer research. The previous RAC has been renamed the Novel and Exceptional Technology and Research Advisory Committee (NExTRAC), which will advise the NIH Director on the scientific, safety, ethical, and social issues associated with emerging biotechnologies. These trials will remain subject to the FDA's oversight and other clinical trial regulations, and oversight at the local level will continue as otherwise set forth in the NIH Guidelines. Specifically, under the NIH Guidelines, supervision of human gene transfer trials includes evaluation and assessment by an institutional biosafety committee, or IBC, a local institutional committee that reviews and oversees research utilizing recombinant or synthetic nucleic acid molecules at that institution. The IBC assesses the safety of the research and identifies any potential risk to public health or the environment, and such review may result in some delay before initiation of a clinical trial. While the NIH Guidelines are not mandatory unless the research in question is being conducted at or sponsored by institutions receiving NIH funding of recombinant or synthetic nucleic acid molecule research, many companies and

other institutions not otherwise subject to the NIH Guidelines voluntarily follow them. Thus, even though we are no longer required to submit a protocol for our product candidates to NIH, we will still be subject to significant regulatory oversight by the FDA and the applicable IBC and institutional review board, or IRB, of each institution at which we or our collaborators conduct clinical trials of our product candidates, and changes in applicable regulatory guidelines may lengthen the regulatory review process for our product candidates, require additional studies or trials, increase development costs, lead to changes in regulatory positions and interpretations or delay or prevent approval and commercialization of such product candidates.

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

Clinical testing is expensive and can take many years to complete, and its outcome is inherently uncertain. Failure or delay can occur at any time during the clinical trial process. Success in preclinical studies and early clinical trials does not ensure that later clinical trials will be successful. A number of companies in the biotechnology and pharmaceutical industries have suffered significant setbacks in clinical trials, even after positive results in earlier preclinical studies or clinical trials. These setbacks have been caused by, among other things, preclinical findings made while clinical trials were underway and safety or efficacy observations made in clinical trials, including previously unreported adverse events. Notwithstanding any potential promising results in earlier studies and trials, we cannot be certain that we will not face similar setbacks. Even if our clinical trials are completed, the results may not be sufficient to obtain regulatory approval for our product candidates. In addition, the results of our preclinical animal studies, including our non-human primate studies, may not be predictive of the results of outcomes in human clinical trials. For example, our tumor-specific cancer immunotherapy candidates and any future product candidates may demonstrate different chemical, biological and pharmacological properties in patients than they do in laboratory studies or may interact with human biological systems in unforeseen or harmful ways. Product candidates in later stages of clinical trials may fail to show the desired pharmacological properties or safety and efficacy traits despite having progressed through preclinical studies and initial clinical trials. Even if we are able to initiate and complete clinical trials, the results may not be sufficient to obtain regulatory approval for our product candidates.

Clinical development involves a lengthy and expensive process with an uncertain outcome, and delays can occur for a variety of reasons outside of our control.

Clinical development is expensive and can take many years to complete, and its outcome is inherently uncertain. Failure can occur at any time during the clinical trial process. Although we initiated our Phase 1/2 clinical trials, GO-004 in the fourth quarter of 2018 and GO-005 in the third quarter of 2019, we may experience delays in enrolling or completing those trials. Additionally, we cannot be certain that studies or trials for SLATE, GRANITE or any future product candidates will begin on time, not require redesign, enroll an adequate number of subjects on time or be completed on schedule, if at all. Clinical trials can be delayed or terminated for a variety of reasons, including delays or failures related to:

- the FDA or comparable foreign regulatory authorities disagreeing as to the design or implementation of our clinical trials;
- delays in obtaining regulatory authorization to commence a trial;
- reaching agreement on acceptable terms with prospective contract research organizations, or CROs, and clinical trial sites, the terms of which can be subject to extensive negotiation and may vary significantly among different CROs and trial sites;
- obtaining IRB, and, where required, IBC approval at each trial site;
- recruiting an adequate number of suitable patients to participate in a trial;
- having subjects complete a trial or return for post-treatment follow-up;
- clinical sites deviating from trial protocol or dropping out of a trial;
- addressing subject safety concerns that arise during the course of a trial;
- adding a sufficient number of clinical trial sites;
- obtaining sufficient quantities of product candidates for use in preclinical studies or clinical trials from third-party suppliers; or
- accessing checkpoint inhibitors for use in combination with our product candidates in preclinical studies or clinical trials, including checkpoint inhibitors that have not been approved by the FDA for such use.

We may experience numerous adverse or unforeseen events during, or as a result of, preclinical studies and clinical trials that could delay or prevent our ability to receive marketing approval or commercialize our product candidates, including:

- we may receive feedback from regulatory authorities that requires us to modify the design of our clinical trials;

- clinical trials of our product candidates may produce negative or inconclusive results, and we may decide, or regulators may require us, to conduct additional clinical trials or abandon our development programs, including our personalized cancer immunotherapy program;
- the number of patients required for clinical trials of our product candidates may be larger than we anticipate, enrollment in these clinical trials may be slower than we anticipate or participants may drop out of these clinical trials at a higher rate than we anticipate;
- we or our third-party contractors may fail to comply with regulatory requirements, fail to maintain adequate quality controls, or be unable to produce sufficient product supply to conduct and complete preclinical studies or clinical trials of our product candidates in a timely manner, or at all;
- we or our investigators might have to suspend or terminate clinical trials of our product candidates for various reasons, including non-compliance with regulatory requirements, a finding that our product candidates have undesirable side effects or other unexpected characteristics, or a finding that the participants are being exposed to unacceptable health risks;
- the cost of clinical trials of our product candidates may be greater than we anticipate;
- the quality of our product candidates or other materials necessary to conduct preclinical studies or clinical trials of our product candidates may be insufficient or inadequate;
- regulators may revise the requirements for approving our product candidates, or such requirements may not be as we anticipate; and
- future collaborators may conduct clinical trials in ways they view as advantageous to them but that are suboptimal for us.

If we are required to conduct additional clinical trials or other testing of our product candidates beyond those that we currently contemplate, if we are unable to successfully complete clinical trials of our product candidates or other testing, if the results of these trials or tests are not positive or are only moderately positive or if there are safety concerns, we may:

- incur unplanned costs;
- be delayed in obtaining marketing approval for our product candidates or not obtain marketing approval at all;
- obtain marketing approval in some countries and not in others;
- obtain marketing approval for indications or patient populations that are not as broad as intended or desired;
- obtain marketing approval with labeling that includes significant use or distribution restrictions or safety warnings, including boxed warnings;
- be subject to additional post-marketing testing requirements, which could be expensive and time consuming; or
- have the treatment removed from the market after obtaining marketing approval.

We could also encounter delays if a clinical trial is suspended or terminated by us, by the IRBs of the institutions in which such trials are being conducted, by the Data Safety Monitoring Board, or DSMB, for such trial or by the FDA or other regulatory authorities. Such authorities may suspend or terminate a clinical trial due to a number of factors, including failure to conduct the clinical trial in accordance with regulatory requirements 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 product candidate, changes in governmental regulations or administrative actions or lack of adequate funding to continue the clinical trial.

Further, conducting clinical trials in foreign countries, as we may do for certain of our product candidates, presents additional risks that may delay completion of our clinical trials. These risks include the failure of enrolled patients in foreign countries to adhere to clinical protocol as a result of differences in healthcare services or cultural customs, managing additional administrative burdens associated with foreign regulatory schemes, as well as political and economic risks relevant to such foreign countries.

Principal investigators for our clinical trials may serve as scientific advisors or consultants to us from time to time and may receive cash or equity compensation in connection with such services. If these relationships and any related compensation result in perceived or actual conflicts of interest, or a regulatory authority concludes that the financial relationship may have affected the interpretation of the trial, the integrity of the data generated at the applicable clinical trial site may be questioned and the utility of the clinical trial itself may be jeopardized, which could result in the delay or rejection of the marketing application we submit. Any such delay or rejection could prevent or delay us from commercializing our current or future product candidates.

If any of our preclinical studies or clinical trials of our product candidates are delayed or terminated, the commercial prospects of our product candidates may be harmed, and our ability to generate revenues from any of these product candidates will be delayed or not realized at all. In addition, any delays in completing our clinical trials may increase our costs, slow down our product candidate development and approval process and jeopardize our ability to commence product sales and generate revenues. Any of these occurrences may significantly harm our business, financial condition and prospects. In addition, many of the factors that cause, or lead to, a delay in the commencement or completion of clinical trials may also ultimately lead to the denial of regulatory approval of our product candidates. If SLATE, GRANITE, any future product candidates or our TSNA prediction platform generally prove to be ineffective, unsafe or commercially unviable, our entire platform and approach would have little, if any, value, which would have a material and adverse effect on our business, financial condition, results of operations and prospects.

As a result of our trial design for GO-004 and GO-005, the Phase 1 portion of the trials will provide little evidence of the efficacy of our personalized immunotherapy product candidate, GRANITE and the off-the-shelf immunotherapy candidate, SLATE, respectively.

Scientific principles and preclinical data suggest that combination treatment of cancer patients with our TSNA-directed immunotherapy product candidates plus checkpoint inhibitors is likely to be most effective for our target indications. The Phase 1 portion of both of our Phase 1/2 clinical trials, GO-004 and GO-005, will, consequently, involve administration of a combination therapy with GRANITE and SLATE, respectively. Notably, all patients in the Phase 1 portion of these trials will receive anti-PD-1 monoclonal antibodies, or mAb, as background therapy. Some patients in both trials will additionally receive anti-CTLA-4 mAb. Checkpoint inhibitors such as anti-PD-1 and anti-CTLA-4 mAb are known to be effective treatments in many cancer patients and elicit objective responses in some patients. Any objective responses observed in our Phase 1 trials will thus be in patients receiving our experimental therapy together with a checkpoint inhibitor and attribution of objective responses to the effects of GRANITE or SLATE alone will not be possible. We expect that efficacy will be studied carefully in the respective programs' Phase 2 cohorts, in which the relative contributions of our personalized and off-the-shelf immunotherapy candidates and the checkpoint inhibitors will be dissected and quantified to some degree. Of note, patient eligibility for our clinical trials is determined based, in part, upon predicted immunogenicity of the patient's tumor. In particular, we only accept patients predicted to have a neoantigenic burden above a certain threshold. Selection of high-immunogenicity tumors is relevant to interpretation of clinical data, since high immunogenicity (which is related to high tumor mutational burden) may be a positive prognostic factor that means our selected patients would have a clinical outcome upon standard therapy which is superior to unselected case controls. As a result, interpretation of "time-to-event" endpoints such as progression-free survival or overall survival will be challenging without a contemporaneous, randomized control group. As a result, the Phase 1 portions of our respective Phase 1/2 clinical trials will provide little evidence of the efficacy of GRANITE or SLATE, which may not be fully understood by investors or market participants, potentially leading to negative effects on our stock price.

We may be unable to obtain regulatory approval for our tumor-specific immunotherapy product candidates under applicable regulatory requirements. The denial or delay of any such approval would delay or prevent commercialization of our product candidates and adversely impact our potential to generate revenue, our business and our results of operations.

To gain approval to market our tumor-specific immunotherapy product candidates, we must provide the FDA and foreign regulatory authorities with clinical data that adequately demonstrate the safety and efficacy of the product candidate for the intended indication applied for in the applicable regulatory filing. Product development is a long, expensive and uncertain process, and delay or failure can occur at any stage of any of our clinical development programs. A number of companies in the biotechnology and pharmaceutical industries have suffered significant setbacks in clinical trials, even after promising results in earlier preclinical or clinical trials. These setbacks have been caused by, among other things, preclinical findings made while clinical studies were underway and safety or efficacy observations made in clinical trials, including previously unreported adverse events. Success in preclinical testing and early clinical trials does not ensure that later clinical trials will be successful, and the results of clinical trials by other parties may not be indicative of the results in trials we may conduct.

We have not previously submitted a BLA or any other marketing application to the FDA or similar filings to comparable foreign regulatory authorities. A BLA or other similar regulatory filing requesting approval to market a product candidate must include extensive preclinical and clinical data and supporting information to establish that the product candidate is safe, pure and potent for each desired indication. The BLA or other similar regulatory filing must also include significant information regarding the chemistry, manufacturing and controls for the product.

The research, testing, manufacturing, labeling, approval, sale, marketing and distribution of biologic products are subject to extensive regulation by the FDA and other regulatory authorities in the United States and other countries, and such regulations differ from country to country. We are not permitted to market our product candidates in the United States or in any foreign countries until they receive the requisite approval from the applicable regulatory authorities of such jurisdictions.

The FDA or any foreign regulatory bodies can delay, limit or deny approval of our product candidates for many reasons, including:

- our inability to demonstrate to the satisfaction of the FDA or the applicable foreign regulatory body that any of our product candidates are safe and effective for the requested indication;
- the FDA's or the applicable foreign regulatory agency's disagreement with our trial protocols or the interpretation of data from preclinical studies or clinical trials;
- our inability to demonstrate that the clinical and other benefits of any of our product candidates outweigh any safety or other perceived risks;
- the FDA's or the applicable foreign regulatory agency's requirement for additional preclinical studies or clinical trials;
- the FDA's or the applicable foreign regulatory agency's non-approval of the formulation, labeling or specifications of SLATE, GRANITE or any of our future product candidates;
- the FDA's or the applicable foreign regulatory agency's failure to approve our manufacturing processes and facilities or the facilities of third-party manufacturers upon which we rely; or
- the potential for approval policies or regulations of the FDA or the applicable foreign regulatory agencies to significantly change in a manner rendering our clinical data insufficient for approval.

Of the large number of biopharmaceutical products in development, only a small percentage successfully complete the FDA or other regulatory bodies' approval processes and are commercialized.

Even if we eventually complete clinical testing and receive approval from the FDA or applicable foreign agencies for any of our product candidates, the FDA or the applicable foreign regulatory agency may grant approval contingent on the performance of costly additional clinical trials which may be required after approval. The FDA or the applicable foreign regulatory agency also may approve our lead product candidate for a more limited indication or a narrower patient population than we originally requested, and the FDA, or applicable foreign regulatory agency, may not approve our product candidates with the labeling that we believe is necessary or desirable for the successful commercialization of such product candidates.

Any delay in obtaining, or inability to obtain, applicable regulatory approval would delay or prevent commercialization of our product candidates and would materially adversely impact our business and prospects.

We have chosen to prioritize development of our off-the-shelf immunotherapy candidate, SLATE, and our personalized immunotherapy candidate, GRANITE. We may expend our limited resources on candidates or indications that do not yield a successful product and fail to capitalize on other product candidates or indications for which there may be a greater likelihood of success or may be more profitable.

We are currently developing our personalized cancer immunotherapy candidates based on the prediction of a patient's TSNA, in order to address a variety of cancers, including metastatic non-small cell lung cancer, or NSCLC, and gastroesophageal, bladder and colorectal cancers. Our off-the-shelf product candidate clinical trial will address mutation positive and metastatic and advanced solid tumors, including NSCLC, colorectal and pancreatic cancers. We have strategically determined to initially focus solely on the development of personalized cancer immunotherapy candidates (including our "off-the-shelf" immunotherapy candidate) rather than pursue other types of immunotherapies based, in part, on the significant resources required to develop and manufacture immunotherapies. As a result, we may initially be foregoing other potentially more profitable therapy indications or those with a greater likelihood of success.

Our decisions concerning the allocation of research, development, collaboration, management and financial resources toward particular product candidates or therapeutic areas may not lead to the development of any viable commercial product and may divert resources away from better opportunities. Similarly, our potential decisions to delay, terminate or collaborate with third parties in respect of certain programs may subsequently also prove to be suboptimal and could cause us to miss valuable opportunities. If we make incorrect determinations regarding the viability or market potential of any of our programs or product candidates or misread trends in the oncology or biopharmaceutical industry, our business, financial condition and results of operations could be materially adversely affected. As a result, we may fail to capitalize on viable commercial products or profitable market opportunities, be required to forego or delay pursuit of opportunities with other product candidates or other diseases and disease pathways that may later prove to have greater commercial potential than those we choose to pursue, or relinquish valuable rights to such product candidates through collaboration, licensing or other royalty arrangements in cases in which it would have been advantageous for us to invest additional resources to retain development and commercialization rights.

If we are unable to obtain regulatory approval for use of our tumor-specific immunotherapy candidates, SLATE and GRANITE, as a first- and second-line therapy, our commercial opportunity and profitability may be limited.

Cancer therapies for advanced/metastatic cancers are sometimes characterized as first line, second line or third line, and the FDA often approves new systemic therapies initially only for third line use. When cancer is detected early enough, surgery plus first-line systemic therapy is sometimes adequate to cure the cancer. Whenever first-line therapy, usually chemotherapy, hormone therapy, radiotherapy, surgery or a combination of these, proves unsuccessful, second line therapy may be administered. Second-line therapies often consist of more chemotherapy, radiation, antibody drugs, tumor targeted small molecules or a combination of these. Third-line therapies can include bone marrow transplantation, antibody and small molecule targeted therapies and new technologies such as adoptive cell therapies.

Traditionally, novel therapeutics are developed and approved in late (third) line therapy of cancer patients. Such clinical programs carry risk of failure because patients are often quite frail, with effects of multiple rounds of prior therapy weakening bone marrow, immune systems and general fitness. Immunotherapy, such as checkpoint inhibitors, has generally been shown to be more effective when used in earlier lines of therapy, with prospect of very durable responses in some patients and there is a trend towards earlier use of these agents, avoiding in particular cytotoxic chemotherapy agents which carry substantial toxicity and very little prospect of long-term responses. “Off-the-shelf” product candidates such as SLATE and tumor-specific immunotherapy product candidates such as GRANITE, are expected to be administered in combination with checkpoint inhibitors and can, in principle, be safely used in early lines of therapy. Our clinical development program also aims to study our products in early stages of cancer treatment (referred to as, adjuvant therapy), which carry a higher safety bar, and often a greater expectation of efficacy over control arms. Such studies may thus be relatively large and slow to achieve maturity. There are new tools available to stratify cancer patients for risk of recurrence or progression, such as liquid biopsies that measure the amount of circulating tumor-derived DNA. We will utilize these tools to attempt to expedite clinical trials in early-stage cancer patients by focusing upon patients at above-average risk of disease recurrence or progression, which events are typical endpoints in clinical trials. The development of liquid biopsies is at an early stage, however, and these tools may prove to carry low utility and thus render early-stage cancer trials slow, necessarily large and expensive. The safety of our product candidates in combination with checkpoint inhibitors in early lines of therapy may also prove to be unacceptable.

We expect to seek approval of our product candidates both as late-line therapy where appropriate, but also as a second line and first line therapy wherever possible and potentially as adjuvant therapy. There is no guarantee that our product candidates, even if approved in late-line therapy, would be approved for second-line or first-line or adjuvant therapy. In addition, we may have to conduct additional clinical trials prior to gaining approval for second-line or first-line or adjuvant therapy.

While our SLATE product is designed to be readily available (off-the-shelf), GRANITE will initially take approximately 16-20 weeks to be manufactured and released for human use, and this long timeline demands that either patients are consented and entered into our trials when they start a prior line of therapy, and start our therapy upon disease progression, or we initiate treatment in patients who have entered the maintenance phase of their original line of treatment. For example, we might enroll newly diagnosed patients who are due to receive front-line chemotherapy and then start their therapy with our immunotherapy product candidate as second-line treatment when they progress upon front-line chemotherapy or fail to tolerate it. This carries the risk of time delays or drop-out, i.e. patients may not progress after first-line chemotherapy for a long time, or they may decide not to receive an immunotherapy product candidate we have manufactured for them, at our expense. Alternatively we may treat first-line patients once they have completed their initial treatment and have not progressed (called maintenance therapy)—this renders efficacy harder to interpret versus simple treatment studies (any objective response cannot clearly be attributed to our products) and may be complicated by standard of care treatments which may necessarily be continued alongside our immunotherapy candidates, further confounding interpretation of efficacy.

Our projections of both the number of people who have the cancers we are targeting, as well as the subset of people with these cancers in a position to receive third-line therapy and who have the potential to benefit from treatment with our product candidates, are based on our beliefs and estimates. These estimates have been derived from a variety of sources, including scientific literature, surveys of clinics, patient foundations, and market research and may prove to be incorrect. Regulatory authorities also may establish narrower definitions around when a patient is ineligible for other treatments than we have used in our projections, and that would reduce the size of the patient population eligible for our product candidates. Further, new studies may change the estimated incidence or prevalence of these cancers. The number of patients may turn out to be lower than expected. Additionally, the potentially addressable patient population for our product candidates may be limited or may not be amenable to treatment with our product candidates. For instance, we anticipate that only a fraction of colorectal cancer patients will be predicted to have a high enough probability of TSNA presence to merit their inclusion into our program. Even if we obtain significant market share for our product candidates, because the potential target populations are small, we may never achieve profitability without obtaining regulatory approval for additional indications, including use as a first-line or second-line therapy.

We may not be successful in our efforts to create a pipeline of immunotherapy candidates or to develop commercially successful products. If we fail to successfully develop additional product candidates, our commercial opportunity may be limited.

We are committed to developing personalized cancer immunotherapies to fight multiple cancer types and are currently advancing multiple product candidates to address a variety of cancers, including metastatic NSCLC and colorectal, gastroesophageal, pancreatic, and bladder cancers as well as other mutation-positive cancers in our SLATE program. Utilizing our EDGE platform, we believe we can develop multiple therapeutic classes of products that will generate a T cell immune response unleashing the natural power of the immune system on the tumor cells. However, one or more of these alternative therapeutic products may never be successfully validated in a human. In addition, identifying, developing, obtaining regulatory approval for and commercializing therapies for the treatment of cancer will require substantial additional funding and is prone to the risks of failure inherent in therapeutic product development. Research programs to identify product candidates also require substantial technical, financial and human resources, regardless of whether or not any product candidates are ultimately identified, and, even if our research programs initially show promise in identifying potential product candidates, they may fail to yield product candidates for clinical development.

We therefore cannot provide any assurance that we will be able to successfully identify additional product candidates, advance any of these additional product candidates through the development process, successfully commercialize any such additional product candidates, if approved, or assemble sufficient resources to identify, acquire, develop or, if approved, commercialize additional product candidates. If we are unable to successfully identify, acquire, develop and commercialize additional product candidates, our commercial opportunity may be limited.

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

The timely completion of clinical trials in accordance with their protocols depends, among other things, on our ability to enroll a sufficient number of patients who remain in the study until its conclusion. 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 patient eligibility criteria defined in the protocol;
- the size of the patient population required for analysis of the trial's primary endpoints;
- the proximity of patients to trial sites;
- the design of the trial;
- our ability to recruit clinical trial investigators with the appropriate competencies and experience;
- clinicians' and patients' perceptions as to the potential advantages of the product candidate being studied in relation to other available therapies, including any new therapies that may be approved for the indications we are investigating; and
- our ability to obtain and maintain patient consents.

In addition, our clinical trials may 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 may 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 in such clinical trial site.

Further, the targeting of TSNA may result in unforeseen events, including harming healthy tissues in humans. As a result, it is possible that safety concerns could negatively affect patient enrollment among the patient populations that we intend to treat. 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.

Our tumor-specific immunotherapy product candidates may cause undesirable side effects or have other properties that could delay or prevent their regulatory approval, limit the commercial profile of an approved label, or result in significant negative consequences following marketing approval, if any.

As with most biological products, use of our product candidates could be associated with side effects or adverse events which can vary in severity from minor reactions to death and in frequency from infrequent to prevalent. Undesirable side effects or unacceptable toxicities caused by our product candidates could cause us or 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 comparable foreign regulatory authorities. While we have only just initiated patient dosing in our clinical trials of GRANITE and SLATE and do not have a comprehensive understanding of its risks, it is likely that there will be side effects associated with their use. Results of our trials could reveal a high and unacceptable severity and prevalence of these or other side effects.

If unacceptable side effects arise in the development of our product candidates, we, the FDA, the IRBs at the institutions in which our studies are conducted, or the DSMB could suspend or terminate our clinical trials or the FDA or comparable foreign regulatory authorities could order us to cease clinical trials or deny approval of our product candidates for any or all targeted indications. Treatment-related side effects could also affect patient recruitment or the ability of enrolled patients to complete any of our clinical trials or result in potential product liability claims. In addition, these side effects may not be appropriately recognized or managed by the treating medical staff. We expect to have to train medical personnel using our product candidates to understand the side effect profiles for our clinical trials and upon any commercialization of any of our product candidates. Inadequate training in recognizing or managing the potential side effects of our product candidates could result in patient injury or death. Any of these occurrences may harm our business, financial condition and prospects significantly.

In addition, even if we successfully advance one of our tumor-specific immunotherapy product candidates through clinical trials, such trials will likely only include a limited number of subjects and limited duration of exposure to our product candidates. As a result, we cannot be assured that adverse effects of our product candidates will not be uncovered when a significantly larger number of patients are exposed to the product candidate. Further, any clinical trials may not be sufficient to determine the effect and safety consequences of taking our product candidates over a multi-year period.

If any of our product candidates receives marketing approval and we or others later identify undesirable side effects caused by such products, a number of potentially significant negative consequences could result, including:

- regulatory authorities may withdraw their approval of the product;
- we may be required to recall a product or change the way such 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;
- regulatory authorities may require the addition of labeling statements, such as a “black box” warning or a contraindication;
- we may be required to implement a Risk Evaluation and Mitigation Strategy, or REMS, or 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.

Any of the foregoing events could prevent us from achieving or maintaining market acceptance of the particular product candidate, if approved, and result in the loss of significant revenues to us, which would materially and adversely affect our results of operations and business. In addition, if one or more of our product candidates or our TSNA-directed immunotherapy approach generally prove to be unsafe, our entire technology platform and pipeline could be affected, which would have a material and adverse effect on our business, financial condition, results of operations and prospects.

Even if one of our tumor-specific immunotherapy product candidates obtains regulatory approval, it may fail to achieve the broad degree of physician and patient adoption and use necessary for commercial success.

Even if one of our tumor-specific immunotherapy product candidates receives FDA or other regulatory approvals, the commercial success of any of our current or future product candidates will depend significantly on the broad adoption and use of the resulting product by physicians and patients for approved indications. The degree and rate of physician and patient adoption of our current or future product candidates, if approved, will depend on a number of factors, including:

- the clinical indications for which the product is approved and patient demand for approved products that treat those indications;
- the safety and efficacy of our product as compared to other available therapies;
- the time required for manufacture and release of our personalized immunotherapy products;
- the availability of coverage and adequate reimbursement from managed care plans, private insurers, government payors (such as Medicare and Medicaid) and other third-party payors for any of our product candidates that may be approved;
- acceptance by physicians, operators of hospitals and clinics and patients of the product as a safe and effective treatment;
- physician and patient willingness to adopt a new therapy over other available therapies for a particular indication;
- proper training and administration of our product candidates by physicians and medical staff;
- patient satisfaction with the results and administration of our product candidates and overall treatment experience, including, for example, the convenience of any dosing regimen;
- the cost of treatment with our product candidates in relation to alternative treatments and reimbursement levels, if any, and willingness to pay for the product, if approved, on the part of insurance companies and other third-party payers, physicians and patients;
- the prevalence and severity of side effects;
- limitations or warnings contained in the FDA-approved labeling for our products;
- the willingness of physicians, operators of hospitals and clinics and patients to utilize or adopt our products as a solution;
- any FDA requirement for a REMS;
- the effectiveness of our sales, marketing and distribution efforts;
- adverse publicity about our products or favorable publicity about competitive products; and
- potential product liability claims.

We cannot assure you that our current or future product candidates, if approved, will achieve broad market acceptance among physicians and patients. Any failure by our product candidates that obtain regulatory approval to achieve market acceptance or commercial success would adversely affect our results of operations.

We currently manufacture a portion of our initial product candidates internally and rely on qualified third parties to supply components of our initial product candidates. Our inability to manufacture sufficient quantities of SLATE, GRANITE or any future product candidates, or the loss of our third-party suppliers, or our or their failure to comply with applicable regulatory requirements or to supply sufficient quantities at acceptable quality levels or prices, or at all, would materially and adversely affect our business.

Manufacturing is a vital component of our tumor-specific immunotherapy approach and we have invested significantly in our manufacturing facility. To ensure timely and consistent product supply assurance to our patients we currently use a hybrid product supply approach whereby certain elements of our initial product candidates are manufactured internally at our manufacturing facilities in Pleasanton, California, and other elements are manufactured at qualified third-party contract manufacturing organizations, or CMOs. All internal and third-party contract manufacturing is performed under cGMP guidelines. We plan to internalize a majority of the manufacturing steps in the supply chain to optimize cost and production time, as well as establish full control over intellectual property and product quality. To do so, we will need to continue to scale up our manufacturing operations, as we do not currently have the infrastructure or capability internally to manufacture all supplies needed for our product candidates or the materials necessary to produce our product candidates for use in the conduct of our preclinical studies or clinical trials, and we currently lack the internal resources and the capability to manufacture certain elements of our product candidates on a clinical scale. Accordingly, we have made, and will be required to continue to make, significant investments in our manufacturing facility and processing in the future, and our efforts to scale our manufacturing operations may not succeed.

In addition, our facilities and the facilities used by our CMOs to manufacture our product candidates are subject to various regulatory requirements and may be subject to the inspection of the FDA or other regulatory authorities. We do not control the manufacturing process at our CMOs, and are completely dependent on them for compliance with current regulatory requirements. If we or our CMOs cannot successfully manufacture material that conforms to our specifications and the strict regulatory requirements of the FDA or comparable regulatory authorities in foreign jurisdictions, we may not be able to rely on our or their manufacturing facilities for the manufacture of elements of our product candidates. In addition, we have limited control over the ability of our CMOs to maintain adequate quality control, quality assurance and qualified personnel. If the FDA or a comparable foreign regulatory authority finds our facilities or those of our CMOs inadequate for the manufacture of our product candidates or if such facilities are subject to enforcement action in the future or are otherwise inadequate, we may need to find alternative manufacturing facilities, which would significantly impact our ability to develop, obtain regulatory approval for or market our product candidates.

Additionally, we and our CMOs may experience manufacturing difficulties due to resource constraints or as a result of labor disputes or unstable political environments. If we or our CMOs were to encounter any of these difficulties, our ability to provide our product candidates to patients in clinical trials, or to provide product for the treatment of patients once approved, would be jeopardized.

Our tumor-specific product candidates are biologics with complex and time-consuming manufacturing processes and we may encounter difficulties in production, particularly with respect to process development or scaling-out of our manufacturing capabilities. If we or any of our third-party manufacturers encounter such difficulties, our ability to provide supply of our product candidates for clinical trials or our products for patients, if approved, could be delayed or stopped, or we may be unable to maintain a commercially viable cost structure.

Our tumor-specific immunotherapy product candidates, SLATE and GRANITE, are considered to be biologics and the manufacturing processes are complex, time-consuming, highly-regulated and subject to multiple risks. SLATE is designed using known genetic sequences available from public databases, while the manufacture of our product candidate GRANITE involves extraction of genetic material from patient tumor samples. Both SLATE and GRANITE require genetic manipulations at the gene sequence level, live cell culture operations, specialized formulations and aseptic fill finish operations. As a result of these complexities, the cost to manufacture biologics in general, and our personalized immunotherapy GRANITE, in particular, is generally higher than traditional small molecule chemical compounds, and the manufacturing process is less reliable and more difficult and time-consuming to reproduce. For example, the entire cGMP manufacturing process from biopsy receipt to the release and shipment of GRANITE to the clinical site for patient administration will initially take approximately 16-20 weeks. In addition, our manufacturing process for both SLATE and GRANITE are in their early stages of development and will be susceptible to product loss or failure, or product variation that may adversely impact patient outcomes. Our supply chain may not function efficiently due to logistical issues associated with but not limited to the collection of a tumor biopsy from the patient, shipping such material to the manufacturing site, sequencing the biopsy specimen, manufacturing the immunotherapy components, shipping the final immunotherapy back to the patient, and injecting the patient with the immunotherapy. Manufacturing issues or different product characteristics resulting from process development activities or even minor deviations during normal manufacturing processes could result in reduced production yields, product defects and other supply disruptions. If for any reason we lose a patient's biopsy or an in-process product at any point in the process, the manufacturing process for that patient will need to be restarted and the resulting delay may adversely affect that patient's outcome. Because GRANITE is manufactured specifically for an individual patient, we will be required to maintain a chain of identity and chain of custody with respect to materials as they move from the patient to the manufacturing facility, through the manufacturing process, and back to the patient. Maintaining such a chain of identity and chain of custody is difficult and complex, and the failure to do so could result in adverse patient outcomes, loss of product or regulatory action including withdrawal of our products from the market, if licensed.

As part of our process development efforts for SLATE and GRANITE, we also may make changes to our manufacturing processes at various points during development, for various reasons, such as controlling costs, achieving scale, decreasing processing time, increasing manufacturing success rate, or other reasons. Such changes carry the risk that they will not achieve their intended objectives, and any of these changes could cause our product candidates to perform differently and affect the results of our ongoing clinical trials or future clinical trials. In some circumstances, changes in the manufacturing process may require us to perform *ex vivo* comparability studies and to collect additional data from patients prior to undertaking more advanced clinical trials. For instance, changes in our process during the course of clinical development may require us to show the comparability of the product used in earlier clinical phases or at earlier portions of a trial to the product used in later clinical phases or later portions of the trial.

Furthermore, if microbial, viral or other contaminations are discovered in our supply of our product candidates or in our manufacturing facilities or those of our CMOs, such manufacturing facilities may need to be closed for an extended period of time to investigate and remedy the contamination. We cannot assure you that any such contaminations or stability failures or other issues relating to the manufacture of our product candidates will not occur in the future.

We depend on third-party suppliers for key materials used in our manufacturing processes, and the loss of these third-party suppliers or their inability to supply us with adequate materials could harm our business.

We rely on third-party suppliers for certain materials required for the production of our personalized immunotherapy candidate. Our dependence on these third-party suppliers and the challenges we may face in obtaining adequate supplies of materials involve several risks, including limited control over pricing, availability, quality and delivery schedules. As a small company, our negotiation leverage is limited and we are likely to get lower priority than our competitors that are larger than we are. We cannot be certain that our suppliers will continue to provide us with the quantities of these raw materials that we require or satisfy our anticipated specifications and quality requirements. Any supply interruption in limited or sole sourced raw materials could materially harm our ability to manufacture our product candidates until a new source of supply, if any, could be identified and qualified. We may be unable to find a sufficient alternative supply channel in a reasonable time or on commercially reasonable terms. Any performance failure on the part of our suppliers could delay the development and potential commercialization of our product candidates, including limiting supplies necessary for clinical trials and regulatory approvals, which would have a material adverse effect on our business.

We rely on third parties in the conduct of all of our preclinical studies and intend to rely on third parties in the conduct of all of our future clinical trials. If these third parties do not successfully carry out their contractual duties, fail to comply with applicable regulatory requirements or meet expected deadlines, we may be unable to obtain regulatory approval for our tumor-specific immunotherapy product candidates.

We currently do not have the ability to independently conduct preclinical studies that comply with the regulatory requirements known as good laboratory practice, or GLP, requirements. We also do not currently have the ability to independently conduct any clinical trials. The FDA and regulatory authorities in other jurisdictions require us to comply with regulations and standards, commonly referred to as good clinical practice, or GCP, requirements for conducting, monitoring, recording and reporting the results of clinical trials, in order to ensure that the data and results are scientifically credible and accurate and that the trial subjects are adequately informed of the potential risks of participating in clinical trials. We rely on medical institutions, clinical investigators, contract laboratories and other third parties, such as CROs, to conduct GLP-compliant preclinical studies and GCP-compliant clinical trials on our product candidates properly and on time. While we have agreements governing their activities, we control only certain aspects of their activities and have limited influence over their actual performance. The third parties with whom we contract for execution of our GLP-compliant preclinical studies and our GCP-compliant clinical trials play a significant role in the conduct of these studies and trials and the subsequent collection and analysis of data. These third parties are not our employees and, except for restrictions imposed by our contracts with such third parties, we have limited ability to control the amount or timing of resources that they devote to our programs. Although we rely on these third parties to conduct our GLP-compliant preclinical studies and GCP-compliant clinical trials, we remain responsible for ensuring that each of our preclinical studies and clinical trials is conducted in accordance with its investigational plan and protocol and applicable laws and regulations, and our reliance on the CROs does not relieve us of our regulatory responsibilities.

Many of the third parties with whom we contract may also have relationships with other commercial entities, including our competitors, for whom they may also be conducting clinical trials or other drug development activities that could harm our competitive position. Further, under certain circumstances, these third parties may terminate their agreements with us upon as little as 10 days' prior written notice. Some of these agreements may also be terminated by such third parties under certain other circumstances, including our insolvency. If the third parties conducting our preclinical studies or our clinical trials do not adequately perform their contractual duties or obligations, experience significant business challenges, disruptions or failures, do not meet expected deadlines, terminate their agreements with us or need to be replaced, or if the quality or accuracy of the data they obtain is compromised due to their failure to adhere to our protocols or to GLPs/GCPs, or for any other reason, we may need to enter into new arrangements with alternative third parties. This could be difficult, costly or impossible, and our preclinical studies or clinical trials may need to be extended, delayed, terminated or repeated. As a result, we may not be able to obtain regulatory approval in a timely fashion, or at all, for the applicable product candidate, our financial results and the commercial prospects for our product candidates would be harmed, our costs could increase, and our ability to generate revenues could be delayed.

Inadequate funding for the FDA, the SEC and other government agencies could hinder their ability to hire and retain key leadership and other personnel, prevent new products and services from being developed or commercialized in a timely manner or otherwise prevent those agencies from performing normal business functions on which the operation of our business may rely, which could negatively impact our business.

The ability of the FDA to review and approve new products can be affected by a variety of factors, including government budget and funding levels, ability to hire and retain key personnel and accept the payment of user fees, and statutory, regulatory, and policy changes. Average review times at the agency have fluctuated in recent years as a result. In addition, government funding of the SEC and other government agencies on which our operations may rely, including those that fund research and development activities is subject to the political process, which is inherently fluid and unpredictable.

Disruptions at the FDA and other agencies may also slow the time necessary for new drugs to be reviewed and/or approved by necessary government agencies, which would adversely affect our business. For example, over the last several years, including for

thirty five days beginning on December 22, 2018, the U.S. government has shut down several times and certain regulatory agencies, such as the FDA and the SEC, have had to furlough critical FDA, SEC and other government employees and stop critical activities. If a prolonged government shutdown occurs, it could significantly impact the ability of the FDA to timely review and process our regulatory submissions, which could have a material adverse effect on our business.

We face significant competition in an environment of rapid technological and scientific change, and we will face significant competition and our failure to effectively compete may prevent us from achieving significant market penetration. Most of our competitors have significantly greater resources than we do, and we may not be able to successfully compete.

The biotechnology and pharmaceutical industries in particular are characterized by rapidly advancing technologies, intense competition and a strong emphasis on developing proprietary therapeutics. We compete with a variety of multinational biopharmaceutical companies and specialized biotechnology companies, as well as technology being developed at universities and other research institutions. Our competitors have developed, are developing or will develop product candidates and processes competitive with our product candidates. Competitive therapeutic treatments include those that have already been approved and accepted by the medical community and any new treatments that enter the market. We believe that a significant number of product candidates are currently under development, and may become commercially available in the future, for the treatment of diseases and other conditions for which we may try to develop product candidates. There is intense and rapidly evolving competition in the biotechnology, biopharmaceutical and antibody and immunoregulatory therapeutics fields. We believe that while our discovery platform, its associated intellectual property and our scientific and technical know-how give us a competitive advantage in this space, competition from many sources remains. Our competitors include larger and better funded biopharmaceutical, biotechnological and therapeutics companies. Moreover, we also compete with current and future therapeutics developed at universities and other research institutions.

Our success will partially depend on our ability to develop and protect therapeutics 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 therapeutics we develop.

If either of SLATE and GRANITE is approved, it will compete with a range of therapeutic treatments that are either in development or currently marketed. Indeed, a variety of oncology drugs and therapeutic biologics are on the market or in clinical development. Such marketed therapies range from immune checkpoint inhibitors such as Bristol-Myers Squibb Company's OPDIVO and YERVOY, Merck & Co., Inc.'s KEYTRUDA and Genentech, Inc.'s TECENTRIQ, and T cell engager immunotherapies such as Amgen, Inc.'s BLINCYTO. The most common therapeutic treatments for common solid tumors are chemotherapeutic compounds, radiation therapy, targeted therapies and now immunotherapies.

In addition, numerous compounds are in clinical development for cancer treatment. The clinical development pipeline for cancer includes small molecules, antibodies and immunotherapies from a variety of groups, including in the neoantigen space, the bispecific antibody space and engineered cell therapy and T cell receptor, or TCR, space. Many of these companies are well-capitalized and, in contrast to us, have significant clinical experience.

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 and the extent to which patients accept relatively new routes of administration, 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 products we develop obsolete or noncompetitive before we recover the expense of developing and commercializing our product candidates. Such competitors could also recruit our employees, which could negatively impact our level of expertise and our ability to execute our business plan.

The successful commercialization of our product candidates will depend in part on the extent to which governmental authorities, private health insurers, and other third-party payors provide coverage, adequate reimbursement levels and implement pricing policies favorable for our product candidates. Failure to obtain or maintain coverage and adequate reimbursement for our product candidates, if approved, could limit our ability to market those products and decrease our ability to generate revenue.

The availability of coverage and adequacy of reimbursement by managed care plans, governmental healthcare programs, such as Medicare and Medicaid, private health insurers and other third-party payors are essential for most patients to be able to afford medical services and pharmaceutical products such as our product candidates that receive FDA approval. Our ability to achieve acceptable levels of coverage and reimbursement for our products or procedures using our products by third-party payors will have an

effect on our ability to successfully commercialize our product candidates. Obtaining coverage and adequate reimbursement for our products may be particularly difficult because of the higher prices often associated with drugs administered under the supervision of a physician. Separate reimbursement for the product itself or the treatment or procedure in which our product is used may not be available. A decision by a third-party payor not to cover or separately reimburse for our products or procedures using our products, could reduce physician utilization of our products once approved. Assuming there is coverage for our product candidates, or procedures using our product candidates by a third-party payor, the resulting reimbursement payment rates may not be adequate or may require co-payments that patients find unacceptably high. We cannot be sure that coverage and reimbursement in the United States, the European Union or elsewhere will be available for our product candidates or procedures using our product candidates, or any product that we may develop, and any reimbursement that may become available may not be adequate or may be decreased or eliminated in the future.

Third-party payors increasingly are challenging prices charged for pharmaceutical products and services, and many third-party payors may refuse to provide coverage and reimbursement for particular drugs or biologics when an equivalent generic drug, biosimilar or a less expensive therapy is available. It is possible that a third-party payor may consider our product candidates as substitutable and only offer to reimburse patients for the less expensive product. Even if we show improved efficacy or improved convenience of administration with our product candidates, pricing of existing third-party therapeutics may limit the amount we will be able to charge for our product candidates. These third-party payors may deny or revoke the reimbursement status of our product candidates, if approved, or establish prices for our product candidates at levels that are too low to enable us to realize an appropriate return on our investment. If reimbursement is not available or is available only at limited levels, we may not be able to successfully commercialize our product candidates, and may not be able to obtain a satisfactory financial return on our product candidates.

There is significant uncertainty related to the insurance coverage and reimbursement of newly-approved products, especially novel products like our immunotherapy product candidates. No regulatory authority has granted approval for a tumor-specific cancer immunotherapy based on a vaccine approach, and there is no model for reimbursement of this type of product. The Medicare and Medicaid programs increasingly are used as models in the United States for how private payors and other governmental payors develop their coverage and reimbursement policies for drugs and biologics. Some third-party payors may require pre-approval of coverage for new or innovative devices or drug therapies before they will reimburse healthcare providers who use such therapies. We cannot predict at this time what third-party payors will decide with respect to the coverage and reimbursement for our product candidates.

No uniform policy for coverage and reimbursement for products exists among third-party payors in the United States. Therefore, coverage and reimbursement for products can differ significantly from payor to payor. As a result, the coverage determination process is often a time-consuming and costly process that may require us to provide scientific and clinical support for the use of our product candidates to each payor separately, with no assurance that coverage and adequate reimbursement will be applied consistently or obtained in the first instance. Furthermore, rules and regulations regarding reimbursement change frequently, in some cases on short notice, and we believe that changes in these rules and regulations are likely.

Outside the United States, international operations are generally subject to extensive governmental price controls and other market regulations, and we believe the increasing emphasis on cost-containment initiatives in Europe and other countries have and will continue to put pressure on the pricing and usage of our product candidates. In many countries, the prices of medical products are subject to varying price control mechanisms as part of national health systems. Other countries allow companies to fix their own prices for medical products, but monitor and control company profits. Additional foreign price controls or other changes in pricing regulation could restrict the amount that we are able to charge for our product candidates. Accordingly, in markets outside the United States, the reimbursement for our product candidates may be reduced compared with the United States and may be insufficient to generate commercially-reasonable revenue and profits.

Moreover, increasing efforts by governmental and third-party payors in the United States and abroad to cap or reduce healthcare costs may cause such organizations to limit both coverage and the level of reimbursement for newly approved products and, as a result, they may not cover or provide adequate payment for our product candidates. We expect to experience pricing pressures in connection with the sale of our product candidates due to the trend toward managed health care, the increasing influence of health maintenance organizations and additional legislative changes. The downward pressure on healthcare costs in general, particularly prescription drugs and biologics and surgical procedures and other treatments, has become intense. As a result, increasingly high barriers are being erected to the entry of new products.

If we are unable to support demand for our existing or future services, including ensuring that we have adequate capacity to meet increased demand, or we are unable to successfully manage the evolution of our EDGE platform, our business could suffer.

As the demand for our personalized and off-the-shelf immunotherapy candidates increases with our clinical trial needs, we will need to continue to increase our workflow capacity for sample intake and general process improvements, expand our internal quality assurance program, and extend our EDGE platform based on additional tumor data collected from our clinical trials at a larger scale within expected turnaround times. We will need additional certified laboratory scientists and technicians and other scientific and technical personnel to process higher volumes of tumor biopsies. Portions of our process are not automated and will require additional personnel to scale. We will also need to purchase additional equipment, some of which can take several months or more to procure, set up, and validate, and increase our software and computing capacity to meet increased volume. There is no assurance that any of these increases in scale, expansion of personnel, equipment, software and computing capacities, or process enhancements will be successfully implemented, or that we will have adequate space in our laboratory facilities to accommodate such required expansion.

As we progress into clinical development and expand our manufacturing capabilities, we will need to incorporate new equipment, implement new technology systems and laboratory processes, and hire new personnel with different qualifications. Failure to manage this growth or transition could result in turnaround time delays, higher service costs, declining service quality, deteriorating customer service, and slower responses to competitive challenges. A failure in any one of these areas could make it difficult for us to meet market expectations for our services and could damage our reputation and the prospects for our business.

We currently have no sales organization. If we are unable to establish sales capabilities on our own or through third parties, we may not be able to market and sell our product candidates effectively in the United States and foreign jurisdictions, if approved, or generate product revenue.

We currently do not have a marketing or sales organization. In order to commercialize our product candidates, if approved, in the United States and foreign jurisdictions, we must build our marketing, sales, distribution, managerial and other non-technical capabilities or make arrangements with third parties to perform these services, and we may not be successful in doing so. If any of our product candidates receive regulatory approval, we expect to establish a sales organization with technical expertise and supporting distribution capabilities to commercialize each such product candidate, which will be expensive and time consuming. We have no prior experience in the marketing, sale and distribution of pharmaceutical products and there are significant risks involved in building and managing a sales organization, including our ability to hire, retain, and incentivize qualified individuals, generate sufficient sales leads, provide adequate training to sales and marketing personnel, and effectively manage a geographically dispersed sales and marketing team. Any failure or delay in the development of our internal sales, marketing and distribution capabilities would adversely impact the commercialization of these products. We may choose to collaborate with third parties that have direct sales forces and established distribution systems, either to augment our own sales force and distribution systems or in lieu of our own sales force and distribution systems. If we are unable to enter into such arrangements on acceptable terms or at all, we may not be able to successfully commercialize our product candidates. If we are not successful in commercializing our product candidates or any future product candidates, either on our own or through arrangements with one or more third parties, we may not be able to generate any future product revenue and we would incur significant additional losses.

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

As of December 31, 2019, we had 174 full-time employees. We will need to continue to expand our managerial, operational, finance and other resources in order to manage our operations and clinical trials, continue our development activities and commercialize our lead product candidate or any future product candidates. Our management and personnel, systems and facilities currently in place may not be adequate to support this future growth. Our need to effectively execute our growth strategy requires that we:

- manage our preclinical studies and clinical trials effectively;
- identify, recruit, retain, incentivize and integrate additional employees, including sales personnel;
- manage our internal development and operational efforts effectively while carrying out our contractual obligations to third parties; and
- continue to improve our operational, financial and management controls, reports systems and procedures.

If we fail to attract and retain senior management and key scientific personnel, our business may be materially and adversely affected.

Our success depends in part on our continued ability to attract, retain and motivate highly qualified management, clinical and scientific personnel. We are highly dependent upon our senior management, particularly our President and Chief Executive Officer, as well as our senior scientists and other members of our senior management team. The loss of services of any of these individuals could delay or prevent the successful development of our products, initiation or completion of our planned clinical trials or the commercialization of our lead product candidate or any future product candidates.

Competition for qualified personnel in the biotechnology and biopharmaceutical fields is intense due to the limited number of individuals who possess the skills and experience required by our industry. We will need to hire additional personnel as we expand our clinical development and if we initiate commercial activities. We may not be able to attract and retain quality personnel on acceptable terms, or at all. In addition, to the extent we hire personnel from competitors, we may be subject to allegations that they have been improperly solicited or that they have divulged proprietary or other confidential information, or that their former employers own their research output.

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

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

- decreased demand for our current or future product candidates;
- injury to our reputation;
- withdrawal of clinical trial participants;
- costs to defend the related litigation;
- a diversion of management's time and our resources;
- substantial monetary awards to trial participants or patients;
- regulatory investigations, product recalls, withdrawals or labeling, marketing or promotional restrictions;
- loss of revenue; and
- the inability to commercialize our current or any future product candidates.

Our inability to obtain and maintain sufficient product liability insurance at an acceptable cost and scope of coverage to protect against potential product liability claims could prevent or inhibit the commercialization of our current or any future product candidates we develop. We currently carry product liability insurance covering our clinical trials in the amount of $10.0 million in the aggregate. Although we maintain such insurance, any claim that may be brought against us could result in a court judgment or settlement in an amount that is not covered, in whole or in part, by our insurance or that is in excess of the limits of our insurance coverage. Our insurance policies also have various exclusions and deductibles, and we may be subject to a product liability claim for which we have no coverage. We will have to pay any amounts awarded by a court or negotiated in a settlement that exceed our coverage limitations or that are not covered by our insurance, and we may not have, or be able to obtain, sufficient funds to pay such amounts. Moreover, in the future, we may not be able to maintain insurance coverage at a reasonable cost or in sufficient amounts to protect us against losses. If and when we obtain approval for marketing any of our product candidates, we intend to expand our insurance coverage to include the sale of such product candidate; however, we may be unable to obtain this liability insurance on commercially reasonable terms or at all.

Our strategic collaboration with bluebird, or any future collaboration arrangements that we may enter into, may not be successful, which could significantly limit the likelihood of receiving the potential economic benefits of the collaboration and adversely affect our ability to develop and commercialize our product candidates.

In August 2018, we entered into a strategic collaboration with bluebird to utilize our EDGE platform to identify and validate tumor-specific targets and provide TCRs directed to ten selected targets for use in bluebird bio's cell therapy products. Under the collaboration, we are entitled to receive up to an aggregate of $1.2 billion in development, regulatory and commercial milestones and tiered single digit royalties on sales of bluebird's cell therapy products utilizing the TCRs we develop directed at the targets we discovered. In addition, in the future we may seek to enter into additional collaboration arrangements for the development or commercialization of certain of our product candidates depending on the merits of retaining commercialization rights for ourselves as compared to entering into collaboration arrangements. To the extent that we decide to enter into collaboration agreements in the future, we may face significant competition in seeking appropriate collaborators. Moreover, any collaboration arrangements are complex and time-consuming to negotiate, document, implement and maintain and challenging to manage. We may not be successful in our efforts with bluebird and we may never receive any milestone or royalty payments. Further, we may be unable to prudently manage our existing collaboration or to enter new ones should we chose to do so. The terms of new collaborations or other arrangements that we may establish may not be favorable to us.

The success of our collaboration arrangements will depend heavily on the efforts and activities of our collaborators. Collaborations are subject to numerous risks, which may include risks that:

- collaborators have significant discretion in determining the efforts and resources that they will apply to collaborations;
- collaborators may not pursue development and commercialization of our product candidates or may elect not to continue or renew development or commercialization programs based on clinical trial results, changes in their strategic focus due to their acquisition of competitive products or their internal development of competitive products, availability of funding or other external factors, such as a business combination that diverts resources or creates competing priorities;
- collaborators may delay clinical trials, provide insufficient funding for a clinical trial program, stop a clinical trial, abandon a product candidate, repeat or conduct new clinical trials or require a new formulation of a product candidate for clinical testing;
- collaborators could independently develop, or develop with third parties, products that compete directly or indirectly with our products or product candidates;
- a collaborator with marketing, manufacturing and distribution rights to one or more products may not commit sufficient resources to or otherwise not perform satisfactorily in carrying out these activities;
- we could grant exclusive rights to our collaborators that would prevent us from collaborating with others;
- collaborators may not properly maintain or defend our intellectual property rights or may use our intellectual property or proprietary information in a way that gives rise to actual or threatened litigation that could jeopardize or invalidate our intellectual property or proprietary information or expose us to potential liability;
- disputes may arise between us and a collaborator that causes the delay or termination of the research, development or commercialization of our current or future product candidates or that results in costly litigation or arbitration that diverts management attention and resources;
- collaborations may be terminated, and, if terminated, this may result in a need for additional capital to pursue further development or commercialization of the applicable current or future product candidates;
- collaborators may own or co-own intellectual property covering products that result from our collaboration with them, and in such cases, we would not have the exclusive right to develop or commercialize such intellectual property;
- disputes may arise with respect to the ownership of any intellectual property developed pursuant to our collaborations; and
- a collaborator's sales and marketing activities or other operations may not be in compliance with applicable laws resulting in civil or criminal proceedings.

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

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

- increased operating expenses and cash requirements;

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

In addition, if we undertake acquisitions, we may issue dilutive securities, assume or incur debt obligations, incur large one-time expenses and acquire intangible assets that could result in significant future amortization expense. Moreover, we may not be able to locate suitable acquisition opportunities and this inability could impair our ability to grow or obtain access to technology or products that may be important to the development of our business.

We or the third parties upon whom we depend may be adversely affected by earthquakes or other natural disasters and our business continuity and disaster recovery plans may not adequately protect us from a serious disaster.

Our corporate headquarters and certain of our other facilities, including our manufacturing facility, are located in the San Francisco Bay Area, which in the past has experienced both severe earthquakes and wildfires. We do not carry earthquake insurance. Earthquakes, wildfires or other natural disasters could severely disrupt our operations, and have a material adverse effect on our business, results of operations, financial condition 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 or other facilities, that damaged critical infrastructure, such as our enterprise financial systems or manufacturing resource planning and enterprise quality systems, 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 currently are limited and are unlikely to prove adequate 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, particularly when taken together with our lack of earthquake insurance, could have a material adverse effect on our business.

Furthermore, integral parties in our supply chain are similarly vulnerable to natural disasters or other sudden, unforeseen and severe adverse events. If such an event were to affect our supply chain, it could have a material adverse effect on our business.

We depend on our information technology systems, and any failure of these systems could harm our business. Security breaches, loss of data, and other disruptions could compromise sensitive information related to our business or prevent us from accessing critical information and expose us to liability, which could adversely affect our business, results of operations and financial condition.

We collect and maintain information in digital form that is necessary to conduct our business, and we are increasingly dependent on information technology systems and infrastructure to operate our business, including our laboratory information management system and our EDGE platform. In the ordinary course of our business, we collect, store and transmit large amounts of confidential information, including intellectual property, proprietary business information and personal information. It is critical that we do so in a secure manner to maintain the confidentiality and integrity of such confidential information. We have established physical, electronic and organizational measures to safeguard and secure our systems to prevent a data compromise, and rely on commercially available systems, software, tools, and monitoring to provide security for our information technology systems and the processing, transmission and storage of digital information. We have also outsourced elements of our information technology infrastructure, and as a result a number of third-party vendors may or could have access to our confidential information. Our internal information technology systems and infrastructure, and those of our current and any future collaborators, contractors and consultants and other third parties on which we rely, are vulnerable to damage from computer viruses, malware, natural disasters, terrorism, war, telecommunication and electrical failures, cyber-attacks or cyber-intrusions over the Internet, attachments to emails, persons inside our organization, or persons with access to systems inside our organization.

The risk of a security breach or disruption or data loss, particularly through cyber-attacks or cyber intrusion, including by computer hackers, foreign governments and cyber terrorists, has generally increased as the number, intensity and sophistication of attempted attacks and intrusions from around the world have increased. In addition, the prevalent use of mobile devices that access confidential information increases the risk of data security breaches, which could lead to the loss of confidential information or other intellectual property. For example, we have experienced phishing attacks in the past resulting in a security breach of our information technology systems, and we may be a target of phishing attacks or other cyber-attacks in the future. Any significant system failure, accident or security breach could have a material adverse effect on our business, financial condition and results of operations. The costs to us to mitigate network security problems, bugs, viruses, worms, malicious software programs and security vulnerabilities could be significant, and while we have implemented security measures to protect our data security and information technology systems, our efforts to address these problems may not be successful, and these problems could result in unexpected interruptions, delays, cessation of service and other harm to our business and our competitive position. If such an event were to occur and cause interruptions in our operations, it could result in a material disruption of our product development programs. For example, the loss of clinical trial data from completed or ongoing or planned clinical trials could result in delays in our regulatory approval efforts and significantly increase our costs to recover or reproduce the data. Moreover, if a computer security breach affects our systems or results in the unauthorized release of personally identifiable information, our reputation could be materially damaged. In addition, such a breach may require notification to governmental agencies, the media or individuals pursuant to various federal and state privacy and security laws, if applicable, including the Health Insurance Portability and Accountability Act of 1996, or HIPAA, as amended by the Health Information Technology for Clinical Health Act of 2009, or HITECH, and its implementing rules and regulations, as well as regulations promulgated by the Federal Trade Commission and state breach notification laws. We would also be exposed to a risk of loss or litigation and potential liability, which could materially adversely affect our business, results of operations and financial condition.

Our business is subject to complex and evolving laws and regulations regarding privacy, data protection and other matters relating to information collection.

There are numerous state, federal and foreign laws, regulations, decisions, and directives regarding privacy and the collection, storage, transmission, use, processing, disclosure and protection of different types of personal data and personal information ("Personal Information") and other personal, customer, or other data, the scope of which is continually evolving and subject to differing interpretations. We may be subject to significant consequences, including penalties and fines, for any failure to comply with such laws, regulations and directives.

California has also recently passed the California Consumer Privacy Act (the "CCPA"), which is the most far-reaching data privacy law introduced in the United States to date, and introduces new compliance burdens on organizations doing business in California who collect Personal Information about California residents. The CCPA's definition of Personal Information is very broad and specifically includes biometric information. It went into effect in 2020 and allows for fines on a dramatic scale, as well as a private right of action from individuals in relation to certain security breaches. The CCPA is also prompting a wave of similar legislative developments in other U.S. states and creating the potential for a patchwork of overlapping but different laws. These developments are increasing our compliance burden and our risk, including risks of regulatory fines, litigation and associated reputational harm.

Furthermore, any failure, or perceived failure, by us to comply with or make effective modifications to our policies, or to comply with any federal, state or international privacy, data-retention or data-protection-related laws, regulations, orders or industry self-regulatory principles could result in proceedings or actions against us by governmental entities or others, a loss of customer confidence, damage to our brand and reputation and a loss of customers, any of which could have an adverse effect on our business. In addition, various federal, state and foreign legislative or regulatory bodies may enact new or additional laws and regulations concerning privacy, data-retention and data-protection issues, including laws or regulations mandating disclosure to domestic or international law enforcement bodies, which could adversely impact our business or our reputation with customers. For example, some countries have adopted laws mandating that some Personal Information regarding customers in their country be maintained solely in their country. Having to maintain local data centers and redesign product, service and business operations to limit Personal Information processing to within individual countries could increase our operating costs significantly.

Our employees and independent contractors, including principal investigators, consultants, commercial collaborators, service providers and other vendors may engage in misconduct or other improper activities, including noncompliance with regulatory standards and requirements, which could have an adverse effect on our results of operations.

We are exposed to the risk that our employees and independent contractors, including principal investigators, consultants, any future commercial collaborators, service providers and other vendors may engage in misconduct or other illegal activity. Misconduct by these parties could include intentional, reckless and/or negligent conduct or other unauthorized activities that violate the laws and regulations of the FDA and other similar regulatory bodies, including those laws that require the reporting of true, complete and accurate information to such regulatory bodies; manufacturing standards; U.S. federal and state healthcare fraud and abuse, data

privacy laws and other similar non-U.S. laws; or laws that require the true, complete and accurate reporting of financial information or data. Activities subject to these laws also involve the improper use or misrepresentation of information obtained in the course of clinical trials, the creation of fraudulent data in our preclinical studies or clinical trials, or illegal misappropriation of product, which could result in regulatory sanctions and cause serious harm to our reputation. It is not always possible to identify and deter misconduct by employees and other third-parties, 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. In addition, we are subject to the risk that a person or government could allege such fraud or other misconduct, even if none occurred. 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 significant impact on our business and financial results, including, without limitation, the imposition of significant civil, criminal and administrative penalties, damages, monetary fines, disgorgement, possible exclusion from participation in Medicare, Medicaid and other U.S. federal healthcare programs or healthcare programs in other jurisdictions, integrity oversight and reporting obligations to resolve allegations of non-compliance, individual imprisonment, other sanctions, contractual damages, reputational harm, diminished profits and future earnings and curtailment of our operations, any of which could adversely affect our ability to operate our business and our results of operations.

Our business involves the use of hazardous materials and we and our third-party manufacturers and suppliers must comply with environmental laws and regulations, which can be expensive and restrict how we do business.

Our research and development activities and our third-party manufacturers' and suppliers' activities involve the controlled storage, use and disposal of hazardous materials owned by us, including the components of our product and product candidates and other hazardous compounds. We and any third-party manufacturers and suppliers we engage are subject to numerous federal, state and local environmental, health and safety laws, regulations and permitting requirements, including those governing laboratory procedures; the generation, handling, use, storage, treatment, and disposal of hazardous and regulated materials and wastes; the emission and discharge of hazardous materials into the ground, air and water; and employee health and safety. Our operations involve the use of hazardous and flammable materials, including chemicals and biological and radioactive materials. Our operations also produce hazardous waste. In some cases, these hazardous materials and various wastes resulting from their use are stored at our and our third-party manufacturers' facilities pending their use and disposal. We generally contract with third parties for the disposal of these materials and wastes. We cannot eliminate the risk of contamination, which could cause an interruption of our commercialization efforts, research and development efforts and business operations, environmental damage resulting in costly clean-up and liabilities under applicable laws and regulations governing the use, storage, handling and disposal of these materials and specified waste products.

Although we believe that the safety procedures utilized by us and our third-party manufacturers for handling and disposing of these materials generally comply with the standards prescribed by these laws and regulations, we cannot guarantee that this is the case or eliminate the risk of accidental contamination or injury from these materials. Under certain environmental laws, we could be held responsible for costs relating to any contamination at our current or past facilities and at third-party facilities. In such an event, we may be held liable for any resulting damages and such liability could exceed our resources and state or federal or other applicable authorities may curtail our use of certain materials and/or interrupt our business operations. Furthermore, environmental laws and regulations are complex, change frequently and have tended to become more stringent. We cannot predict the impact of such changes and cannot be certain of our future compliance.

Compliance with applicable environmental laws and regulations may be expensive, and current or future environmental laws and regulations may impair our research, product development and manufacturing efforts. In addition, we cannot entirely eliminate the risk of accidental injury or contamination from these materials or wastes. Although we maintain workers' compensation insurance to cover us for costs and expenses we may incur due to injuries to our employees resulting from the use of hazardous materials, this insurance may not provide adequate coverage against potential liabilities. We do not carry specific biological or hazardous waste insurance coverage, and our property, casualty, and general liability insurance policies specifically exclude coverage for damages and fines arising from biological or hazardous waste exposure or contamination. Accordingly, in the event of contamination or injury, we could be held liable for damages or be penalized with fines in an amount exceeding our resources, and our clinical trials or regulatory approvals could be suspended, which could have a material adverse effect on our business, results of operations and financial condition.

Epidemic diseases, or the perception of their effects, could have a material adverse effect on our business, financial condition, results of operations or cash flows.

Outbreaks of epidemic, pandemic, or contagious diseases, such as the recent novel coronavirus or, historically, the Ebola virus, Middle East Respiratory Syndrome, Severe Acute Respiratory Syndrome, or the H1N1 virus, could disrupt our business. Business disruptions could include disruptions or restrictions on our ability to travel, as well as temporary closures of the facilities of our suppliers. Any disruption of our suppliers could impact our operating results. For example, a supplier of our lipid nanoparticle

formulation, is located in China, which has recently experienced an outbreak of the novel coronavirus. While at this point, the extent to which the coronavirus outbreak may impact our results is uncertain, it could result in delays in delivery of our lipid nanoparticle formulation from our supplier, which could delay our product development activities. In addition, a significant outbreak of epidemic, pandemic, or contagious diseases in the human population could result in a widespread health crisis that could adversely affect the economies and financial markets of many countries, resulting in an economic downturn that could affect demand for our current or future products. Any of these events could have a material adverse effect on our business, financial condition, results of operations, or cash flows.

Risks Related to Intellectual Property

Our success depends on our ability to protect our intellectual property and our proprietary technologies.

Our commercial success depends in part on our ability to obtain and maintain patent protection and trade secret protection for our product candidates, proprietary technologies and their uses as well as our ability to operate without infringing upon the proprietary rights of others. We generally seek to protect our proprietary position by filing patent applications in the United States and abroad related to our product candidates, proprietary technologies and their uses that are important to our business. Our patent applications cannot be enforced against third parties practicing the technology claimed in such applications unless, and until, patents issue from such applications, and then only to the extent the issued claims cover the technology. There can be no assurance that our patent applications or those of our licensors will result in additional patents being issued or that issued patents will afford sufficient protection against competitors with similar technology, nor can there be any assurance that the patents issued will not be infringed, designed around or invalidated by third parties. Even issued patents may later be found invalid or unenforceable or may be modified or revoked in proceedings instituted by third parties before various patent offices or in courts. The degree of future protection for our proprietary rights is uncertain. Only limited protection may be available and may not adequately protect our rights or permit us to gain or keep any competitive advantage. If we do not adequately protect our intellectual property and proprietary technology, competitors may be able to use our product candidates and proprietary technologies and erode or negate any competitive advantage we may have, which could have a material adverse effect on our financial condition and results of operations.

We have applied, and we intend to continue applying, for patents covering aspects of our product candidates, proprietary technologies and their uses that we deem appropriate. However, we may not be able to apply for patents on certain aspects of our current or future product candidates, proprietary technologies and their uses in a timely fashion, at a reasonable cost, in all jurisdictions, or at all, and any potential patent coverage we obtain may not be sufficient to prevent substantial competition. As of December 31, 2019, our solely owned patent portfolio includes 23 pending U.S. patent applications and 111 pending foreign patent applications and one issued U.S. patent relating to the use of a predictive model to identify neoantigens, particularly where the predictive model was trained using mass spectrometry data. We cannot be certain that the claims in any of our patent applications will be considered patentable by the United States Patent and Trademark Office, or USPTO, courts in the United States or by the patent offices and courts in foreign countries, nor can we be certain that the claims in our issued patents will not be found invalid or unenforceable if challenged.

The patent application process is subject to numerous risks and uncertainties, and there can be no assurance that we or any of our actual or potential future collaborators will be successful in protecting our product candidates, proprietary technologies and their uses by obtaining and defending patents. These risks and uncertainties include the following:

- the USPTO and various foreign governmental patent agencies require compliance with a number of procedural, documentary, fee payment and other provisions during the patent process, the noncompliance with which can result in abandonment or lapse of a patent or patent application, and partial or complete loss of patent rights in the relevant jurisdiction;
- patent applications may not result in any patents being issued;
- patents that may be issued or in-licensed may be challenged, invalidated, modified, revoked, circumvented, found to be unenforceable or otherwise may not provide any competitive advantage;
- our competitors, many of whom have substantially greater resources than we do and many of whom have made significant investments in competing technologies, may seek or may have already obtained patents that will limit, interfere with or eliminate our ability to make, use and sell our potential product candidates;
- other parties may have designed around our claims or developed technologies that may be related or competitive to our platform, may have filed or may file patent applications and may have received or may receive patents that overlap or conflict with our patent applications, either by claiming the same methods or devices or by claiming subject matter that could dominate our patent position;

- any successful opposition to any patents owned by or licensed to us could deprive us of rights necessary for the practice of our technologies or the successful commercialization of any products or product candidates that we may develop;
- because patent applications in the United States and most other countries are confidential for a period of time after filing, we cannot be certain that we or our licensors were the first to file any patent application related to our product candidates, proprietary technologies and their uses;
- an interference proceeding can be provoked by a third party or instituted by the USPTO to determine who was the first to invent any of the subject matter covered by the patent claims of our applications for any application with an effective filing date before March 16, 2013;
- there may be significant pressure on the U.S. government and international governmental bodies to limit the scope of patent protection both inside and outside the United States for disease treatments that prove successful, as a matter of public policy regarding worldwide health concerns; and
- countries other than the United States may have patent laws less favorable to patentees than those upheld by U.S. courts, allowing foreign competitors a better opportunity to create, develop and market competing product candidates.

The patent position of biopharmaceutical companies generally is highly uncertain, involves complex legal and factual questions, and has been the subject of much litigation in recent years. Moreover, the patent prosecution process is also expensive and time-consuming, and we may not be able to file and prosecute all necessary or desirable patent applications at a reasonable cost or in a timely manner. 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. Although we enter into non-disclosure and confidentiality agreements with parties who have access to patentable aspects of our research and development output, such as our employees, corporate collaborators, outside scientific collaborators, CROs, contract manufacturers, consultants, advisors and other third parties, any of these parties may breach such agreements and disclose such output before a patent application is filed, thereby jeopardizing our ability to seek patent protection.

The issuance of a patent is not conclusive as to its inventorship, scope, validity or enforceability, and our patents, if issued, or the patent rights that we license from others, may be challenged in the courts or patent offices in the United States and abroad. Once granted, patents may remain open to opposition, interference, re-examination, post-grant review, *inter partes* review, nullification or derivation action in court or before patent offices or similar proceedings for a given period after allowance or grant, during which time third parties can raise objections against such initial grant. Such challenges may result in loss of exclusivity or in patent claims being narrowed, invalidated or held unenforceable, which could limit our ability to stop others from using or commercializing similar or identical products, or limit the duration of the patent protection of our products and product candidates. Given the amount of time required for the development, testing and regulatory review of new product candidates, patents protecting such candidates might expire before or shortly after such candidates are commercialized. As a result, our intellectual property may not provide us with sufficient rights to exclude others from commercializing products similar or identical to ours.

Our ability to enforce our patent rights depends on our ability to detect infringement. It may be difficult to detect infringers who do not advertise the components or methods that are used in connection with their products and services. Moreover, it may be difficult or impossible to obtain evidence of infringement in a competitor's or potential competitor's product or service. We may not prevail in any lawsuits that we initiate, and the damages or other remedies awarded if we were to prevail may not be commercially meaningful.

In addition, proceedings to enforce or defend our patents could put our patents at risk of being invalidated, held unenforceable or interpreted narrowly. Such proceedings could also provoke third parties to assert claims against us, including that some or all of the claims in one or more of our patents are invalid or otherwise unenforceable. If any of our patents covering our products are invalidated or found unenforceable, or if a court found that valid, enforceable patents held by third parties covered one or more of our products, our competitive position could be harmed or we could be required to incur significant expenses to enforce or defend our rights. If we initiate lawsuits to protect or enforce our patents, or litigate against third-party claims, such proceedings would be expensive and would divert the attention of our management and technical personnel.

The degree of future protection for our proprietary rights is uncertain, and we cannot ensure that:

- any of our patents, or any of our pending patent applications, if issued, or those of our licensors, will include claims having a scope sufficient to protect our products;
- any of our pending patent applications or those of our licensors may issue as patents;
- others will not or may not be able to make, use, offer to sell, or sell products that are the same as or similar to our own but that are not covered by the claims of the patents that we own or license;
- we will be able to successfully commercialize our products on a substantial scale, if approved, before the relevant patents that we own or license expire;

- we were the first to make the inventions covered by each of the patents and pending patent applications that we own or license;
- we or our licensors were the first to file patent applications for these inventions;
- others will not develop similar or alternative technologies that do not infringe the patents we own or license;
- any of the patents we own or license will be found to ultimately be valid and enforceable;
- any patents issued to us or our licensors will provide a basis for an exclusive market for our commercially viable products or will provide us with any competitive advantages;
- a third party may not challenge the patents we own or license and, if challenged, a court would hold that such patents are valid, enforceable and infringed;
- we may develop or in-license additional proprietary technologies that are patentable;
- the patents of others will not have an adverse effect on our business;
- our competitors do not conduct research and development activities in countries where we do not have enforceable patent rights and then use the information learned from such activities to develop competitive products for sale in our major commercial markets;
- we will develop additional proprietary technologies or products that are separately patentable; or
- our commercial activities or products will not infringe upon the patents of others.

Where we obtain licenses from or collaborate with third parties, in some circumstances, we may not have the right to control the preparation, filing and prosecution of patent applications, or to maintain the patents, covering technology that we license from third parties, or such activities, if controlled by us, may require the input of such third parties. We may also require the cooperation of our licensors and collaborators to enforce any licensed patent rights, and such cooperation may not be provided. Therefore, these patents and applications may not be prosecuted and enforced in a manner consistent with the best interests of our business. Moreover, if we do obtain necessary licenses, we will likely have obligations under those licenses, and any failure to satisfy those obligations could give our licensor the right to terminate the license. Termination of a necessary license, or expiration of licensed patents or patent applications, could have a material adverse impact on our business.

The lives of our patents may not be sufficient to effectively protect our products and business.

Patents have a limited lifespan. In the United States, the natural expiration of a patent is generally 20 years after its first effective non-provisional filing date. Although various extensions may be available, the life of a patent, and the protection it affords, is limited. Even if patents covering our product candidates, proprietary technologies and their uses are obtained, once the patent life has expired, we may be open to competition. In addition, although upon issuance in the United States a patent's life can be increased based on certain delays caused by the USPTO, this increase can be reduced or eliminated based on certain delays caused by the patent applicant during patent prosecution. Given the amount of time required for the development, testing and regulatory review of new product candidates, patents protecting such candidates might expire before or shortly after such candidates are commercialized. If we do not have sufficient patent life to protect our product candidates, proprietary technologies and their uses, our business and results of operations will be adversely affected.

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

We rely on the protection of our trade secrets, including unpatented know-how, technology and other proprietary information. We have taken steps to protect our trade secrets and unpatented know-how, including entering into confidentiality agreements with third parties, and confidential information and inventions agreements with employees, consultants and advisors. In addition to contractual measures, we try to protect the confidential nature of our proprietary information using commonly accepted physical and technological security measures. Despite these efforts, we cannot provide any assurances that all such agreements have been duly executed, and any of these parties may breach the agreements and disclose our proprietary information, including our trade secrets, and we may not be able to obtain adequate remedies for such breaches. In addition, such security measures may not provide adequate protection for our proprietary information, for example, in the case of misappropriation of a trade secret by an employee, consultant, customer or third party with authorized access. Our security measures may not prevent an employee, consultant or customer from misappropriating our trade secrets and providing them to a competitor, and recourse we take against such misconduct may not provide an adequate remedy to protect our interests fully. Monitoring unauthorized uses and disclosures is difficult, and we do not know whether the steps we have taken to protect our proprietary technologies will be effective. Unauthorized parties may also attempt to copy or reverse engineer certain aspects of our products that we consider proprietary. Enforcing a claim that a party illegally disclosed or misappropriated a trade secret can be difficult, expensive and time-consuming, and the outcome is unpredictable. Even though we use commonly accepted security measures, the criteria for protection of trade secrets can vary among different jurisdictions.

Enforcing a claim that a party illegally disclosed or misappropriated a trade secret is difficult, expensive and time-consuming, and the outcome is unpredictable. In addition, some courts inside and outside the United States are less willing or unwilling to protect trade secrets. Moreover, third parties may still obtain this information or may come upon this or similar information independently, and we would have no right to prevent them from using that technology or information to compete with us. Trade secrets will over time be disseminated within the industry through independent development, the publication of journal articles and the movement of personnel skilled in the art from company to company or academic to industry scientific positions. Though our agreements with third parties typically restrict the ability of our advisors, employees, collaborators, licensors, suppliers, third-party contractors and consultants to publish data potentially relating to our trade secrets, our agreements may contain certain limited publication rights. If any of our trade secrets were to be lawfully obtained or independently developed by a competitor, we would have no right to prevent such competitor from using that technology or information to compete with us, which could harm our competitive position. Because from time to time we expect to rely on third parties in the development, manufacture, and distribution of our products and provision of our services, we must, at times, share trade secrets with them. Despite employing the contractual and other security precautions described above, the need to share trade secrets increases the risk that such trade secrets become known by our competitors, are inadvertently incorporated into the technology of others, or are disclosed or used in violation of these agreements. If any of these events occurs or if we otherwise lose protection for our trade secrets, the value of this information may be greatly reduced and our competitive position would be harmed. If we do not apply for patent protection prior to such publication or if we cannot otherwise maintain the confidentiality of our proprietary technology and other confidential information, then our ability to obtain patent protection or to protect our trade secret information may be jeopardized.

Our rights to develop and commercialize our product candidates are subject in part to the terms and conditions of licenses granted to us by other companies. The patent protection, prosecution and enforcement for some of our product candidates may be dependent on third parties.

We currently are reliant upon licenses of certain patent rights and proprietary technology from third parties that is important or necessary to the development of our technology and products, including technology related to our product candidates. For example, we rely on our license agreement with Arbutus Biopharma Corporation for certain lipid nanoparticle-based delivery technologies. This and other licenses we may enter into in the future may not provide adequate rights to use such intellectual property and technology in all relevant fields of use or in all territories in which we may wish to develop or commercialize our technology and products in the future. As a result, we may not be able to develop and commercialize our technology and products in fields of use and territories for which we are not granted rights pursuant to such licenses.

Licenses to additional third-party technology that may be required for our development programs may not be available in the future or may not be available on commercially reasonable terms, which could have a material adverse effect on our business and financial condition.

In some circumstances, we may not have the right to control the preparation, filing, prosecution and enforcement of patent applications, or to maintain the patents, covering technology that we license from third parties. In addition, some of our agreements with our licensors require us to obtain consent from the licensor before we can enforce patent rights, and our licensor may withhold such consent or may not provide it on a timely basis. Therefore, we cannot be certain that our licensors or collaborators will prosecute, maintain, enforce and defend such intellectual property rights in a manner consistent with the best interests of our business, including by taking reasonable measures to protect the confidentiality of know-how and trade secrets, or by paying all applicable prosecution and maintenance fees related to intellectual property registrations for any of our product candidates. We also cannot be certain that our licensors have drafted or prosecuted the patents and patent applications licensed to us in compliance with applicable laws and regulations, which may affect the validity and enforceability of such patents or any patents that may issue from such applications. If they fail to do so, this could cause us to lose rights in any applicable intellectual property that we in-license, and as a result our ability to develop and commercialize products or product candidates may be adversely affected and we may be unable to prevent competitors from making, using and selling competing products.

Our current licenses, and our future licenses likely will, impose various royalty payments, milestones, and other obligations on us. If we fail to comply with any of these obligations, we may be required to pay damages and the licensor may have the right to terminate the license. Termination by the licensor would cause us to lose valuable rights, and could prevent us from developing and commercializing our product candidates and proprietary technologies. Our business would suffer if any current or future licenses terminate, if the licensors fail to abide by the terms of the license, if the licensors fail to enforce licensed patents against infringing third parties, if the licensed patents or other rights are found to be invalid or unenforceable, or if we are unable to enter into necessary licenses on acceptable terms. Furthermore, if any current or future licenses terminate, or if the underlying patents fail to provide the intended exclusivity, competitors or other third parties may gain the freedom to seek regulatory approval of, and to market, products identical to ours. 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 or otherwise violating the licensor's 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 any, the amounts may 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.

Litigation or other proceedings or third-party claims of intellectual property infringement could require us to spend significant time and money and could prevent us from selling our products.

Our commercial success depends significantly on our ability to operate without infringing the patents and other proprietary rights of third parties. However, our research, development and commercialization activities may be subject to claims that we infringe or otherwise violate patents or other intellectual property rights owned or controlled by third parties. Claims by third parties that we infringe their proprietary rights may result in liability for damages or prevent or delay our developmental and commercialization efforts. We cannot assure you that our operations do not, or will not in the future, infringe existing or future patents.

Other entities may have or obtain patents or proprietary rights that could limit our ability to make, use, sell, offer for sale or import our product candidates and future approved products or impair our competitive position. There is a substantial amount of litigation, both within and outside the United States, involving patent and other intellectual property rights in the biotechnology and pharmaceutical industries, including patent infringement lawsuits, interferences, oppositions, reexaminations, *inter partes* review proceedings and post-grant review proceedings before the USPTO and/or corresponding foreign patent offices. Numerous third-party U.S. and foreign issued patents and pending patent applications exist in the fields in which we are developing product candidates. There may be third-party patents or patent applications with claims to materials, formulations, methods of manufacture or methods for treatment related to the use or manufacture of our product candidates. For example, we are aware of U.S. Serial Nos. 15/187,174 and 14/794,449, expiring in May 2031 (absent any patent term adjustments or extensions), directed to certain methods of identifying and using neoantigens. If a patent issues from such patent applications with claims similar to those that are currently pending, our ability to commercialize GRANITE in the United States may be adversely affected if we do not obtain a license under such patent. In addition, we are aware of and have timely opposed EP Patent 2569633, expiring in May 2031 (absent any patent term adjustments or extensions), directed to certain methods of identifying and using neoantigens. EP Patent 2569633 is currently validated in Great Britain, France, Germany, Netherlands, Italy, Ireland, Spain and Switzerland. Our opposition was filed in the company's name on November 7, 2016 by Vossius & Partner. Four other parties also filed oppositions to the patent within the required timeframe. The Opposition Division of the European Patent Office, or EPO, held opposition hearings on October 15 and 16, 2018, and determined that EP Patent 2569633 does not meet the requirements of the European Patent Convention, or EPC, and consequently, revoked the patent. We received notice in April 2019 that EP Patent 2569633 patentees and licensors filed their appeal to the Opposition Division's decision, and we, along with other opposers, filed responses in August 2019. If, after appeal, EP Patent 2569633 is ultimately maintained by the EPO with claims similar to those that are currently opposed, our ability to commercialize GRANITE in certain European countries may be adversely affected if we do not obtain a license under the patent.

Furthermore, the scope of a patent claim is determined by an interpretation of the law, the written disclosure in a patent and the patent's prosecution history and can involve other factors such as expert opinion. Our interpretation of the relevance or the scope of claims in a patent or a pending application may be incorrect, which may negatively impact our ability to market our products. Further, we may incorrectly determine that our technologies, products, or product candidates are not covered by a third-party patent or may incorrectly predict whether a third party's pending patent application will issue with claims of relevant scope. Our determination of the expiration date of any patent in the United States or abroad that we consider relevant may be incorrect, which may negatively impact our ability to develop and market our products or product candidates.

As the biotechnology industry expands and more patents are issued, the risk increases that our product candidates may be subject to claims of infringement of the patent rights of third parties. Our competitors in both the United States and abroad, many of which have substantially greater resources and have made substantial investments in patent portfolios and competing technologies, may have applied for or obtained or may in the future apply for and obtain, patents that will prevent, limit or otherwise interfere with our ability to make, use and sell our product candidates. We do not always conduct independent reviews of pending patent applications of and patents issued to third parties.

Patent applications in the United States and elsewhere are typically 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. Certain U.S. applications that will not be filed outside the United States can remain confidential until patents issue. In addition, patent applications in the United States and elsewhere can be pending for many years before issuance, or unintentionally abandoned patents or applications can be revived. Furthermore, pending patent applications that have been published can, subject to certain limitations, be later amended in a manner that could cover our technologies, our product candidates or the use of our product candidates. As such, there may be applications of others now pending or recently revived patents of which we are unaware. These applications may later result in issued patents, or the revival of previously abandoned patents, that will prevent, limit or otherwise interfere with our ability to make, use or sell our products. Because patent applications are maintained as confidential for a certain period of time, until the relevant application is published, we may be unaware of third-party patents that may be infringed by commercialization of SLATE, GRANITE or our

other product candidates, and cannot be certain that we were the first to file a patent application related to a product candidate or technology. Moreover, because patent applications can take many years to issue, there may be currently-pending patent applications that may later result in issued patents that our product candidates may infringe. In addition, identification of third-party patent rights that may be relevant to our technology is difficult because patent searching is imperfect due to differences in terminology among patents, incomplete databases and the difficulty in assessing the meaning of patent claims. Any claims of patent infringement asserted by third parties would be time consuming and could:

- result in costly litigation;
- divert the time and attention of our technical personnel and management;
- cause development delays;
- prevent us from commercializing SLATE, GRANITE or our other product candidates until the asserted patent expires or is held finally invalid or not infringed in a court of law;
- require us to develop non-infringing technology, which may not be possible on a cost-effective basis;
- require us to pay damages to the party whose intellectual property rights we may be found to be infringing, which may include treble damages if we are found to have been willfully infringing such intellectual property;
- require us to pay the attorney's fees and costs of litigation to the party whose intellectual property rights we may be found to be infringing; and/or
- require us to enter into royalty or licensing agreements, which may not be available on commercially reasonable terms, or at all.

Although no third party has asserted a claim of patent infringement against us as of the date of this report, others may hold proprietary rights that could prevent SLATE, GRANITE or any future immunotherapy candidates from being marketed. Any patent-related legal action against us claiming damages and seeking to enjoin commercial activities relating to our product candidates or processes could subject us to potential liability for damages, including treble damages if we were determined to willfully infringe, and require us to obtain a license to manufacture or market SLATE, GRANITE or any future immunotherapy candidates. Defense of these claims, regardless of their merit, would involve substantial litigation expense and would be a substantial diversion of employee resources from our business. We cannot predict whether we would prevail in any such actions or that any license required under any of these patents would be made available on commercially acceptable terms, if at all. Even if such licenses are available, we could incur substantial costs related to royalty payments for licenses obtained from third parties, which could negatively affect our gross margins, and the rights may be non-exclusive, which could give our competitors access to the same technology or intellectual property rights licensed to us. In addition, we cannot be certain that we could redesign our product candidates or processes to avoid infringement, if necessary. Accordingly, an adverse determination in a judicial or administrative proceeding, or the failure to obtain necessary licenses, could prevent us from developing and commercializing SLATE, GRANITE or any future immunotherapy candidates, which could harm our business, financial condition and operating results. In addition, intellectual property litigation, regardless of its outcome, may cause negative publicity and could prohibit us from marketing or otherwise commercializing our product candidates and technology.

If we collaborate with third parties in the development of technology in the future, our collaborators may not properly maintain or defend our intellectual property rights or may use our proprietary information in such a way as to invite litigation that could jeopardize or invalidate our intellectual property or proprietary information or expose us to litigation or potential liability. Further, collaborators may infringe the intellectual property rights of third parties, which may expose us to litigation and potential liability. Also, we may be obligated under our agreements with our collaborators, licensors, suppliers and others to indemnify and hold them harmless for damages arising from intellectual property infringement by us.

We may be involved in lawsuits to protect or enforce our patents or the patents of our licensors, which could be expensive, time consuming, and unsuccessful. Further, our issued patents could be found invalid or unenforceable if challenged in court.

Competitors may infringe our intellectual property rights or those of our licensors. To prevent infringement or unauthorized use, we may be required to file infringement claims, which can be expensive and time-consuming. In addition, in a patent infringement proceeding, a court may decide that a patent we own or in-license is not valid, is unenforceable and/or is not infringed. If we or any of our potential future collaborators were to initiate legal proceedings against a third party to enforce a patent directed at one of our product candidates, the defendant could counterclaim that our patent is invalid and/or unenforceable in whole or in part. In patent litigation in the United States, defendant counterclaims alleging invalidity and/or unenforceability are commonplace. Grounds for a validity challenge include an alleged failure to meet any of several statutory requirements, including lack of novelty, obviousness or non-enablement. Grounds for an unenforceability assertion could include an allegation that someone connected with prosecution of the patent withheld relevant information from the USPTO or made a misleading statement during prosecution. Third parties may also raise similar claims before the USPTO, even outside the context of litigation. For example, third parties may petition the USPTO for

post-grant review within nine months of our patent's issuance date. Further, after the USPTO period for filing post-grant review has expired, third parties may file a petition for *inter partes* review on certain grounds. Similar mechanisms for challenging the validity and enforceability of a patent exist in ex-U.S. patent offices and may result in the revocation, cancellation, or amendment of any ex-U.S. patents we hold in the future. The outcome following legal assertions of invalidity and unenforceability is unpredictable, and prior art could render our patents or those of our licensors invalid. If a defendant were to prevail on a legal assertion of invalidity and/or unenforceability, we would lose at least part, and perhaps all, of the patent protection on such product candidate. Such a loss of patent protection would have a material adverse impact on our business.

Interference or derivation proceedings provoked by third parties or brought by us or declared by the USPTO may be necessary to determine the priority of inventions with respect to our patents or patent applications or those of our licensors. An unfavorable outcome could require us to cease using the related technology or to attempt to license rights to it from the prevailing party. Our business could be harmed if the prevailing party does not offer us a license on commercially reasonable terms or at all, or if a non-exclusive license is offered and our competitors gain access to the same technology. Our defense of litigation or interference proceedings may fail and, even if successful, may result in substantial costs and distract our management and other employees. In addition, the uncertainties associated with litigation could have a material adverse effect on our ability to raise the funds necessary to continue our clinical trials, continue our research programs, license necessary technology from third parties or enter into development or manufacturing partnerships that would help us bring our product candidates to market.

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

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

We may not be successful in obtaining or maintaining necessary rights to our product candidates through acquisitions and in-licenses.

We currently have rights to the intellectual property, through licenses from third parties and under patents that we own, to develop our product candidates. Because our programs may require the use of proprietary rights held by third parties, the growth of our business will depend in part on our ability to acquire, in-license or use these proprietary rights. We may be unable to acquire or in-license any compositions, methods of use, processes or other third-party intellectual property rights from third parties that we identify as necessary for our product candidates. The licensing and acquisition of third-party intellectual property rights is a competitive area, and a number of more established companies are also pursuing strategies to license or acquire third-party intellectual property rights that we may consider attractive. These established companies may have a competitive advantage over us due to their size, cash resources and greater clinical development and commercialization capabilities. In addition, companies that perceive us to be a competitor may be unwilling to assign or license rights to us. We also may be unable to license or acquire third-party intellectual property rights on terms that would allow us to make an appropriate return on our investment.

We have collaborated with U.S. academic institutions and may in the future collaborate with U.S. and foreign academic institutions to accelerate our preclinical research or development under written agreements with these institutions. These institutions may provide us with an option to negotiate a license to any of the institution's rights in technology resulting from the collaboration. Regardless of such option, we may be unable to negotiate a license within the specified timeframe or under terms that are acceptable to us. If we are unable to do so, the institution may offer the intellectual property rights to other parties, potentially blocking our ability to pursue our program.

If we are unable to successfully obtain rights to required third-party intellectual property rights or maintain the existing intellectual property rights we have, we may have to abandon development of that program and our business and financial condition could suffer.

We may fail to comply with any of our obligations under existing or future agreements pursuant to which we license or have otherwise acquired intellectual property rights or technology, which could result in the loss of rights or technology that are material to our business.

We are party to various agreements that we depend on to operate our business, including intellectual property rights relating to SLATE and GRANITE, in particular, our agreement with Arbutus. Our rights to use currently licensed intellectual property or intellectual property to be licensed in the future are subject to the continuation of and our compliance with the terms of these agreements. Disputes may arise regarding our rights to intellectual property licensed to us from a third party, including but not limited to:

- the scope of rights granted under the license agreement and other interpretation-related issues;
- the extent to which our technology and processes infringe on intellectual property of the licensor that is not subject to the licensing agreement;
- the sublicensing of patent and other rights;
- our diligence obligations under the license agreement and what activities satisfy those diligence obligations;
- the ownership of inventions and know-how resulting from the creation or use of intellectual property by us, alone or with our licensors and collaborators;
- the scope and duration of our payment obligations;
- our rights upon termination of such agreement; and
- the scope and duration of exclusivity obligations of each party to the agreement.

If disputes over intellectual property and other rights that we have licensed or acquired from third parties prevent or impair our ability to maintain our current license agreements on acceptable terms, we may be unable to successfully develop and commercialize the affected product candidates. If we fail to comply with our obligations under current or future license agreements, these agreements may be terminated or the scope of our rights under them may be reduced and we might be unable to develop, manufacture or market any product that is licensed under these agreements.

We may be subject to claims that we have wrongfully hired an employee from a competitor or that we or our employees have wrongfully used or disclosed alleged confidential information or trade secrets of their former employers.

As is common in the biotechnology and biopharmaceutical industries, in addition to our employees, we engage the services of consultants to assist us in the development of our product candidates. Many of these consultants, and many of our employees, were previously employed at, or may have previously provided or may be currently providing consulting services to, other biotechnology or biopharmaceutical companies including our competitors or potential competitors. Although we try to ensure that our employees and consultants do not use the proprietary information or know-how of others in their work for us, we may become subject to claims that we, our employees or a consultant inadvertently or otherwise used or disclosed trade secrets or other information proprietary to their former employers or their former or current clients. Litigation may be necessary to defend against these claims. If we fail in defending any such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights, which could adversely affect our business. Even if we are successful in defending against these claims, litigation could result in substantial costs and be a distraction to our management team.

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

We may also be subject to claims that former employees, collaborators or other third parties have an ownership interest in our patents or other intellectual property. In addition, we may face claims by third parties that our agreements with employees, contractors or consultants obligating them to assign intellectual property to us are ineffective or in conflict with prior or competing contractual obligations of assignment, which could result in ownership disputes regarding intellectual property we have developed or will develop and interfere with our ability to capture the commercial value of such intellectual property. Litigation may be necessary to defend against these and other claims challenging inventorship or ownership. If we fail in defending any such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights. Such an outcome could have a material adverse effect on our business. Even if we are successful in defending against such claims, litigation could result in substantial costs and distraction to management and other employees.

If we do not obtain patent term extension for our product candidates, our business may be materially harmed.

Depending upon the timing, duration and specifics of FDA marketing approval of SLATE, GRANITE or any future immunotherapy candidates, one or more of our U.S. patents may be eligible for limited patent term restoration under the Drug Price Competition and Patent Term Restoration Act of 1984, also known as the Hatch-Waxman Amendments. The Hatch-Waxman

Amendments permit a patent restoration term of up to five years as compensation for patent term lost during product development and the FDA regulatory review process. The Hatch-Waxman Act allows a maximum of one patent to be extended per FDA approved product as compensation for the patent term lost during the FDA regulatory review process. A patent term extension cannot extend the remaining term of a patent beyond a total of 14 years from the date of product approval and only those claims covering such approved drug product, a method for using it or a method for manufacturing it may be extended. Patent term extension may also be available in certain foreign countries upon regulatory approval of our product candidates. However, we may not be granted an extension because of, for example, failing to apply within applicable deadlines, failing to apply prior to expiration of relevant patents or otherwise failing to satisfy applicable requirements. Moreover, the applicable time period or the scope of patent protection afforded could be less than we request. If we are unable to obtain patent term extension or restoration or the term of any such extension is less than we request, our competitors may obtain approval of competing products following our patent expiration, and our revenue could be reduced, possibly materially.

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

Our registered or unregistered trademarks or trade names may be challenged, infringed, circumvented or declared generic or determined to be infringing on other marks. We may not be able to protect our rights to these trademarks and trade names, which we need to build name recognition among potential partners or customers in our markets of interest. At times, competitors may adopt trade names or trademarks similar to ours, thereby impeding our ability to build brand identity and possibly leading to market confusion. In addition, there could be potential trade name or trademark infringement claims brought by owners of other trademarks or trademarks that incorporate variations of our registered or unregistered trademarks or trade names. Over the long term, if we are unable to establish name recognition based on our trademarks and trade names, then we may not be able to compete effectively and our business may be adversely affected. We may license our trademarks and trade names to third parties, such as distributors. Though these license agreements may provide guidelines for how our trademarks and trade names may be used, a breach of these agreements or misuse of our trademarks and tradenames by our licensees may jeopardize our rights in or diminish the goodwill associated with our trademarks and trade names. Our efforts to enforce or protect our proprietary rights related to trademarks, trade names, trade secrets, domain names, copyrights or other intellectual property may be ineffective and could result in substantial costs and diversion of resources and could adversely affect our financial condition or results of operations.

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

Our patent rights may be affected by developments or uncertainty in U.S. or ex-U.S. patent statutes, patent case laws in USPTO rules and regulations or in the rules and regulations of ex-U.S. patent offices. There are a number of recent changes to the U.S. patent laws that may have a significant impact on our ability to protect our technology and enforce our intellectual property rights. For example, on September 16, 2011, the Leahy-Smith America Invents Act, or Leahy-Smith Act, was signed into law. The Leahy-Smith Act includes a number of significant changes to U.S. patent law. These include provisions that affect the way patent applications will be prosecuted and may also affect patent litigation. In particular, under the Leahy-Smith Act, the United States transitioned in March 2013 to a "first to file" system in which the first inventor to file a patent application will be entitled to the patent. Third parties are allowed to submit prior art before the issuance of a patent by the USPTO, and may become involved in post-grant proceedings including opposition, derivation, reexamination, *inter partes* review or interference proceedings challenging our patent rights or the patent rights of others. An adverse determination in any such submission, proceeding or litigation could reduce the scope or enforceability of, or invalidate, our patent rights, which could adversely affect our competitive position. This could have a negative impact on some of our intellectual property and could increase uncertainties surrounding obtaining and enforcement or defense of our issued patents. In addition, Congress may pass patent reform legislation that is unfavorable to us. The Supreme Court has ruled on several patent cases in recent years, either narrowing the scope of patent protection available in certain circumstances or weakening the rights of patent owners in certain situations. In addition to increasing uncertainty with regard to our ability to obtain patents in the future, this combination of events has created uncertainty with respect to the value of patents, once obtained. Depending on decisions by Congress, the federal courts and the USPTO, the laws and regulations governing patents could change in unpredictable ways that would weaken our ability to obtain new patents or to enforce our existing patents and patents we might obtain in the future.

Similarly, statutory or judicial changes to the patent laws of other countries may increase the uncertainties and costs surrounding the prosecution of patent applications and the enforcement or defense of issued patents.

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

Filing, prosecuting and defending all current and future patents in all countries throughout the world would be prohibitively expensive, and our intellectual property rights in some countries outside the United States can be less extensive than those in the United States. In addition, the laws of some foreign countries do not protect intellectual property rights to the same extent as federal and state laws in the United States. Consequently, we may not be able to prevent third parties from practicing our inventions in all

countries outside the United States, or from selling or importing products made using our inventions in and into the United States or other jurisdictions. Competitors may use our technologies in jurisdictions where we have not obtained patent protection to develop their own products and, further, may export otherwise infringing products to territories where we have patent protection but enforcement is not as strong as that in the United States. These products may compete with our product candidates, and our patents or other intellectual property rights may not be effective or sufficient to prevent them from competing.

The legal systems of many foreign countries do not favor the enforcement of patents and other intellectual property protection, which could make it difficult for us to stop the infringement of our patents or marketing of competing products in violation of our proprietary rights. For example, some foreign countries have compulsory licensing laws under which a patent owner must grant licenses to third parties. In addition, some countries limit the enforceability of patents against third parties, including government agencies or government contractors. In these countries, patents may provide limited or no benefit. Proceedings to enforce our patent rights in foreign jurisdictions could result in substantial costs and divert our efforts and attention from other aspects of our business, could put our patents at risk of being invalidated or interpreted narrowly and our patent applications at risk of not issuing and could provoke third parties to assert claims against us. We may not prevail in any lawsuits that we initiate, and the damages or other remedies awarded, if any, may not be commercially meaningful. Accordingly, our efforts to enforce our intellectual property rights around the world may be inadequate to obtain a significant commercial advantage from the intellectual property that we develop or license.

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

The USPTO and various foreign governmental patent agencies require compliance with a number of procedural, documentary, fee payment and other provisions during the patent process. Periodic maintenance fees, renewal fees, annuity fees and various other governmental fees on patents and/or applications will be due to be paid to the USPTO and various governmental patent agencies outside of the US in several stages over the lifetime of the patents and/or applications. We employ reputable professionals and rely on such third parties to help us comply with these requirements and effect payment of these fees with respect to the patents and patent applications that we own, and if we license intellectual property we may have to rely upon our licensors to comply with these requirements and effect payment of these fees with respect to any patents and patent applications that we license. 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. However, there are situations in which noncompliance can result in abandonment or lapse of a patent or patent application, resulting in partial or complete loss of patent rights in the relevant jurisdiction. In such an event, competitors might be able to enter the market earlier than would otherwise have been the case.

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

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

- others may be able to make personalized cancer immunotherapies that are similar to ours but that are not covered by the claims of the patents that we own or have exclusively licensed;
- we or our licensors or future collaborators might not have been the first to make the inventions covered by the issued patents or pending patent applications that we own or have exclusively licensed;
- we or our licensors or future collaborators might not have been the first to file patent applications covering certain of our inventions;
- others may independently develop similar or alternative technologies or duplicate any of our technologies without infringing our intellectual property rights;
- it is possible that our pending patent applications will not lead to issued patents;
- issued patents that we own or have exclusively licensed may be held invalid or unenforceable, as a result of legal challenges by our competitors;
- our competitors might conduct research and development activities in countries where we do not have patent rights and then use the information learned from such activities to develop competitive products for sale in our major commercial markets;
- we may not develop additional proprietary technologies that are patentable; and
- the patents of others may have an adverse effect on our business.

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

Risks Related to Government Regulation

Even if we obtain regulatory approval for a product candidate, our products will remain subject to regulatory scrutiny.

If one or more of our product candidates is approved, each will be subject to ongoing regulatory requirements for manufacturing, labeling, packaging, storage, advertising, promotion, sampling, record-keeping, conduct of post-marketing studies, and submission of safety, efficacy, and other post- market information, including both federal and state requirements in the United States and requirements of comparable foreign regulatory authorities.

Manufacturers and manufacturers' facilities are required to comply with extensive FDA and comparable foreign regulatory authority requirements, including ensuring that quality control and manufacturing procedures conform to cGMP regulations. As such, we and our contract manufacturers will be subject to continual review and inspections to assess compliance with cGMP and adherence to commitments made in any approved marketing application. Accordingly, we and others with whom we work must continue to expend time, money, and effort in all areas of regulatory compliance, including manufacturing, production, and quality control.

We will have to comply with requirements concerning advertising and promotion for our products. Promotional communications with respect to prescription drugs and biologics are subject to a variety of legal and regulatory restrictions and must be consistent with the information in the product's approved label. As such, we may not promote our products "off-label" for indications or uses for which they do not have approval. The holder of an approved application must submit new or supplemental applications and obtain approval for certain changes to the approved product, product labeling, or manufacturing process. We could also be asked to conduct post-marketing clinical studies to verify the safety and efficacy of our products in general or in specific patient subsets. An unsuccessful post-marketing study or failure to complete such a study could result in the withdrawal of marketing approval.

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

- issue warning letters;
- impose civil or criminal penalties;
- suspend or withdraw regulatory approval;
- suspend any of our clinical studies;
- refuse to approve pending applications or supplements to approved applications submitted by us;
- impose restrictions on our operations, including closing our contract manufacturers' facilities; or
- seize or detain products, or require a product recall.

Any government investigation of alleged violations of law could require us to expend significant time and resources in response, and could generate negative publicity. Any failure to comply with ongoing regulatory requirements may significantly and adversely affect our ability to commercialize and generate revenue from our products. If regulatory sanctions are applied or if regulatory approval is withdrawn, the value of our company and our operating results will be adversely affected.

Moreover, the policies of the FDA and of other regulatory authorities 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 or executive action, either in the United States or abroad. For example, certain policies of the Trump administration may impact our business and industry. Namely, the Trump administration has taken several executive actions, including the issuance of a number of Executive Orders, that could impose significant burdens on, or otherwise materially delay, FDA's ability to engage in routine oversight activities such as implementing statutes through rulemaking, issuance of guidance, and review and approval of marketing applications. It is difficult to predict how these orders will be implemented, and the extent to which they will impact the FDA's ability to exercise its regulatory authority. If these executive actions impose restrictions on FDA's ability to engage in oversight and implementation activities in the normal course, our business may be negatively impacted. In addition, 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.

We may seek orphan drug designation for certain future product candidates, but we may be unable to obtain such designations or to maintain the benefits associated with orphan drug designation, including market exclusivity, which may cause our revenue, if any, to be reduced.

We may pursue orphan drug designation for certain of our future product candidates. Under the Orphan Drug Act, the FDA may designate a drug or biologic product as an orphan drug if it is intended to treat a rare disease or condition, defined as a patient population of fewer than 200,000 in the United States, or a patient population greater than 200,000 in the United States where there is no reasonable expectation that the cost of developing the drug will be recovered from sales in the United States. In the European Union, the EMA's Committee for Orphan Medicinal Products, or COMP, grants orphan drug designation to promote the development of products that are intended for the diagnosis, prevention, or treatment of a life-threatening or chronically debilitating condition affecting not more than five in 10,000 persons in the European Union. Additionally, designation is granted for products intended for the diagnosis, prevention, or treatment of a life-threatening, seriously debilitating or serious and chronic condition when, without incentives, it is unlikely that sales of the drug in the European Union would be sufficient to justify the necessary investment in developing the drug or biological product or where there is no satisfactory method of diagnosis, prevention, or treatment, or, if such a method exists, the medicine must be of significant benefit to those affected by the condition.

In the United States, orphan drug designation entitles a party to financial incentives such as opportunities for grant funding towards clinical trial costs, tax credits for certain clinical trial costs, and application fee waivers. In addition, if a product receives the first FDA approval for the indication for which it has orphan designation, the product is entitled to orphan drug exclusivity, which means the FDA may not approve any other application to market the same drug for the same indication for a period of seven years, except in limited circumstances, such as a showing of clinical superiority over the product with orphan exclusivity or where the manufacturer is unable to assure sufficient product quantity the orphan patient population. In the European Union, orphan drug designation entitles a party to financial incentives such as reduction of fees or fee waivers and ten years of market exclusivity following drug or biological product approval. This period may be reduced to six years if the orphan drug designation criteria are no longer met, including where it is shown that the product is sufficiently profitable not to justify maintenance of market exclusivity.

Even if we obtain orphan drug designation for a product candidate, we may not be the first to obtain marketing approval for the product candidate for any particular orphan indication due to the uncertainties associated with developing novel biologic products. Further, even if we obtain orphan drug exclusivity for a product candidate, that exclusivity may not effectively protect the product from competition because different drugs with different active moieties can be approved for the same condition. Even after an orphan drug is approved, the FDA or EMA can subsequently approve the same drug with the same active moiety for the same condition if the FDA or EMA concludes that the later drug is clinically superior in that it is safer, more effective, or makes a major contribution to patient care. Orphan drug designation neither shortens the development time or regulatory review time of a drug or biologic nor gives the drug or biologic any advantage in the regulatory review or approval process.

Enacted and future healthcare legislation may increase the difficulty and cost for us to obtain marketing approval of and commercialize our product candidates and may affect the prices we may set.

In the United States, the European Union and other jurisdictions, there have been, and we expect there will continue to be, a number of legislative and regulatory changes and proposed changes to the healthcare system that could affect our future results of operations. In particular, there have been and continue to be a number of initiatives at the U.S. federal and state levels that seek to reduce healthcare costs and improve the quality of healthcare. For example, in March 2010, the Patient Protection and Affordable Care Act, as amended by the Health Care and Education Reconciliation Act, or collectively the ACA, was enacted, which substantially changed the way healthcare is financed by both governmental and private payors. Among the provisions of the ACA, those of greatest importance to the pharmaceutical and biotechnology industries include the following:

- an annual, non-deductible fee payable by any entity that manufactures or imports certain branded prescription drugs and biologic agents (other than those designated as orphan drugs), which is apportioned among these entities according to their market share in certain government healthcare programs;
- a new methodology by which rebates owed by manufacturers under the Medicaid Drug Rebate Program are calculated for drugs that are inhaled, infused, instilled, implanted or injected;
- expansion of eligibility criteria for Medicaid programs by, among other things, allowing states to offer Medicaid coverage to certain individuals with income at or below 133% of the federal poverty level, thereby potentially increasing a manufacturer's Medicaid rebate liability;
- a licensure framework for follow on biologic products;
- 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
- establishment of a Center for Medicare and Medicaid Innovation at the Centers for Medicare & Medicaid Services, or CMS, to test innovative payment and service delivery models to lower Medicare and Medicaid spending, potentially including prescription drug spending.

Since its enactment, there have been judicial, Congressional, and executive branch challenges to certain aspects of the ACA, and we expect there will be additional challenges and amendments to the ACA in the future. For example, the Tax Cuts and Jobs Act of 2017, or Tax Act, was enacted, which includes a provision repealing, effective January 1, 2019, the tax-based shared responsibility payment imposed by the ACA on certain individuals who fail to maintain qualifying health coverage for all or part of a year that is commonly referred to as the "individual mandate". On December 14, 2018, a U.S. District Court Judge in the Northern District of Texas, ruled that the individual mandate is a critical and 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. On December 18, 2019, the U.S. Court of Appeals for the 5th Circuit upheld the District Court's decision that the individual mandate was unconstitutional but remanded the case back to the District Court to determine whether the remaining provisions of the ACA are invalid as well. It is unclear how these decisions, subsequent appeals, if any, and other efforts to challenge, repeal or 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. In August 2011, the Budget Control Act of 2011, among other things, led to aggregate reductions of Medicare payments to providers of 2% per fiscal year. These reductions went into effect in April 2013 and, due to subsequent legislative amendments to the statute, will remain in effect through 2029 unless additional action is taken by Congress. In January 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. These new laws or any other similar laws introduced in the future may result in additional reductions in Medicare and other health care funding, which could negatively affect our customers and accordingly, our financial operations.

Moreover, payment methodologies may be subject to changes in healthcare legislation and regulatory initiatives. For example, CMS may develop new payment and delivery models, such as bundled payment models. In addition, recently there has been heightened governmental scrutiny over the manner in which manufacturers set prices for their marketed products, which has resulted in several U.S. Congressional inquiries and proposed and enacted federal and state legislation designed to, among other things, bring more transparency to drug pricing, reduce the cost of prescription drugs under government payor programs, and review the relationship between pricing and manufacturer patient programs. While some proposed measures will require authorization through additional legislation to become effective, Congress and the Trump administration have each indicated that it will continue to seek new legislative and/or administrative measures to control drug costs. We expect that additional U.S. federal healthcare reform measures will be adopted in the future, any of which could limit the amounts that the U.S. federal government will pay for healthcare products and services, which could result in reduced demand for our product candidates or additional pricing pressures.

Individual states in the United States have also 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. Legally mandated price controls on payment amounts by third-party payors or other restrictions could harm our business, results of operations, financial condition and prospects. In addition, regional healthcare authorities and individual hospitals are increasingly using bidding procedures to determine what pharmaceutical products and which suppliers will be included in their prescription drug and other healthcare programs. This could reduce the ultimate demand for our product candidates or put pressure on our product pricing.

Additionally, on May 30, 2018, the Trickett Wendler, Frank Mongiello, Jordan McLinn, and Matthew Bellina Right to Try Act of 2017, or the Right to Try Act, was signed into law. The law, among other things, provides a federal framework for certain patients to access certain investigational new drug products that have completed a Phase I clinical trial and that are undergoing investigation for FDA approval. Under certain circumstances, eligible patients can seek treatment without enrolling in clinical trials and without obtaining FDA permission under the FDA expanded access program. There is no obligation for a pharmaceutical manufacturer to make its drug products available to eligible patients as a result of the Right to Try Act.

In the European Union, similar political, economic and regulatory developments may affect our ability to profitably commercialize our product candidates, if approved. In addition to continuing pressure on prices and cost containment measures, legislative developments at the European Union or member state level may result in significant additional requirements or obstacles that may increase our operating costs. The delivery of healthcare in the European Union, including the establishment and operation of health services and the pricing and reimbursement of medicines, is almost exclusively a matter for national, rather than European Union, law and policy. National governments and health service providers have different priorities and approaches to the delivery of health care and the pricing and reimbursement of products in that context. In general, however, the healthcare budgetary constraints in most European Union member states have resulted in restrictions on the pricing and reimbursement of medicines by relevant health service providers. Coupled with ever-increasing European Union and national regulatory burdens on those wishing to develop and market products, this could prevent or delay marketing approval of our product candidates, restrict or regulate post-approval activities and affect our ability to commercialize our product candidates, if approved. In markets outside of the United States and European Union, reimbursement and healthcare payment systems vary significantly by country, and many countries have instituted price ceilings on specific products and therapies.

We cannot predict the likelihood, nature or extent of government regulation that may arise from future legislation or administrative action in the United States, the European Union or any other jurisdiction. If we or any third parties we may engage are slow or unable to adapt to changes in existing requirements or the adoption of new requirements or policies, or if we or such third parties are not able to maintain regulatory compliance, our product candidates may lose any regulatory approval that may have been obtained and we may not achieve or sustain profitability.

Our business operations and current and future relationships with investigators, healthcare professionals, consultants, third-party payors, patient organizations and customers will be subject to applicable healthcare regulatory laws, which could expose us to penalties.

Our business operations and current and future arrangements with investigators, healthcare professionals, consultants, third-party payors, patient organizations and customers, may expose us to broadly applicable fraud and abuse and other healthcare laws and regulations. These laws may constrain the business or financial arrangements and relationships through which we conduct our operations, including how we research, market, sell and distribute our product candidates, if approved. Such laws include:

- the U.S. federal Anti-Kickback Statute, which prohibits, among other things, persons or entities from knowingly and willfully soliciting, offering, receiving or providing any remuneration (including any kickback, bribe, or certain rebate), directly or indirectly, overtly or covertly, in cash or in kind, to induce or reward, or in return for, either the referral of an individual for, or the purchase, lease, order or recommendation of, any good, facility, item or service, for which payment may be made, in whole or in part, under any U.S. federal healthcare program, such as Medicare and Medicaid. A person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation;
- the U.S. federal civil and criminal false claims and civil monetary penalties laws, including the civil False Claims Act, which prohibit, among other things, including through civil whistleblower or qui tam actions, individuals or entities from knowingly presenting, or causing to be presented, to the U.S. federal government, claims for payment or approval that are false or fraudulent, knowingly making, using or causing to be made or used, a false record or statement material to a false or fraudulent claim, or from knowingly making a false statement to avoid, decrease or conceal an obligation to pay money to the U.S. federal government. Pharmaceutical manufacturers can cause false claims to be presented to the U.S. federal government by engaging in impermissible marketing practices, such as the off-label promotion of a product for an indication for which it has not received FDA approval. In addition, the government may assert that a claim including items and services resulting from a violation of the U.S. federal Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the civil False Claims Act;
- HIPAA, which imposes criminal and civil liability for, among other things, knowingly and willfully executing, or attempting to execute, a scheme to defraud any healthcare benefit program, or knowingly and willfully falsifying, concealing or covering up a material fact or making any materially false statement, in connection with the delivery of, or payment for, healthcare benefits, items or services. Similar to the U.S. federal Anti-Kickback Statute, a person or entity does not need to have actual knowledge of the healthcare fraud statute implemented under HIPAA or specific intent to violate it in order to have committed a violation;
- HIPAA, as amended by HITECH, and its implementing regulations, which also imposes certain obligations, including mandatory contractual terms, with respect to safeguarding the privacy and security of individually identifiable health information of covered entities subject to the rule, such as health plans, healthcare clearinghouses and certain healthcare providers as well as their business associates, independent contractors of a covered entity that perform certain services involving the use or disclosure of individually identifiable health information on their behalf;
- the Food, Drug, and Cosmetic Act, which prohibits, among other things, the adulteration or misbranding of drugs, biologics and medical devices;

  the U.S. Public Health Service Act, which prohibits, among other things, the introduction into interstate commerce of a biological product unless a biologics license is in effect for that product;
- the U.S. Physician Payments Sunshine Act and its implementing regulations, which requires certain manufacturers of drugs, devices, biologics and medical supplies that are reimbursable under Medicare, Medicaid, or the Children's Health Insurance Program, with specific exceptions, to report annually to the government information related to certain payments and other transfers of value to physicians, certain other health care professionals beginning in 2022, and teaching hospitals, as well as ownership and investment interests held by physicians and their immediate family members;

- analogous U.S. state laws and regulations, including: state anti-kickback and false claims laws, which may apply to our business practices, including but not limited to, research, distribution, sales and marketing arrangements and claims involving healthcare items or services reimbursed by any third-party payor, including private insurers; state laws that require pharmaceutical companies to comply with the pharmaceutical industry's voluntary compliance guidelines and the relevant compliance guidance promulgated by the U.S. federal government, or otherwise restrict payments that may be made to healthcare providers and other potential referral sources; state laws and regulations that require drug manufacturers to file reports relating to pricing and marketing information, which requires tracking gifts and other remuneration and items of value provided to healthcare professionals and entities; state and local laws requiring the registration of pharmaceutical sales representatives; and state 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;
- the U.S. Foreign Corrupt Practices Act of 1977, as amended, which prohibits, among other things, U.S. companies and their employees and agents from authorizing, promising, offering, or providing, directly or indirectly, corrupt or improper payments or anything else of value to foreign government officials, employees of public international organizations and foreign government owned or affiliated entities, candidates for foreign political office, and foreign political parties or officials thereof; and
- similar healthcare laws and regulations in the European Union and other jurisdictions, including reporting requirements detailing interactions with and payments to healthcare providers.

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

Risks Related to Our Common Stock

Our stock price is volatile and you may not be able to resell shares of our common stock at or above the price you paid.

The trading price of our common stock is highly volatile and could be subject to wide fluctuations in response to various factors, some of which are beyond our control. These factors include those discussed in this "Risk Factors" section of this report and others such as:

- results from, and any delays in, our clinical trials for SLATE, GRANITE or any other future clinical development programs, including public misperception of the results of our trials;
- announcements by academic or other third parties challenging the fundamental premises underlying our approach to treating cancer and/or biopharmaceutical product development;
- announcements of regulatory approval or disapproval of our current or any future product candidates;
- failure or discontinuation of any of our research and development programs;
- manufacturing setbacks or delays of or issues with the supply of the materials for our personalized immunotherapy candidate;
- announcements relating to future licensing, collaboration or development agreements, including the early termination or failure of an existing strategic collaboration;
- delays in the commercialization of our current or any future product candidates;
- public misperception regarding the use of our therapies;
- acquisitions and sales of new products, technologies or businesses;

- quarterly variations in our results of operations or those of our future competitors;
- changes in earnings estimates or recommendations by securities analysts;
- announcements by us or our competitors of new products, significant contracts, commercial relationships, acquisitions or capital commitments;
- developments with respect to intellectual property rights;
- our commencement of, or involvement in, litigation;
- changes in financial estimates or guidance, including our ability to meet our future revenue and operating profit or loss estimates or guidance;
- any major changes in our board of directors or management;
- new legislation in the United States relating to the sale or pricing of pharmaceuticals;
- FDA or other U.S. or foreign regulatory actions affecting us or our industry;
- product liability claims or other litigation or public concern about the safety of our product candidates;
- market conditions in the biopharmaceutical and biotechnology sectors; and
- general economic conditions in the United States and abroad.

In addition, the stock markets in general, and the markets for biopharmaceutical and biotechnology stocks in particular, have experienced extreme volatility that may have been unrelated to the operating performance of the issuer. These broad market fluctuations may adversely affect the trading price or liquidity of our common stock. In the past, when the market price of a stock has been volatile, holders of that stock have sometimes instituted securities class action litigation against the issuer. If any of our stockholders were to bring such a lawsuit against us, we could incur substantial costs defending the lawsuit and the attention of our management would be diverted from the operation of our business.

An active, liquid and orderly market for our common stock may not develop, and you may not be able to resell your common stock.

Prior to our initial public offering in September 2018, there was no public market for shares of our common stock. Our stock recently began trading on the Nasdaq Global Select Market, but we can provide no assurance that we will be able to maintain an active trading market on the Nasdaq Global Select Market or any other exchange in the future. The lack of an active market may impair your ability to sell your shares at the time you wish to sell them or at a price that you consider reasonable. An inactive market may also impair our ability to raise capital by selling shares and may impair our ability to acquire other businesses, applications, or technologies using our shares as consideration.

If securities or industry analysts do not publish research or reports about our business, 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 common stock will be influenced by the research and reports that industry or securities analysts publish about us or our business. If any of the analysts who cover us issue an adverse or misleading opinion regarding us, our business model, our intellectual property or our stock performance, or if our clinical trials and operating results fail to meet the expectations of analysts, our stock price would likely decline. If one or more of these analysts cease coverage of us 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.

We incur significant costs as a result of operating as a public company, and our management devotes substantial time to new compliance initiatives. We may fail to comply with the rules that apply to public companies, including Section 404 of the Sarbanes-Oxley Act of 2002, which could result in sanctions or other penalties that would harm our business.

We incur significant legal, accounting and other expenses as a public company, including costs resulting from public company reporting obligations under the Exchange Act and regulations regarding corporate governance practices. The listing requirements of the Nasdaq Global Select Market and the rules of the Securities and Exchange Commission, or SEC, require that we satisfy certain corporate governance requirements relating to director independence, filing annual and interim reports, stockholder meetings, approvals and voting, soliciting proxies, conflicts of interest and a code of conduct. Our management and other personnel devote a substantial amount of time to ensure that we comply with all of these requirements. Moreover, the reporting requirements, rules and regulations will increase our legal and financial compliance costs and will make some activities more time-consuming and costly. Any changes we make to comply with these obligations may not be sufficient to allow us to satisfy our obligations as a public company on a timely basis, or at all. These reporting requirements, rules and regulations, coupled with the increase in potential litigation exposure

associated with being a public company, could also make it more difficult for us to attract and retain qualified persons to serve on our board of directors or board committees or to serve as executive officers, or to obtain certain types of insurance, including directors' and officers' insurance, on acceptable terms or at all.

As a public company, we are subject to Section 404 of the Sarbanes-Oxley Act of 2002, or Section 404, and the related rules of the SEC, which generally require our management and independent registered public accounting firm to report on the effectiveness of our internal control over financial reporting. However, for so long as we remain an emerging growth company as defined in the JOBS Act, we intend to take advantage of certain exemptions from various reporting requirements that are applicable to public companies that are not emerging growth companies, including, but not limited to, not being required to comply with the auditor attestation requirements of Section 404. Once we are no longer an emerging growth company or, if prior to such date, we opt to no longer take advantage of the applicable exemption, we will be required to include an opinion from our independent registered public accounting firm on the effectiveness of our internal controls over financial reporting. We will remain an emerging growth company until the earlier of (1) December 31, 2023, (2) the last day of the fiscal year in which we have total annual gross revenue of at least $1.07 billion, (3) the last day of the fiscal year 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 or (4) the date on which we have issued more than $1.0 billion in non-convertible debt during the prior three-year period.

In order to provide the reports required by these rules we must conduct reviews and testing of our internal controls. During the course of our review and testing, we may identify deficiencies and be unable to remediate them before we must provide the required reports. Furthermore, if we have a material weakness in our internal controls over financial reporting, we may not detect errors on a timely basis and our financial statements may be materially misstated. We or our independent registered public accounting firm may not be able to conclude on an ongoing basis that we have effective internal control over financial reporting, which could harm our operating results, cause investors to lose confidence in our reported financial information and cause the trading price of our stock to fall. In addition, as a public company we are required to file accurate and timely quarterly and annual reports with the SEC under the Exchange Act. In order to report our results of operations and financial statements on an accurate and timely basis, we will depend on third party vendors to provide timely and accurate notice of their costs to us. Any failure to report our financial results on an accurate and timely basis could result in sanctions, lawsuits, delisting of our shares from the Nasdaq Global Select Market or other adverse consequences that would materially harm to our business.

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

We may choose to raise additional capital in the future, depending on market conditions, strategic considerations and operational requirements. For example, in October 2019, we filed a shelf registration statement on Form S-3 with the SEC covering the offering of up to $250.0 million of common stock, preferred stock, debt securities, warrants and units, including the sale and issuance of up to $75.0 million in shares of our common stock to be issued from time to time in an "at the market offering" program pursuant to a Sales Agreement that we have entered into with Cowen and Company, LLC. We have issued and may continue to issue shares in our "at the market offering" program or other registered offerings under the shelf registration statement. To the extent that additional capital is raised through the issuance of shares of common stock or other securities convertible into shares of common stock, our stockholders will be diluted. In addition, future issuances of our common stock or other equity securities (or securities convertible into our common stock or other equity securities), or the perception that such sales may occur, could adversely affect the trading price of our common stock and impair our ability to raise capital through future offerings of shares or other securities.

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.

As of December 31, 2019, our executive officers, directors and their respective affiliates held over a majority of our outstanding voting stock. Therefore, these stockholders will have the ability to influence us through this ownership position. These stockholders may be able to determine all matters requiring stockholder approval. For example, these stockholders may be able to control elections of directors, or approval of any merger, sale of assets, or other major corporate transaction. This may prevent or discourage unsolicited acquisition proposals or offers for our common stock that you may feel are in your best interest as one of our stockholders.

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

If our existing stockholders sell, or indicate an intention to sell, substantial amounts of our common stock in the public market, the trading price of our common stock could decline. As of December 31, 2019, we have outstanding a total of 36,363,830 shares of common stock, of which the holders of approximately 5.7 million shares of our common stock are entitled to rights with respect to the registration of their shares under the Securities Act. 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 purchased by affiliates. Any sales of securities by these stockholders could have a material adverse effect on the trading price of our common stock. In addition, as of December 31,

2019, approximately 6.0 million shares of common stock that are either subject to outstanding options or reserved for future issuance under our existing equity incentive plan will become eligible for sale in the public market to the extent permitted by the provisions of various vesting schedules, Rule 144 and Rule 701 under the Securities Act. If these additional shares of common stock are sold, or if it is perceived that they will be sold, in the public market, the trading price of our common stock could decline.

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

We have incurred substantial losses during our history and do not expect to become profitable in the near future, and we may never achieve profitability. To the extent that we continue to generate taxable losses, unused losses will carry forward to offset a portion of future taxable income, if any, until such unused losses expire, if ever. Under Sections 382 and 383 of the Internal Revenue Code of 1986, as amended, or the IRC, if a corporation undergoes an "ownership change," generally defined as a greater than 50 percentage point change (by value) in its equity ownership by certain stockholders over a three-year period, the corporation's ability to use its pre-change net operating loss carryforwards, or NOLs, and other pre-change tax attributes (such as research and development tax credits) to offset its post-change income or taxes may be limited. In connection with our initial public offering which closed in October 2018, we performed an IRC Section 382 and 383 analysis and determined we had an ownership change. There was no reduction in federal or California net operating loss carryforwards or research and development income tax credits as a result of this ownership change. Any equity financing transactions, private placements, and other transactions that may occur within the specified three-year period may trigger additional ownership changes, which could further limit our use of such tax attributes. Any such limitations, whether as a result of prior or future offerings of our common stock or sales of common stock by existing stockholders, could have an adverse effect on our results of operations in our future years. Furthermore, under recently enacted U.S. tax legislation, although the treatment of tax losses generated before December 31, 2017 has generally not changed, tax losses generated in calendar year 2018 and beyond may only offset 80% of our taxable income. This change may require us to pay federal income taxes in future years despite generating a loss for federal income tax purposes in prior years.

Recent U.S. tax legislation and future changes to applicable U.S. tax laws and regulations may have a material adverse effect on our business, financial condition and results of operations.

Changes in laws and policy relating to taxes may have an adverse effect on our business, financial condition and results of operations. For example, the U.S. government recently enacted significant tax reform legislation, and certain provisions of the new law may adversely affect us. Changes include, but are not limited to, a federal corporate income tax rate decrease to 21% for tax years beginning after December 31, 2017, a reduction to the maximum deduction allowed for net operating losses generated in tax years after December 31, 2017, eliminating carrybacks of net operating losses, and providing for indefinite carryforwards for losses generated in tax years after December 31, 2017. The legislation is unclear in many respects and could be subject to potential amendments and technical corrections, and will be subject to interpretations and implementing regulations by the Treasury and Internal Revenue Service, any of which could mitigate or increase certain adverse effects of the legislation. In addition, it is unclear how these U.S. federal income tax changes will affect state and local taxation. Generally, future changes in applicable U.S. tax laws and regulations, or their interpretation and application could have an adverse effect on our business, financial condition and results of operations.

Provisions in our charter documents and under Delaware law could discourage a takeover that stockholders may consider favorable and may lead to entrenchment of management.

Our amended and restated certificate of incorporation and amended and restated bylaws contain provisions that could delay or prevent changes in control or changes in our management without the consent of our board of directors. These provisions include the following:

- a classified board of directors with three-year staggered terms, which may delay the ability of stockholders to change the membership of a majority of our board of directors;
- no cumulative voting in the election of directors, which limits the ability of minority stockholders to elect director candidates;
- the exclusive right of our board of directors to elect a director to fill a vacancy created by the expansion of the board of directors or the resignation, death or removal of a director, which prevents stockholders from being able to fill vacancies on our board of directors;
- the ability of our board of directors to authorize the issuance of shares of preferred stock and to determine the price and other terms of those shares, including preferences and voting rights, without stockholder approval, which could be used to significantly dilute the ownership of a hostile acquiror;
- the ability of our board of directors to alter our amended and restated bylaws without obtaining stockholder approval;

- the required approval of at least 66 2/3% of the shares entitled to vote at an election of directors to adopt, amend or repeal our amended and restated bylaws or repeal the provisions of our amended and restated certificate of incorporation regarding the election and removal of directors;
- a prohibition on stockholder action by written consent, which forces stockholder action to be taken at an annual or special meeting of our stockholders;
- the requirement that a special meeting of stockholders may be called only by our chief executive officer or president or by the board of directors, which may delay the ability of our stockholders to force consideration of a proposal or to take action, including the removal of directors; and
- advance notice procedures that stockholders must comply with in order to nominate candidates to our board of directors or to propose matters to be acted upon at a stockholders' meeting, which may discourage or deter a potential acquiror from conducting a solicitation of proxies to elect the acquiror's own slate of directors or otherwise attempting to obtain control of us.

We are also subject to the anti-takeover provisions contained in Section 203 of the Delaware General Corporation Law. Under Section 203, a corporation may not, in general, engage in a business combination with any holder of 15% or more of its capital stock unless the holder has held the stock for three years or, among other exceptions, the board of directors has approved the transaction.

Claims for indemnification by our directors and officers may reduce our available funds to satisfy successful third-party claims against us and may reduce the amount of money available to us.

Our amended and restated certificate of incorporation and amended and restated bylaws provide that we will indemnify our directors and officers, in each case to the fullest extent permitted by Delaware law.

In addition, as permitted by Section 145 of the Delaware General Corporation Law, our amended and restated bylaws and our indemnification agreements that we have entered into with our directors and officers provide that:

- We will indemnify our directors and officers for serving us in those capacities or for serving other business enterprises at our request, to the fullest extent permitted by Delaware law. Delaware law provides that a corporation may indemnify such person if such person acted in good faith and in a manner such person reasonably believed to be in or not opposed to the best interests of the registrant and, with respect to any criminal proceeding, had no reasonable cause to believe such person's conduct was unlawful.
- We may, in our discretion, indemnify employees and agents in those circumstances where indemnification is permitted by applicable law.
- We are required to advance expenses, as incurred, to our directors and officers in connection with defending a proceeding, except that such directors or officers shall undertake to repay such advances if it is ultimately determined that such person is not entitled to indemnification.
- We will not be obligated pursuant to our amended and restated bylaws to indemnify a person with respect to proceedings initiated by that person against us or our other indemnitees, except with respect to proceedings authorized by our board of directors or brought to enforce a right to indemnification.
- The rights conferred in our amended and restated bylaws are not exclusive, and we are authorized to enter into indemnification agreements with our directors, officers, employees and agents and to obtain insurance to indemnify such persons.
- We may not retroactively amend our amended and restated bylaw provisions to reduce our indemnification obligations to directors, officers, employees and agents.

Our amended and restated certificate of incorporation and our amended and restated bylaws provide for an exclusive forum in the Court of Chancery of the State of Delaware and in the U.S. federal district courts for certain 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 and our amended and restated bylaws provide that, unless we consent in writing to the selection of an alternative forum, the Court of Chancery of the State of Delaware is the exclusive forum for any derivative action or proceeding brought on our behalf, any action asserting a breach of fiduciary duty, any action asserting a claim against us arising pursuant to the Delaware General Corporation Law, our amended and restated certificate of incorporation or our amended and restated bylaws, or any action asserting a claim against us that is governed by the internal affairs doctrine. The exclusive

forum provision will not apply to suits brought to enforce any liability or duty created by the Exchange Act or any other claim for which the federal courts have exclusive jurisdiction. In addition, our amended and restated certificate of incorporation provides that the U.S. federal district courts are the exclusive forum for the resolution of any complaint asserting a cause of action arising under the Securities Act. Our exclusive forum provision will not relieve us of our duties to comply with the federal securities laws and the rules and regulations thereunder, and our stockholders will not be deemed to have waived our compliance with these laws, rules and regulations.

The enforceability of similar federal court choice of forum provisions in other companies' certificates of incorporation has been challenged in legal proceedings, and it is possible that a court could find this type of provision to be inapplicable or unenforceable. If a court were to find either of the choice of forum provisions contained in our amended and restated certificate of incorporation or amended and restated bylaws to be inapplicable or unenforceable in an action, we may incur additional costs associated with resolving such action in other jurisdictions, which could adversely affect our business and financial condition.

The choice of forum provision may limit a stockholder's ability to bring a claim in a judicial forum that it finds favorable for disputes with us or our directors, officers or other employees, which may discourage such lawsuits against us and our directors, officers and other employees and result in increased costs for investors to bring a claim.

We do not currently intend to pay dividends on our common stock, and, consequently, your ability to achieve a return on your investment will depend on appreciation in the price of our common stock.

We do not currently intend to pay any cash dividends on our common stock for the foreseeable future. We currently intend to invest our future earnings, if any, to fund our growth. Therefore, you are not likely to receive any dividends on your common stock for the foreseeable future. Since we do not intend to pay dividends, your ability to receive a return on your investment will depend on any future appreciation in the market value of our common stock. There is no guarantee that our common stock will appreciate or even maintain the price at which our holders have purchased it.

Item 1B. Unresolved Staff Comments.

None.

Item 2. Properties.

Our corporate headquarters are currently located at 5959 Horton Street, Emeryville, California, comprising approximately 34,569 square feet of office and laboratory space. We terminated our 5858 Horton Street lease in Emeryville, California, where we leased and occupied approximately 13,100 square feet of office and laboratory space concurrently with the commencement of the new 5959 Horton Street lease in late 2019. The initial lease term for the 5959 Horton lease expires on November 30, 2029 and we have an option to extend the lease term for two consecutive additional terms of 5 years. We also lease an aggregate of 28,600 square feet of space in two Cambridge, Massachusetts facilities, including (i) the lease of approximately 13,900 square feet of office and laboratory space, the current term of which expires in April 2022, with an option to extend the term through April 2025, and (ii) the lease of approximately 14,700 square feet of office and laboratory space, the current term of which expires in August 2021. The lease of the facility under (ii) above includes an early termination provision whereby upon 6 month's written notice to the Landlord, we have the right to terminate the lease with no penalty.

We lease a manufacturing facility in Pleasanton, California, where we occupy approximately 42,600 square feet of space. The current term of our lease expires in November 2024, with an option to extend the term through November 2029. We also lease an additional space in Pleasanton, California where we occupy approximately 3,223 square feet of general office space. The current term of the lease expires in November 2024.

We believe our existing facilities are sufficient for our needs for the immediate future. To meet the future needs of our business, we may lease additional or alternate space, and we believe suitable additional or alternative space will be available in the future on commercially reasonable terms.

Item 3. Legal Proceedings.

From time to time, we may become involved in litigation or other legal proceedings. We are not currently a party to any litigation or legal proceedings that, in the opinion of our management, are likely to have a material adverse effect on our business. Regardless of outcome, litigation can have an adverse impact on us because of defense and settlement costs, diversion of management resources and other factors.

Item 4. Mine Safety Disclosures.

Not applicable.

PART II

Item 5. Market for Registrant's Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities.

Our common stock has been listed on the Nasdaq Global Select Market under the symbol "GRTS" since September 28, 2018. Prior to that date, there was no public trading market for our common stock. The following table sets forth for the periods indicated the high and low intraperiod sales price per share of our common stock as reported on the Nasdaq Global Select Market for the periods indicated:

Year ended December 31, 2019:	**High**	**Low**
First quarter	$ 18.96	$ 9.97
Second quarter	15.70	9.20
Third quarter	12.28	8.45
Fourth quarter	11.61	7.07
Year ended December 31, 2018:		
Fourth quarter (from September 28, 2018)	$ 31.10	$ 11.61

Holders of Common Stock

As of March 6, 2020, there were 39 holders of record of our common stock. Because many of our shares of common stock are held by brokers and other institutions on behalf of stockholders, we are unable to estimate the total number of beneficial owners of our common stock represented by these record holders.

Dividend Policy

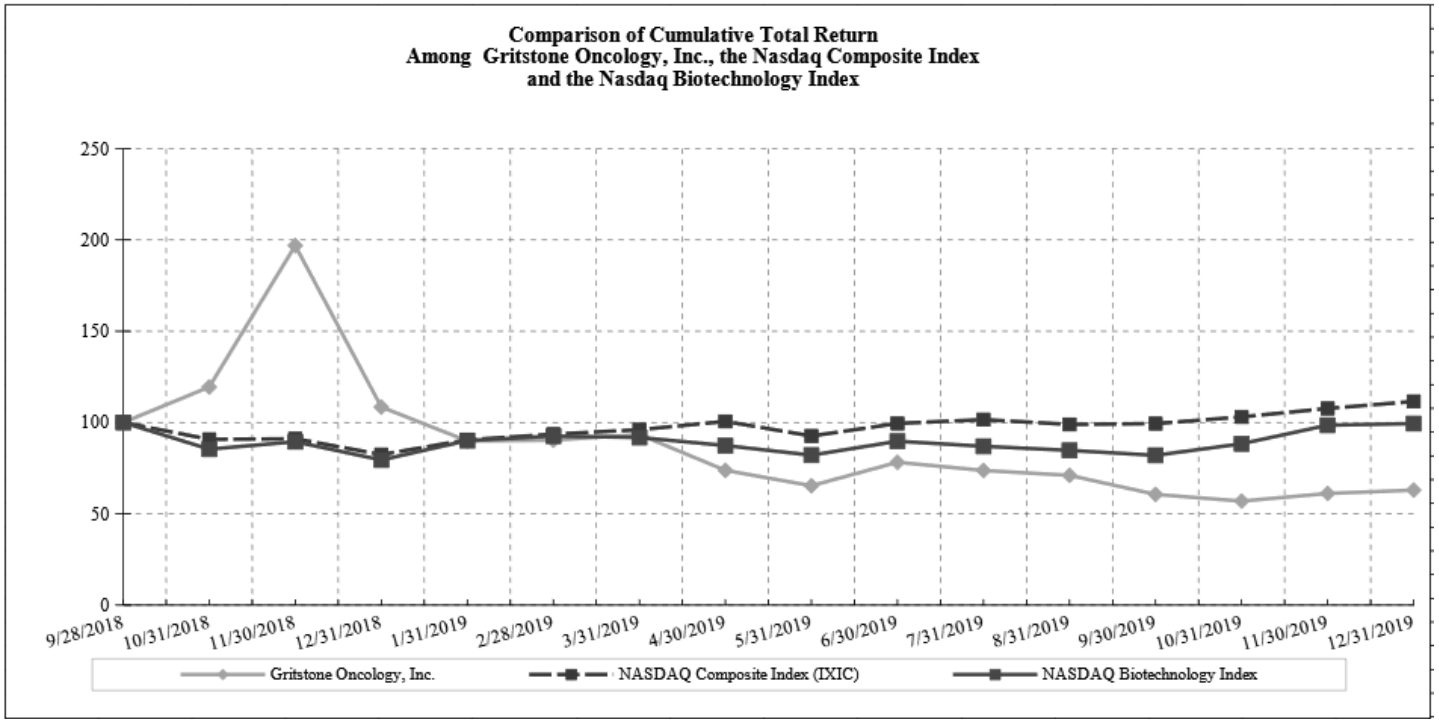
We have never declared or paid any cash dividends on our common stock or any other securities. We anticipate that we will retain all available funds and any future earnings, if any, for use in the operation of our business and do not anticipate paying cash dividends in the foreseeable future. In addition, future debt instruments may materially restrict our ability to pay dividends on our common stock. Payment of future cash dividends, if any, will be at the discretion of the board of directors after taking into account various factors, including our financial condition, operating results, current and anticipated cash needs, the requirements of current or then-existing debt instruments and other factors the board of directors deems relevant.

Performance Graph

This graph is not "soliciting material" or deemed "filed" with the SEC for purposes of Section 18 of the Exchange Act, or otherwise subject to liabilities under that Section, and shall not be deemed incorporated by reference into any filing of Gritstone Oncology, Inc. under the Securities Act of 1933, as amended (the "Securities Act"), whether made before or after the date hereof and irrespective of any general incorporation language in any such filing.

The following graph compares the cumulative total return to stockholder return on our common stock relative to the cumulative total returns of the Nasdaq Composite Index and the Nasdaq Biotechnology Index. An investment of $100 is assumed to have been made in our common stock and each index on September 28, 2018 (the first day of trading of our common stock) and its relative performance is tracked through December 31, 2019. Pursuant to applicable Securities and Exchange Commission rules, all values assume reinvestment of the full amount of all dividends, however no dividends have been declared on our common stock to

date. The stockholder returns shown on the graph below are based on historical results and are not necessarily indicative of future performance, and we do not make or endorse any predictions as to future stockholder returns.



	9/28/2018	12/31/2018	3/31/2019	6/30/2019	9/30/2019	12/31/2019
Gritstone Oncology, Inc.	$ 100.00	$ 108.50	$ 93.40	$ 78.23	$ 60.64	$ 62.99
Nasdaq Composite Index	100.00	82.46	96.06	99.50	99.42	111.51
Nasdaq Biotechnology Index	100.00	79.46	91.82	89.75	82.01	99.42

Recent Sales of Unregistered Securities

There were no unregistered sales of equity securities by us during the period covered by this Annual Report on Form 10-K, other than those previously reported in a Quarterly Report on Form 10-Q or in a current Report on Form 8-K.

Use of Proceeds from Registered Securities

On September 27, 2018, the U.S. Securities and Exchange Commission declared effective our registration statement on Form S-1 (File Nos. 333-226976), as amended, filed in connection with our IPO. The IPO closed on October 2, 2018 and we issued and sold 6,666,667 shares of our common stock at a price to the public of $15.00 per share. On October 31, 2018, the underwriters exercised their option to purchase additional shares with respect to 187,535 shares of our common stock, at a price to the public of $15.00 per share. We received gross proceeds from the IPO, including from the exercise of the underwriters' option to purchase additional shares, of approximately $102.8 million, before deducting underwriting discounts and commissions of approximately $7.2 million. The managing underwriters of the offering were Goldman Sachs & Co. LLC, Cowen and Company, LLC, Barclays Capital Inc. and BTIG, LLC. No offering expenses were paid or are payable, directly or indirectly, to our directors or officers, to persons owning 10% or more of any class of our equity securities or to any of our affiliates.

The net proceeds from the IPO have been invested in short-term, interest-bearing, investment-grade securities and government securities. There has been no material change in the expected use of the net proceeds from our IPO as described in our registration statement on Form S-1.

Issuer Purchases of Equity Securities

Not applicable.

Item 6. Selected Financial Data.

The following tables present our selected financial data. We have derived the following selected statements of operations and comprehensive loss data for the years ended December 31, 2019, 2018, and 2017, and the balance sheet data as of December 31, 2019, 2018, and 2017, from our audited financial statements and related notes included elsewhere in this Annual Report on Form 10-K. Our historical results are not necessarily indicative of the results that may be expected in the future. You should read the financial data below in conjunction with the section titled "Management's Discussion and Analysis of Financial Condition and Results of Operations" and our financial statements and related notes included elsewhere in this Annual Report on Form 10-K.

	Year Ended December 31,		
	2019	2018	2017
	(in thousands, except share and per share amounts)		
Statements of Operations and Comprehensive Loss Data:			
Collaboration revenue	$ 4,365	$ 1,187	$ —
Operating expenses:			
Research and development	82,896	54,965	35,691
General and administrative	19,409	11,806	6,072
Total operating expenses	102,305	66,771	41,763
Loss from operations	(97,940)	(65,584)	(41,763)
Interest income, net	3,507	809	386
Net loss	(94,433)	(64,775)	(41,377)
Unrealized gain (loss) on marketable securities	109	(11)	(71)
Net and comprehensive loss	$ (94,324)	$ (64,786)	$ (41,448)
Net loss per share, basic and diluted [(1)]	$ (2.81)	$ (7.26)	$ (20.70)
Weighted-average number of shares outstanding, basic and diluted [(1)]	33,554,823	8,919,281	1,999,044

(1) See Notes 2 and 12 to our financial statements for further details on the calculations of our basic and diluted net loss per share and the weighted-average number of shares used in the computation of the per share amounts.

	December 31,	
	2019	2018
	(in thousands)	
Balance Sheets Data:		
Cash, cash equivalents and marketable securities	$ 127,776	$ 153,110
Working capital [(1)]	111,773	142,528
Total assets	184,389	189,558
Total liabilities	50,045	40,436
Accumulated deficit	(220,988)	(126,402)
Total stockholders' equity	134,344	149,122

(1) We define working capital as current assets less current liabilities. See our financial statements and related notes for details regarding our current assets and current liabilities.

Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations.

You should read the following discussion and analysis of our financial condition and results of operations together with the section titled "Selected Financial Data" and our audited financial statements and the related notes to those included elsewhere in this Annual Report on Form 10-K. This discussion and analysis and other parts of this report contain forward-looking statements that involve risks and uncertainties, such as our plans, objectives, expectations, intentions and beliefs. Our actual results could differ materially from those discussed in these forward-looking statements. Factors that could cause or contribute to such differences

include, but are not limited to, those identified below and those discussed in the section titled "Risk Factors" included elsewhere in this Annual Report on Form 10-K.

Overview

We are an immuno-oncology company developing tumor-specific cancer immunotherapies to fight multiple cancer types. Our approach harnesses the natural power of a patient's own immune system to recognize short tumor-specific peptide sequences presented on cancer cells, referred to as tumor-specific neoantigens, or TSNA, in order to destroy tumor cells. Our tumor-specific immunotherapy programs are built on two key pillars—first, our proprietary Gritstone EDGE artificial intelligence platform which enables us to identify TSNA with high accuracy; and second, a potent immunotherapy platform which we have engineered to deliver the selected TSNA and drive the patient's immune system to attack and destroy tumors.

We initiated a first-in-human Phase 1/2 clinical trial of GRANITE, our first personalized immunotherapy product candidate, in the fourth quarter of 2018, evaluating it in the treatment of multiple common solid tumors, , in each case in combination with checkpoint inhibitors provided by our collaborator, Bristol-Myers Squibb Company, or BMS. We dosed our first patient in this trial, GO-004, in the first quarter of 2019. The Phase 1 portion of the GO-004 Phase 1/2 trial will seek to establish a dose for further investigation in Phase 2 and to evaluate safety, tolerability and, importantly, immunogenicity of our product candidate. We will seek to further evaluate efficacy and safety in the Phase 2 cohort expansion portion in several common solid tumor types.

Our second tumor-specific product candidate series, SLATE, utilizes the same antigen delivery system as GRANITE but contains a fixed cassette with TSNA that are shared across a subset of cancer patients rather than a cassette unique to an individual patient, providing us with an off-the-shelf alternative to our personalized manufactured product candidate, GRANITE. The U.S. Food and Drug Administration, or FDA, allowed the Investigational New Drug application, or IND, for SLATE to proceed in June 2019 and we have initiated a Phase 1/2 clinical trial of SLATE, GO-005, in combination with immune checkpoint inhibitors for the treatment of patients with advanced solid tumors, including metastatic non-small cell lung cancer, pancreatic cancer and colorectal cancer. We dosed our first patient in this trial, GO-005, in the third quarter of 2019.

We are developing a second immunotherapy platform targeting shared tumor antigens, including shared TSNA, which relies upon bispecific antibodies, or BiSAb, targeting solid tumors. BiSAb have been shown by others to exhibit early evidence of efficacy in B cell malignancies, using B cell-specific targets such as CD19, CD20, CD22 and BCMA, and our goal is to extend this concept into the treatment of solid tumors using our novel approach to identify tumor-specific antigens and antibody fragments against such targets. Our BiSAb approach uses an antibody fragment to recognize a tumor antigen and, in the same molecule, a different antibody fragment to recognize immune effector cells such as CD3+ T cells. These therapeutics aim to refocus immune effector cells specifically upon the tumor through antibody-driven recognition of tumor-specific antigens. We use our EDGE platform to identify novel solid tumor-specific antigens and develop antibody fragments that bind tightly and with high specificity to these targets. These antibody fragments are deployed within a bispecific antibody framework to form novel "drug-in-a-bottle" therapeutic candidates. We expect this program to generate a development candidate in the second half of 2020.

We have funded our operations to date primarily from private placements of our convertible preferred stock, the net proceeds from our initial public offering, or IPO, which we completed in October 2018, from our follow-on public offering, which we completed in April 2019, and from our at the marketing offering, as well as cash proceeds from bluebird under the collaboration agreement we entered into in August 2018, or the bluebird Bio, Inc., or bluebird, Collaboration Agreement. We do not expect to generate revenue from any product candidates that we develop until we obtain regulatory approval for one or more of such product candidates and commercialize our products or enter into collaboration agreements with third parties. Substantially all of our net losses have resulted from costs incurred in connection with our research and development programs and from general and administrative costs associated with our operations. Our SLATE, GRANITE and BiSAb programs will require substantial additional development time and resources before we would be able to apply for or receive regulatory approvals and begin generating revenue from product sales. In addition, we expect to incur additional costs associated with operating as a public company. We also do not yet have a sales organization or commercial infrastructure and, accordingly, we will incur significant expenses to develop a sales organization or commercial infrastructure in advance of generating any commercial product sales. As a result, we will need substantial additional capital to support our operating activities.

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

Manufacturing is a vital component of personalized immunotherapy, and we have invested significantly in our manufacturing facility, which opened in November 2017. We currently use a hybrid approach to manufacturing our personalized immunotherapy wherein certain elements of our product candidates are manufactured on an outsourced basis at qualified third-party contract manufacturing organizations, or CMOs, and other elements of our product candidates are manufactured internally. Our goal is to internalize the majority of the manufacturing steps to drive down both cost and production time, as well as establish full control over intellectual property and product quality, which will require significant investments in our manufacturing facility and processes.

Since we commenced operations in August 2015, we have invested a significant portion of our efforts and financial resources in research and development activities and establishing our manufacturing facility. We have incurred net losses each year since inception. Our net losses were $94.4 million, $64.8 million and $41.4 million for the years ended December 31, 2019, 2018 and 2017, respectively. As of December 31, 2019, we had an accumulated deficit of $221.0 million, and we do not expect positive cash flows from operations in the foreseeable future. We do not have any products approved for sale. We expect to continue to incur net operating losses for at least the next several years as we advance our personalized cancer immunotherapy through clinical development, seek regulatory approval, prepare for and, if approved, proceed to commercialization, continue our research and development efforts and invest in our manufacturing facility.

In October 2018, we completed our IPO and sold and issued an aggregate of 6,854,202 shares of our common stock, including 187,535 shares sold pursuant to the underwriters' partial exercise of their option to purchase additional shares, at a price to the public of $15.00 per share. We received aggregate net proceeds from the offering of $92.5 million, after deducting underwriting discounts and commissions and offering costs.

In April 2019, we completed an underwritten public offering and sold and issued an aggregate of 6,500,000 shares of common stock at a price to the public of $11.50 per share. We received aggregate net proceeds from the offering of approximately $69.7 million, after deducting underwriting discounts and commissions and offering costs.

In October 2019, we filed a shelf registration statement on Form S-3, or the "Shelf Registration Statement", with the SEC covering the offering of up to $250.0 million of common stock, preferred stock, debt securities, warrants and units, including the sale and issuance of up to $75.0 million in shares of our common stock to be issued from time to time in an "at the market offering" program pursuant to a Sales Agreement, or the "Sales Agreement", that we have entered into with Cowen and Company, LLC, or "Cowen". The Shelf Registration Statement was declared effective by the SEC on November 8, 2019. Through December 31, 2019, we have received aggregate proceeds from our at the market offering of $3.8 million, net of commissions and offering costs, and have $70.8 million remaining to raise.

Components of Our Operating Results

Collaboration Revenue

To date, we have not generated any revenue from product sales and do not expect to generate any revenue from product sales for the foreseeable future. For the years ended December 31, 2019 and 2018, we recognized $4.3 million and $1.2 million, respectively, of revenue from the bluebird Collaboration Agreement. No revenue was recognized for the year ended December 31, 2017.

In the future, we will continue to recognize revenue from the bluebird Collaboration Agreement and may generate revenue from product sales or other collaboration agreements, strategic alliances and licensing arrangements. We expect that our revenue will fluctuate from quarter-to-quarter and year-to-year as a result of the timing and amount of license fees, milestones, reimbursement of costs incurred and other payments and product sales, to the extent that any are successfully commercialized. If we fail to complete the development of our product candidates in a timely manner or obtain regulatory approval for them, our ability to generate future revenue, and our results of operations and financial position, would be materially adversely affected.

Operating Expenses

Research and Development Expenses

Since our inception, we have focused significant resources on our research and development activities, including conducting preclinical studies, manufacturing development efforts and related development activities for our product candidates.

Research and development activities account for a significant portion of our operating expenses. Research and development costs are expensed as incurred. These costs include:

- External research and development expenses, including:
    - Expenses incurred under arrangement with third parties, including clinical research organizations, or CROs, preclinical testing organizations, CMOs, academic and non-profit institutions and consultants;
    - Fees related to our license agreements;
- Internal research and development expenses, including:
    - Headcount related expenses, including salaries, payroll taxes, benefits, non-cash stock-based compensation and travel, for employees contributing to research and development activities, including the costs associated with the development of our EDGE platform; and
- Other expenses, which include direct and allocated expenses for laboratories, facilities and other costs.

In October 2017, we entered into a license agreement with Arbutus Biopharma Corporation, or Arbutus. Certain terms of the agreement were modified by amendment in July 2018. Under the agreement, Arbutus grants us a worldwide, exclusive license to certain technology of Arbutus, including Arbutus' portfolio of proprietary and clinically validated LNP products and associated intellectual property, as well as technology transfer of Arbutus' manufacturing know-how. Under this agreement, we made an upfront payment of $5.0 million, which was included in research and development expenses during the year ended December 31, 2017. Following the acceptance of our investigational new drug application for GRANITE by the U.S. Food and Drug Administration, we made a $2.5 million development milestone payment to Arbutus in September 2018 that was recorded as research and development expense. During the years ended December 31, 2019 and 2018, we reimbursed Arbutus for materials and personnel costs totaling $0.4 million and $0.4 million, respectively. In August 2019, a milestone was met following the initial patient treatment of SLATE in our GO-005 clinical trial. We recorded $3.0 million as research and development expense in connection with the milestone. The milestone payment was made in October 2019. See "Business—License and Collaborations—License Agreement with Arbutus Biopharma Corporation" for additional information.

We expect our research and development expenses to increase substantially in the future as we advance our cancer immunotherapy candidates into and through clinical studies and pursue regulatory approval. Conducting the necessary clinical studies to obtain regulatory approval is costly and time-consuming and such clinical studies generally become larger and more costly to conduct as they advance into later stages. The successful development of our product candidates is highly uncertain. The actual probability of success for our product candidates may be affected by a variety of risks and uncertainties associated with drug development, including those set forth in the section entitled "Risk Factors" included in Part I, Section 1A and elsewhere in this report.

Due to the early-stage nature of our cancer immunotherapy programs, we do not track costs on a project-by-project basis.

General and Administrative Expenses

Our general and administrative expenses consist primarily of salaries and related costs, including payroll taxes, benefits, non-cash stock-based compensation and travel. Other general and administrative expenses include legal costs of pursuing patent protection of our intellectual property, and professional service fees for auditing, tax and general legal services. We expect our general and administrative expenses to continue to increase in the future as we expand our operating activities and prepare for potential commercialization of our current and future product candidates, increase our headcount and support our operations as a public company, including increased expenses related to legal, accounting, regulatory and tax-related services associated with maintaining compliance with requirements of the Nasdaq Global Select Market and the SEC, directors and officers liability insurance premiums

and investor relations activities. Allocated expenses consist of rent expenses related to our office and research and development facilities, depreciation and other allocated costs not otherwise included in research and development expenses.

Interest Income, Net

Interest income, net, consists primarily of interest income and investment income earned on our cash, cash equivalents and marketable securities, and for 2018, interest expense on our lease financing obligation, which was derecognized on January 1, 2019 in connection with our adoption of Accounting Standards Update No. 2016-02, Leases ("Topic 842").

Results of Operations

Comparison of the Years Ended December 31, 2019 and 2018

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

	Year Ended December 31,		
	2019	2018	Change
Collaboration revenue	$ 4,365	$ 1,187	$ 3,178
Operating expenses:			
Research and development	82,896	54,965	27,931
General and administrative	19,409	11,806	7,603
Total operating expenses	102,305	66,771	35,534
Loss from operations	(97,940)	(65,584)	(32,356)
Interest income, net	3,507	809	2,698
Net loss	$ (94,433)	$ (64,775)	$ (29,658)

Collaboration Revenue

Collaboration revenue was $4.4 million and $1.2 million for the years ended December 31, 2019 and 2018, respectively. The $3.2 million increase was due to an entire year of revenue recognized in 2019 pursuant to the bluebird Collaboration Agreement which we entered into in August 2018.

Research and Development Expenses

Research and development expenses were $82.9 million for the year ended December 31, 2019 compared to $55.0 million for the year ended December 31, 2018.

The increase of $27.9 million for the year ended December 31, 2019 was primarily due to increases in personnel related expenses, expenses related to outside services and consultants, in-house laboratory supplies and consumables and facilities expenses. Personnel related costs increased by $7.9 million, as a direct result of our increased research and development headcount. Outside services and consultants increased by $7.5 million for clinical trials, preclinical testing and contract manufacturing expansion. In-house expenses for laboratory supplies and consumables increased by $6.0 million, and reflect our increased research and development personnel. Facility related expenses increased by $6.0 million to accommodate our manufacturing expansion and increased research and development personnel. Milestone and license payments increased by $0.5 million reflecting a $2.5 million payment made in 2018 and a $3.0 million payment made in 2019 under a certain agreement upon the achievement of certain milestones.

General and Administrative Expenses

General and administrative expenses were $19.4 million for the year ended December 31, 2019 compared to $11.8 million for the year ended December 31, 2018. The increase of $7.6 million was primarily attributable to a $2.6 million increase in personnel related costs as we expanded our headcount, and a $4.2 million increase in outside services for legal, finance, recruiting and other professional services to support our ongoing operations and operate as a public company. Facility related expenses increased by $0.8 million to accommodate our increased general and administrative personnel.

Interest Income, Net

Interest income, net was $3.5 million for the year ended December 31, 2019 compared to $0.8 million for the year ended December 31, 2018. The income for both years represents interest and investment income from cash, cash equivalents and marketable securities. The increase of $2.7 million was due to a higher average cash, cash equivalents and marketable securities balance in 2019 than in 2018 and decreased interest expense incurred on our lease financing obligation due to our adoption of Topic 842, and the change in accounting treatment related to the Pleasanton lease, which was derecognized on January 1, 2019 in connection with our adoption of Topic 842.

Comparison of the Years Ended December 31, 2018 and 2017

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

	Year Ended December 31,		
	2018	2017	Change
Collaboration revenue	$ 1,187	$ —	$ 1,187
Operating expenses:			
Research and development	54,965	35,691	19,274
General and administrative	11,806	6,072	5,734
Total operating expenses	66,771	41,763	25,008
Loss from operations	(65,584)	(41,763)	(23,821)
Interest income, net	809	386	423
Net loss	$ (64,775)	$ (41,377)	$ (23,398)

Collaboration Revenue

Collaboration revenue was $1.2 million for the year ended December 31, 2018. No collaboration revenue was recognized for the year ended December 31, 2017. The increase was due to recognition of revenue during the period pursuant to the bluebird Collaboration Agreement which we entered into in August 2018.

Research and Development Expenses

Research and development expenses were $55.0 million for the year ended December 31, 2018 compared to $35.7 million for the year ended December 31, 2017.

The increase of $19.3 million for the year ended December 31, 2018 was primarily due to increases in personnel related expenses, expenses related to outside services and consultants, in-house laboratory supplies and consumables and facilities expenses. Personnel related costs increased by $7.7 million, as a direct result of our increased research and development headcount. Outside services and consultants increased by $5.4 million for clinical trials, preclinical testing and contract manufacturing expansion. In-house expenses for laboratory supplies and consumables increased by $3.3 million, and reflect our increased research and development headcount. Facility related expenses increased by $4.9 million to accommodate our manufacturing expansion and increased research and development headcount. These increases in research and development expenses were partially offset by a $2.0 million decrease in milestone and license payments reflecting lower payments made under certain agreements upon the achievement of certain milestones.

General and Administrative Expenses

General and administrative expenses were $11.8 million for the year ended December 31, 2018 compared to $6.1 million for the year ended December 31, 2017. The increase of $5.7 million was primarily attributable to a $2.7 million increase in personnel related costs as we expanded our headcount, and a $2.3 million increase in outside services for legal, finance, recruiting and other professional services to support our ongoing operations. Facility related expenses increased by $0.7 million to accommodate our increased general and administrative headcount.

Interest Income, Net

Interest income was $0.8 million for the year ended December 31, 2018 compared to interest income of $0.4 million for the year ended December 31, 2017. The increase of $0.4 million was due to a higher average cash, cash equivalents and marketable securities balance in 2018 than in 2017, partially offset by increased interest expense incurred on our lease financing obligation.

Liquidity and Capital Resources

Sources of Liquidity

From our inception through December 31, 2019, we have funded our operations primarily through private placements of our convertible preferred stock, our Collaboration Agreement with bluebird, and the proceeds from the sale of our common stock in our IPO, follow on public offering, and at the market offering. We have raised net cash proceeds of $177.9 million from the issuance of our convertible preferred stock and a non-refundable upfront payment of $20.0 million from bluebird.

In October 2018, we completed our initial public offering by issuing 6,854,202 shares of our common stock, including 187,535 shares sold pursuant to the underwriters' partial exercise of their option to purchase additional shares, at an offering price of $15.00 per share, for net proceeds of approximately $92.5 million, after deducting underwriting discounts and commissions and offering costs.

In April 2019, we completed an underwritten public offering and sold and issued an aggregate of 6,500,000 shares of common stock at a price to the public of $11.50 per share. We received aggregate net proceeds from the offering of approximately $69.7 million, after deducting underwriting discounts and commissions and offering costs.

In October 2019, we filed the Shelf Registration Statement, covering the offering of up to $250.0 million of common stock, preferred stock, debt securities, warrants and units, including the sale and issuance of up to $75.0 million in shares of our common stock to be issued from time to time in an "at the market offering" program pursuant to the Sales Agreement with Cowen. The Shelf Registration Statement was declared effective by the SEC on November 8, 2019. Through December 31, 2019, we have received aggregate proceeds from our at the market offering of $3.8 million, net of commissions and offering costs, and have $70.8 million remaining to raise.

As of December 31, 2019, we had cash, cash equivalents, and marketable securities of $127.8 million and an accumulated deficit of $221.0 million, compared to cash, cash equivalents, and marketable securities of $153.1 million and an accumulated deficit of $126.4 million as of December 31, 2018.

Additionally, we do not expect positive cash flows from operations in the foreseeable future. Historically, we have incurred operating losses as a result of ongoing efforts to develop our cancer immunotherapy candidates, including conducting ongoing research and development, clinical and preclinical studies and providing general and administrative support for these operations. We expect to continue to incur net operating losses for at least the next several years as we advance SLATE, GRANITE, the BiSAb program and any future product candidates through clinical development, seek regulatory approval, prepare for and, if approved, proceed to commercialization, continue our research and development efforts and invest in our manufacturing facility.

Future Funding Requirements

We do not have any products approved for sale, and we do not expect to generate any meaningful revenue unless and until we obtain regulatory approval of and commercialize any of our current and future product candidates and/or enter into additional significant collaboration agreements with third parties, and we do not know when, or if, either will occur. We expect to continue to incur significant losses for the foreseeable future, and we expect the losses to increase as we continue the development of, and seek regulatory approvals for, our current and future product candidates, and begin to commercialize any approved products. We are subject to all the risks typically related to the development of new product candidates, and we may encounter unforeseen expenses, difficulties, complications, delays and other unknown factors that may adversely affect our business. Moreover, we expect to incur additional costs associated with operating as a public company. We anticipate that we will need substantial additional funding in connection with our continuing operations.

Until we can generate a sufficient amount of revenue from the commercialization of our tumor-specific immunotherapy product candidates or from additional significant collaboration or license agreements with third parties, if ever, we expect to finance our future cash needs through public or private equity offerings or debt financings. Additional capital may not be available on reasonable terms, if at all. If we are unable to raise additional capital in sufficient amounts or on terms acceptable to us, we may have to significantly delay, scale back or discontinue the development or commercialization of one or more of our current or future product candidates. If we raise additional funds by issuing equity or convertible debt securities, it could result in dilution to our existing stockholders and increased fixed payment obligations. In addition, as a condition to providing additional funds to us, future investors

may demand, and may be granted, rights superior to those of existing stockholders. If we incur indebtedness, we could become subject to covenants that would restrict our operations and potentially impair our competitiveness, such as limitations on our ability to incur additional debt, limitations on our ability to acquire, sell or license intellectual property rights and other operating restrictions that could adversely impact our ability to conduct our business. Additionally, any future collaborations we enter into with third parties may provide capital in the near term but we may have to relinquish valuable rights to our product candidates or grant licenses on terms that are not favorable to us. Any of the foregoing could significantly harm our business, financial condition and prospects.

Since our inception, we have incurred significant losses and negative cash flows from operations. We have an accumulated deficit of $221.0 million through December 31, 2019. We expect to incur substantial additional losses in the future as we conduct and expand our research and development activities. We believe that our existing cash, cash equivalents and marketable securities will be sufficient to enable us to fund our projected operations through at least the next 12 months from the date of this Annual Report on Form 10-K. We have based our projections of operating capital requirements on assumptions that may prove to be incorrect and we may use all our available capital resources sooner than we expect. Because of the numerous risks and uncertainties associated with research, development and commercialization of product candidates, we are unable to estimate the exact amount of our operating capital requirements. Our future capital requirements depend on many factors, including:

- the scope, progress, results and costs of developing our tumor-specific immunotherapy product candidates, and conducting preclinical studies and clinical trials, including our Phase 1/2 clinical trial of GRANITE, which we initiated in the fourth quarter of 2018;
- the scope, progress, results and costs of conducting studies and clinical trials for our SLATE product candidate series, including the Phase 1/2 clinical trial for SLATE, which we initiated in the third quarter of 2019;
- the scope, progress, results and costs of conducting drug discovery, preclinical studies and clinical trials for our BiSAb program, for which we expect to select a product candidate in the second half of 2020;
- the timing of, and the costs involved in, obtaining regulatory approvals for our tumor-specific immunotherapy product candidates;
- the number and characteristics of any additional product candidates we develop or acquire;
- the timing and amount of any milestone, royalty or other payments we are required to make pursuant to any current or future collaboration or license agreements;
- the cost of manufacturing our tumor-specific immunotherapy product candidates we successfully commercialize, including the cost of scaling up our internal manufacturing operations;
- the cost of building a sales force in anticipation of product commercialization;
- the cost of commercialization activities, including building a commercial infrastructure, marketing, sales and distribution costs;
- our ability to maintain existing, and establish new, strategic collaborations, licensing or other arrangements and the financial terms of any such agreements, including the timing and amount of any future milestone, royalty or other payments due under any such agreement;
- any product liability or other lawsuits related to our products;
- the expenses needed to attract, hire and retain skilled personnel;
- the costs associated with being a public company;
- the costs involved in preparing, filing, prosecuting, maintaining, defending and enforcing our intellectual property portfolio; and
- the timing, receipt and amount of sales of any future approved products, if any.

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

Cash Flows

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

	Year Ended December 31,		
	2019	2018	2017
Cash used in operating activities	$ (85,011)	$ (38,162)	$ (34,971)
Cash provided by (used in) investing activities	15,841	(59,103)	(33,252)
Cash provided by financing activities	74,395	110,441	95,812
Net increase in cash and cash equivalents	$ 5,225	$ 13,176	$ 27,589

Cash Used in Operating Activities

During the year ended December 31, 2019, cash used in operating activities was $85.0 million, which consisted of a net loss of $94.4 million, adjusted by non-cash charges of $15.1 million and cash used due to changes in our operating assets and liabilities of $5.7 million. The non-cash charges consisted primarily of depreciation and amortization expense of $3.4 million, stock-based compensation of $5.3 million, and non-cash operating lease expense of $6.4 million. The change in our operating assets and liabilities was primarily due to a decrease of $4.3 million as a result of the deferred revenue recorded in connection with our Collaboration Agreement with bluebird, a decrease of $3.3 million due to pre-payments made per our lease agreements, and a decrease of $0.3 million in deposits and other long-term assets, offset by increases of $1.5 million in accrued research and development expenses and $0.7 million in accrued compensation.

During the year ended December 31, 2018, cash used in operating activities was $38.2 million, which consisted of a net loss of $64.8 million, adjusted by non-cash charges of $6.4 million and cash used due to changes in our operating assets and liabilities of $20.2 million. The non-cash charges consisted primarily of depreciation and amortization expense of $3.4 million and stock-based compensation of $3.0 million. The change in our operating assets and liabilities was primarily due to an increase of $18.8 million as a result of the deferred revenue recorded in connection with our Collaboration Agreement with bluebird, an increase of $3.3 million in accounts payable, and $1.7 million in accrued compensation, offset by a decrease of $1.8 million in prepaid expenses and other assets, and an increase of $1.0 million in accrued and other liabilities and deferred rent, and $0.8 million in deposits and other long-term assets.

During the year ended December 31, 2017, cash used in operating activities was $35.0 million, which consisted of a net loss of $41.4 million, adjusted by non-cash charges of $2.9 million and cash provided by changes in our operating assets and liabilities of $3.5 million. The non-cash charges consisted primarily of depreciation and amortization expense of $1.8 million and stock-based compensation of $1.1 million. The change in our operating assets and liabilities was primarily due to an increase of $4.3 million in accounts payable and accrued liabilities. Our accrued liabilities increased due to employee bonuses and general business expenses, reflective of our increased headcount and expenses. This was partially offset by an increase of $0.4 million in prepaid expenses and other current assets for prepaid research and development being conducted by third-party service providers.

Cash Provided by (Used in) Investing Activities

During the year ended December 31, 2019, cash provided by investing activities was $15.8 million, which consisted of $113.0 million in proceeds from the maturity of marketable securities, offset by $81.0 million of purchases of marketable securities and $16.2 million of capital expenditures to purchase property and equipment.

During the year ended December 31, 2018, cash used in investing activities was $59.1 million, which consisted of $102.1 million of purchases of marketable securities, $5.7 million of capital expenditures to purchase property and equipment, offset by $48.7 million in proceeds from the maturity of marketable securities.

During the year ended December 31, 2017, cash used in investing activities was $33.3 million, which consisted of $63.2 million of purchases of marketable securities, $11.5 million of capital expenditures to purchase property and equipment, offset by $41.5 million in proceeds from the maturity of marketable securities.

Cash Provided by Financing Activities

During the year ended December 31, 2019, cash provided by financing activities was $74.4 million, which primarily consisted of $70.3 million in proceeds from the issuance of common stock in a public offering, $4.0 million in proceeds from the issuance of common stock related to our at the market offering, $0.4 million in proceeds from the issuance of common stock from the purchase of

shares under our employee stock purchase plan, and $0.5 million of proceeds from the exercise of stock options, offset by $0.8 million of payments of deferred financing costs.

During the year ended December 31, 2018, cash provided by financing activities was $110.4 million, which primarily consisted of $20.9 million in net proceeds from the issuances of shares of our Series C convertible preferred stock and $92.5 million in net proceeds from our IPO, offset by $3.1 million paid for deferred offering costs associated with preparation for our initial public offering.

During the year ended December 31, 2017, cash provided by financing activities was $95.8 million, which primarily consisted of net proceeds from the issuances of shares of our convertible preferred stock.

Since our inception through December 31, 2019, we have raised an aggregate of approximately $177.9 million through the issuance and sale of shares of our convertible preferred stock, net of $0.4 million in issuance costs, which we have used to fund our operations. During 2018, aggregate net proceeds from our sale of Series C convertible preferred stock were $20.9 million. During 2017, net proceeds from our sale of Series B convertible preferred stock were $95.8 million. During 2016, net proceeds from our sale of Series A convertible preferred stock were $35.7 million.

Off-Balance Sheet Arrangements

We have not entered into any off-balance sheet arrangements, as defined under SEC rules.

Contractual Obligations and Commitments

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

	Payments Due by Period				
	Total	Less than 1 Year	1-3 Years	3-5 Years	More than 5 Years
Operating leases [(1)]	$ 34,905	$ 5,366	$ 10,101	$ 6,908	$ 12,530
Total obligations	$ 34,905	$ 5,366	$ 10,101	$ 6,908	$ 12,530

(1) See Note 6 to our financial statements.

We are party to license agreements pursuant to which we have in-licensed various intellectual property rights. The license agreements obligate us to make certain milestone payments related to achievement of specified events, as well as royalties in the low-single digits based on sales of licensed products. In September 2018, we made a milestone payment of $2.5 million pursuant to a license agreement. In August 2019, following the initial patient treatment of SLATE, we recorded $3.0 million as research and development expense in connection with the milestone. During the years ended December 31, 2019 and 2018, no royalties were due from the sales of licensed products. The table above does not include any milestone or royalty payments to the counterparties to these agreements as the amounts, timing and likelihood of such payments are not known. See Note 7 to our financial statements.

In September 2017, we entered into a contract research and development agreement with a third party contract research organization (CRO) to provide research, analysis and antibody samples to further the development of our personalized immunotherapy candidate in the treatment of cancer. During the year ended December 31, 2018, we recognized a total of $1.0 million of research and development expense under the agreement. During the year ended December 31, 2019, we recognized an insignificant amount of research and development expense under the agreement. We are also obligated to pay the CRO certain milestone payments of up to $36.4 million on achievement of specified events. None of these events had occurred as of December 31, 2019 or 2018. However, we are unable to estimate the timing or likelihood of achieving the milestones and, therefore, any related payments are not included in the table above.

In May 2019, we entered into a contract research and testing agreement with a third party CRO to provide antibody discovery related services. During the year ended December 31, 2019, we recognized a total of $1.0 million of research and development expense under the agreement. We are also obligated to pay the CRO certain milestone payments of up to $34.8 million on

achievement of specified events. None of these events had occurred as of December 31, 2019. However, we are unable to estimate the timing or likelihood of achieving the milestones and, therefore, any related payments are not included in the table above.

We enter into contracts in the normal course of business with CROs for clinical trials and CMOs for clinical supply manufacturing and with vendors for preclinical research studies and other services and products for operating purposes, which generally provide for termination within 30 days of notice, and therefore are cancelable contracts and not included in the table above.

Critical Accounting Policies and Use of Estimates

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

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

Revenue Recognition

We analyze our collaboration agreements to assess whether such arrangements involve joint operating activities performed by parties that are both active participants in the activities and exposed to significant risks and rewards dependent on the commercial success of such activities. This assessment is performed throughout the life of the arrangement based on changes in the responsibilities of all parties in the arrangement. For collaboration arrangements that are considered to be in the scope of the collaboration guidance and that contain multiple elements, we first determine which elements of the collaboration are deemed to be within the scope of the collaboration guidance and those that are more reflective of a vendor-customer relationship and, therefore, within the scope of the revenue with contracts with customer guidance. For elements of collaboration arrangements that are accounted for pursuant to the revenue from contracts with customer guidance, an appropriate recognition method is determined and applied consistently, generally by analogy to the revenue from contracts with customers guidance.

The terms of the collaboration and license agreements entered into typically include payment of one or more of the following: non-refundable, up-front fees; development, regulatory, and commercial milestone payments; payments for manufacturing supply services; and royalties on net sales of licensed products. Each of these payments results in license, collaboration, and other revenues, except for revenues from royalties on net sales of licensed products, which are classified as royalty revenues. The core principle of the accounting for revenue from contracts with customers guidance is to recognize revenues when promised goods or services are transferred to customers in an amount that reflects the consideration that is expected to be received in exchange for those goods or services.

In determining the appropriate amount of revenue to be recognized as we fulfill our obligations under each of our agreements, we perform the following steps: (i) identification of the promised goods or services in the contract; (ii) determination of whether the promised goods or services are performance obligations including whether they are distinct in the context of the contract; (iii) measurement of the transaction price, including the constraint on variable consideration; (iv) allocation of the transaction price to the performance obligations based on estimated selling prices; and (v) recognition of revenue when (or as) we satisfy each performance obligation.

Amounts received prior to satisfying the revenue recognition criteria are recorded as deferred revenue in our balance sheets. If the related performance obligation is expected to be satisfied within the next twelve months this will be classified in current liabilities. Amounts recognized as revenue prior to receipt are recorded as contract assets in our balance sheets. If we expect to have an unconditional right to receive consideration in the next twelve months, this will be classified in current assets. A net contract asset or liability is presented for each contract with a customer.

At contract inception, we assess the goods or services promised in a contract with a customer and identify those distinct goods and services that represent a performance obligation. A promised good or service may not be identified as a performance obligation if

it is immaterial in the context of the contract with the customer, if it is not separately identifiable from other promises in the contract (either because it is not capable of being separated or because it is not separable in the context of the contract), or if the performance obligation does not provide the customer with a material right.

We consider the terms of the contract and our customary business practices to determine the transaction price. The transaction price is the amount of consideration to which we expect to be entitled in exchange for transferring promised goods or services to a customer. The consideration promised in a contract with a customer may include fixed amounts, variable amounts, or both. Variable consideration will only be included in the transaction price when it is not considered constrained, which is when it is probable that a significant reversal in the amount of cumulative revenue recognized will not occur.

If it is determined that multiple performance obligations exist, the transaction price is allocated at the inception of the agreement to all identified performance obligations based on the relative standalone selling prices. The relative selling price for each deliverable is estimated using objective evidence if it is available. If objective evidence is not available, we use our best estimate of the selling price for the deliverable.

Revenue is recognized when, or as, we satisfy a performance obligation by transferring a promised good or service to a customer. An asset is transferred when, or as, the customer obtains control of that asset, which for a service, is considered to be as the services are received and used. We recognize revenue over time by measuring the progress toward complete satisfaction of the relevant performance obligation using an appropriate input or output method based on the nature of the good or service promised to the customer.

After contract inception, the transaction price is reassessed at every period end and updated for changes such as resolution of uncertain events. Any change in the transaction price is allocated to the performance obligations on the same basis as at contract inception.

Management may be required to exercise considerable judgment in estimating revenue to be recognized. Judgment is required in identifying performance obligations, estimating the transaction price, estimating the stand-alone selling prices of identified performance obligations, which may include forecasted revenue, development timelines, reimbursement rates for personnel costs, discount rates and probabilities of technical and regulatory success, and estimating the progress towards satisfaction of performance obligations.

Research and Development Expenses

We record research and development expenses to operations as incurred. Research and development expenses represent costs incurred by us for the discovery and development of our product candidates and the development of our technology and include: internal research and development expense, including employee-related expenses, including salaries, benefits, travel and non-cash stock-based compensation expense; external research and development expenses incurred under arrangements with third parties, such as CROs, preclinical testing organizations, contract manufacturing organizations (CMOs), academic and non-profit institutions and consultants; license fees; other expenses, which include direct and allocated expenses for laboratory, facilities and other costs; and costs incurred related to our Collaboration Agreements. Costs to develop our technologies are recorded as research and development expense unless the criteria to be capitalized as internal-use software costs is met.

As part of the process of preparing financial statements, we are required to estimate and accrue expenses. We record the estimated expenses of research and development activities conducted by third-party service providers based upon the estimated amount of services provided within research and development expense in the statements of operations and comprehensive loss. These services include the conduct of clinical and preclinical studies, contract manufacturing activities and consulting services. Payments made prior to the receipt of goods or services to be used in research and development are deferred and recognized as expense in the period in which the related goods are received or services are realized or consumed. If the costs have been prepaid, this expense reduces the prepaid expenses in the balance sheet, and if not yet invoiced, the costs are included in accrued liabilities in the balance sheet. These costs are a significant component of our research and development expenses. We record amortization of prepaid expenses or accrued expenses for these costs based on the estimated amount of work completed and in accordance with agreements established with these third parties. Such payments are evaluated for current or long-term classification based on when they will be realized.

Costs for certain research and development activities are recognized based on an evaluation of the progress to completion of specific tasks. We estimate the amount of work completed through discussions with internal personnel and external service providers as to the progress or stage of completion of the services and the agreed-upon fee to be paid for such services. We make judgments and estimates in determining the accrued balance in each reporting period. As actual costs become known, we adjust our accrued estimates. Although we do not expect our estimates to be materially different from amounts actually incurred, our understanding of the status and timing of services performed may vary from our estimates and could result in us reporting amounts that are too high or too

low in any particular period. Our accrued expenses are dependent, in part, upon the receipt of timely and accurate reporting from external CROs, CMOs, and other third-party service providers. To date, we have not experienced material differences between our accrued expenses and actual expenses.

We have and may continue to enter into license agreements to access and utilize certain technology. We evaluate if the license agreement is an acquisition of an asset or a business. To date none of our license agreements have been considered to be an acquisition of a business. For asset acquisitions, the upfront payments to acquire such licenses, as well as any future milestone payments made before product approval, are immediately recognized as research and development expense when due, provided there is no alternative future use of the rights in other research and development projects. These license agreements may also include contingent consideration in the form of cash. We assess whether such contingent consideration meets the definition of a derivative.

Stock-Based Compensation

We measure stock-based compensation expense for stock options granted to our employees, directors, and non-employees on the date of grant and recognize the corresponding compensation expense of those awards over the requisite service period, which is generally the vesting period of the respective award. We account for stock-based compensation arrangements with non-employee consultants using a fair value approach. Forfeitures of awards are estimated based on historical forfeiture experience and the experience of other companies in the same industry. The estimate of forfeitures will be adjusted over the service period to the extent that actual forfeitures differ, or are expected to differ, from prior estimates.

Prior to our IPO, the fair value of our shares of common stock underlying the stock options was the responsibility of and determined by our Board. Because there was no public market for our common stock, the Board determined the fair value of common stock at the time of grant of the option by considering a number of objective and subjective factors, including, among others: the prices at which we sold shares of our convertible preferred stock to outside investors in arms-length transactions; the rights, preferences and privileges of our convertible preferred stock relative to those of our common stock; our results of operations, financial position and capital resources; current business conditions and projections; the lack of marketability of our common stock; the hiring of key personnel and the experience of management; progress of our research and development activities; our stage of development and material risks related to its business; the fact that the option grants involve illiquid securities in a private company; and the likelihood of achieving a liquidity event, such as an initial public offering or sale, in light of prevailing market conditions.

Following the IPO, the market traded price of the shares of common stock underlying the stock options is the fair value of our stock as reported on The Nasdaq Global Select Market on the grant date.

We estimate the fair value of stock options granted to our employees, directors, and non-employees on the grant date and the resulting stock-based compensation expense, using the Black-Scholes option-pricing model. The Black-Scholes option-pricing model requires the use of subjective assumptions which determine the fair value of stock-based awards. These assumptions include:

Expected Term. Our expected term represents the period that our stock options are expected to be outstanding and is determined using the simplified method (based on the mid-point between the vesting date and the end of the contractual term), as we do not have sufficient historical data to use any other method to estimate expected term.

Expected Volatility. Due to our limited trading history for our common stock, expected volatility is estimated based on the average volatility for comparable publicly traded biopharmaceutical companies over a period equal to the expected term of the stock option grants. The comparable companies are 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 the stock option grants.

Expected Dividend Yield. We have never paid dividends on our common stock and have no plans to pay dividends on our common stock. Therefore, we use an expected dividend yield of zero.

If any of the assumptions used in the Black-Scholes option pricing model change significantly, stock-based compensation expense may differ materially in the future from that recorded in the current period. We expect to continue to grant stock options and awards in the future, and to the extent that we do, our actual stock-based compensation expense recognized in future periods will likely increase.

As of December 31, 2019, we had $11.5 million of total unrecognized stock-based compensation expense which we expect to recognize over a weighted-average period of 2.76 years.

We have not recognized, and we do not expect to recognize in the near future, any tax benefit related to employee stock-based compensation expense as a result of the full valuation allowance on our deferred tax assets including deferred tax assets related to our net operating loss carryforwards.

Leases

Prior to January 1, 2019, we assessed agreements to determine whether the arrangement was or contained a lease at the inception of the arrangement and if such a lease is classified as a financing or operating lease. For all of our leases accounted for as operating leases, the lease expense was expensed on a straight-line basis over the term of the lease. Our lease agreements contained rent holidays, scheduled rent increases and renewal options. Rent holidays and scheduled rent increases were included in the determination of rent expense and recorded ratably over the lease term. We did not assume renewals in its determination of the lease term unless they were deemed to be reasonably assured at the inception of the lease. We begin recognizing rent expense on the date that we obtain the legal right to use and control the leased space. Deferred rent consisted of the difference between cash payments and the recognition of rent expense on a straight-line basis for the buildings we occupied.

Funding of leasehold improvements by our landlord was accounted for as a tenant improvement allowance and recorded as current and non-current deferred rent liabilities and amortized on a straight-line basis as a reduction of rent expense over the term of the lease.

In certain arrangements, we were involved in the construction of improvements to buildings we are leasing. To the extent we were involved with the structural improvements of the construction project or took construction risk, we were considered to be the owner of the building and related improvements for accounting purposes during the construction period. Therefore, we recorded the fair value of the building subject to the lease within property and equipment on the balance sheet, plus the amount of building improvements incurred and funded by us and/or the landlord as of the balance sheet date. We also recorded a corresponding lease financing obligation on our balance sheet representing the amounts financed by the lessor for the building and lessor financed improvements. Lessor financed improvement incentives due but not yet received were recorded as prepaid expense and other current assets on the balance sheet.

Once construction was completed, we considered the requirements for sale-leaseback accounting treatment, including evaluating whether all risks of ownership had been transferred back to the landlord, as evidenced by a lack of our continuing involvement in the leased property. If we concluded the arrangement did not qualify for sale-leaseback accounting treatment, the building and improvements remained on our balance sheet and were subject to depreciation and assessment of impairment. We bifurcated our lease payments into a portion allocated to the lease financing obligation and a portion allocated to the parcel of land on which the building had been built. The portion of the lease payments allocated to the land was treated for accounting purposes as operating lease payments, and therefore was recorded as rent expense in the statements of operations and comprehensive loss. The portion of the lease payments allocated to the lease financing obligation was further bifurcated into a portion allocated to interest expense and a portion allocated to reduce the lease financing obligation.

The interest rate used for the lease financing obligation represented our estimated incremental borrowing rate at the inception of the lease, adjusted to reduce any built-in loss. The initial recording of these assets and liabilities was classified as non-cash investing and financing items, respectively, for purpose of the statements of cash flows.

The most significant estimates used by management in accounting for the lease financing transaction and the impact of these estimates are as follows:

- *Incremental borrowing rate*. We estimate our incremental borrowing rate as the rate we would have incurred to borrow, based on our credit quality at the inception of the lease over a similar term, the funds necessary to purchase the leased building subject to the financing lease transaction. The incremental borrowing rate is used in determining allocating our rental payments between interest expense and a reduction of the outstanding lease financing obligation.
- *Land capitalization rate*. The land capitalization rate is the rate of return on the land underlying the lease properly considering expected income that the land would be expected to generate. The land lease capitalization rate is estimated using comparable market data for land capitalization rates for similar properties. The land capitalization rate is used in determining allocating our rental payments between interest expense and a reduction of the outstanding lease financing obligation.
- *Fair value of leased building and underlying land*. The fair value of a leased building and underlying land subject to the lease financing transaction is based on comparable market data for similar properties as of the lease inception date. The fair value of the underlying land is used in determining allocating our rental payments between interest expense and a reduction of the outstanding lease financing obligation.

In March 2017, we entered into a non-cancelable lease for 42,620 square feet of office, cleanroom, and laboratory support manufacturing space in Pleasanton, California. Subsequently, in April 2017, we took possession of the space. The scope of the tenant improvements did not qualify under the lease accounting guidance as "normal tenant improvements" and we were the deemed owner of the leased building during the construction period for accounting purposes. In November 2017, construction on the facility was substantially completed and the leased property was placed into service. We determined that the completed construction project did not qualify for sale-leaseback accounting due to the collateral held by the landlord in the form of a letter of credit and will instead be accounted for as a financing transaction. The leased building for the Pleasanton facility and related improvements remained on our balance sheet as of December 31, 2018 and rental payments associated with the lease were allocated to operating lease expense for the ground underlying the leased building and principal and interest payments on the lease financing obligation.

Subsequent to adoption of Topic 842 on January 1, 2019, we determine whether the arrangement is or contains a lease at the inception of the arrangement and if such a lease is classified as a financing lease or operating lease. Leases with a term greater than one year are recognized on the balance sheet as right-of-use assets, lease liabilities and, if applicable, long-term lease liabilities. We have elected not to recognize on the balance sheet leases with terms of one year or less. Lease liabilities and their corresponding right-of-use assets are recorded based on the present value of lease payments over the expected lease term. The interest rate implicit in lease contracts is typically not readily determinable. As such, we utilize the appropriate incremental borrowing rate, which is the rate incurred to borrow on a collateralized basis over a similar term an amount equal to the lease payments in a similar economic environment. Certain adjustments to the right-of-use asset may be required for items such as initial direct costs paid or incentives received and impairment charges if we determine the right-of-use asset is impaired.

We consider a lease term to be the noncancelable period that it has the right to use the underlying asset, including any periods where it is reasonably assured we will exercise the option to extend the contract. Periods covered by an option to extend are included in the lease term if the lessor controls the exercise of that option.

We recognize lease expense on a straight-line basis over the expected lease term.

Our facilities operating leases have lease and non-lease components which we have elected to account for as one single lease component. The lease components resulting in a right-of-use asset have been recorded on the balance sheet and amortized as lease expense on a straight-line basis over the lease term.

JOBS Act

We are an emerging growth company under the JOBS Act. As an emerging growth company, we may delay the adoption of certain accounting standards until those standards would otherwise apply to private companies. We have nonetheless irrevocably elected not to avail ourselves of this exemption and, as a result, we will adopt new or revised accounting standards on the relevant dates on which adoption of such standards is required for other public companies.

We will remain an emerging growth company until the earliest of (1) December 31, 2023, (2) the last day of the fiscal year in which we have total annual gross revenue of at least $1.07 billion, (3) the last day of the fiscal year in which we are deemed to be a "large accelerated filer" as defined in Rule 12b-2 under the Exchange Act, which would occur if the market value of our common stock held by non-affiliates exceeded $700.0 million as of the last business day of the second fiscal quarter of such year or (4) the date on which we have issued more than $1.0 billion in non-convertible debt securities during the prior three-year period.

Recent Accounting Pronouncements

Refer to "Note 2. Summary of Significant Accounting Policies" to our audited financial statements for a discussion of recent accounting pronouncements.

Item 7A. Quantitative and Qualitative Disclosures About Market Risk.

Interest Rate Sensitivity

We are exposed to market risk related to changes in interest rates. We had cash, cash equivalents and marketable securities of $127.8 million as of December 31, 2019, which consisted primarily of money market funds and marketable securities, largely composed of investment grade, short-term fixed income securities.

The primary objective of our investment activities is to preserve capital to fund our operations. We also seek to maximize income from our investments without assuming significant risk. To achieve our objectives, we maintain a portfolio of investments in a variety of securities of high credit quality and short-term duration, according to our board-approved investment charter.

Our investments are subject to interest rate risk and could fall in value if market interest rates increase. A hypothetical 10% relative change in interest rates during any of the periods presented would not have had a material impact on our financial statements.

Item 8. Financial Statements and Supplementary Data

Gritstone Oncology, Inc.

Index to Financial Statements

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Stockholders and the Board of Directors of
Gritstone Oncology, Inc.

Opinion on the Financial Statements

We have audited the accompanying balance sheets of Gritstone Oncology, Inc. ("the Company") as of December 31, 2019 and 2018, the related statements of operations and comprehensive loss, stockholders' equity and cash flows for each of the three years in the period ended December 31, 2019, and the related notes (collectively referred to as the "financial statements"). In our opinion, the financial statements present fairly, in all material respects, the financial position of the Company at December 31, 2019 and 2018, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2019 in conformity with U.S. generally accepted accounting principles.

Adoption of New Accounting Standard

As discussed in Note 2 to the financial statements, the Company changed its method of accounting for leases in 2019 due to the adoption of Accounting Standard Updated ("ASU") No. 2016-02, Leases ("Topic 842"), effective January 1, 2019, using the modified retrospective approach.

Basis for Opinion

These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on the Company's financial statements based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. The Company is not required to have, nor were we engaged to perform, an audit of its internal control over financial reporting. As part of our audits we are required to obtain an understanding of internal control over financial reporting but not for the purpose of expressing an opinion on the effectiveness of the Company's internal control over financial reporting. Accordingly, we express no such opinion.

Our audits included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audits provide a reasonable basis for our opinion.

/s/ Ernst & Young LLP

We have served as the Company's auditor since 2016.

Redwood City, California
March 11, 2020

Gritstone Oncology, Inc.
Balance Sheets

(In thousands, except share amounts and par value)

	December 31, 2019	December 31, 2018
Assets		
Current assets:		
Cash and cash equivalents	$ 57,408	$ 52,183
Marketable securities	70,368	100,927
Prepaid expenses and other current assets	3,497	4,526
Total current assets	131,273	157,636
Property and equipment, net	26,911	29,494
Operating lease right-of-use assets	23,427	—
Deposits and other long-term assets	2,778	2,428
Total assets	$ 184,389	$ 189,558
Liabilities and stockholders' equity		
Current liabilities:		
Accounts payable	$ 4,621	$ 4,825
Accrued compensation	4,598	3,951
Accrued liabilities	1,041	740
Accrued research and development expenses	1,779	252
Lease liabilities, current portion	2,505	—
Deferred revenue, current portion	4,956	5,340
Total current liabilities	19,500	15,108
Deferred rent, net of current portion	—	1,353
Other non-current liabilities	—	12
Lease financing obligation, net of current portion	—	10,490
Lease liabilities, net of current portion	20,985	—
Deferred revenue, net of current portion	9,560	13,473
Total liabilities	50,045	40,436
Commitments and contingencies (Notes 6 and 7)		
Stockholders' equity:		
Convertible preferred stock, $0.0001 par value; 10,000,000 shares authorized; no shares issued and outstanding	—	—
Common stock, $0.0001 par value; 300,000,000 shares authorized at December 31, 2019 and 2018; 36,332,956 and 28,823,130 shares issued and outstanding at December 31, 2019 and 2018, respectively	17	16
Additional paid-in capital	355,291	275,593
Accumulated other comprehensive gain (loss)	24	(85)
Accumulated deficit	(220,988)	(126,402)
Total stockholders' equity	134,344	149,122
Total liabilities and stockholders' equity	$ 184,389	$ 189,558

See accompanying notes to financial statements.

Gritstone Oncology, Inc.
Statements of Operations and Comprehensive Loss

(In thousands, except share and per share amounts)

	Year Ended December 31,		
	2019	2018	2017
Collaboration revenue	$ 4,365	$ 1,187	$ —
Operating expenses:			
Research and development	82,896	54,965	35,691
General and administrative	19,409	11,806	6,072
Total operating expenses	102,305	66,771	41,763
Loss from operations	(97,940)	(65,584)	(41,763)
Interest income, net	3,507	809	386
Net loss	(94,433)	(64,775)	(41,377)
Other comprehensive gain (loss):			
Unrealized gain (loss) on marketable securities, net of tax	109	(11)	(71)
Net and comprehensive loss	$ (94,324)	$ (64,786)	$ (41,448)
Net loss per share, basic and diluted	$ (2.81)	$ (7.26)	$ (20.70)
Weighted-average number of shares used in computing net loss per share, basic and diluted	33,554,823	8,919,281	1,999,044

See accompanying notes to financial statements.

Gritstone Oncology, Inc.
Statements of Stockholders' Equity

(In thousands, except share amounts)

	Convertible Preferred Stock		Common Stock		Additional Paid-In	Accumulated Other Comprehensive	Accumulated	Total Stockholders
	Shares	Amount	Shares	Amount	Capital	Gain (Loss)	Deficit	Equity
Balance at December 31, 2016	8,878,227	$ 61,139	1,811,790	$ 1	$ 802	$ (3)	$ (20,250)	$ 41,689
Issuance of Series B convertible preferred stock at $10.76 per share for cash, net of issuance costs of $210	8,919,302	95,798	—	—	—	—	—	95,798
Unrealized loss on marketable securities, net of tax	—	—	—	—	—	(71)	—	(71)
Lapse of repurchase rights related to common stock issued pursuant to early exercises	—	—	338,924	—	117	—	—	117
Issuance of common stock upon exercise of stock options	—	—	1,811	—	—	—	—	—
Stock-based compensation	—	—	—	—	1,126	—	—	1,126
Net loss	—	—	—	—	—	—	(41,377)	(41,377)
Balance at December 31, 2017	17,797,529	156,937	2,152,525	1	2,045	(74)	(61,627)	97,282
Issuance of Series C convertible preferred stock at $13.04 per share for cash, net of issuance costs of $81	1,611,603	20,935	—	—	—	—	—	20,935
Issuance of common stock upon initial public offering at $15.00 per share for cash, net of issuance costs of $10,276	—	—	6,854,202	1	92,536	—	—	92,537
Conversion of Series A, B, and C convertible preferred stock into common stock upon initial public offering	(19,409,132)	(177,872)	19,409,132	14	177,858	—	—	—
Unrealized loss on marketable securities, net of tax	—	—	—	—	—	(11)	—	(11)
Lapse of repurchase rights related to common stock issued pursuant to early exercises	—	—	282,204	—	97	—	—	97
Issuance of common stock upon exercise of stock options	—	—	80,463	—	49	—	—	49
Issuance of common stock for consulting services	—	—	4,347	—	36	—	—	36
Exercise of common stock warrants	—	—	40,257	—	13	—	—	13
Stock-based compensation	—	—	—	—	2,959	—	—	2,959
Net loss	—	—	—	—	—	—	(64,775)	(64,775)
Balance at December 31, 2018	—	—	28,823,130	16	275,593	(85)	(126,402)	149,122
Cumulative effect of adoption of Topic 842	—	—	—	—	—	—	(153)	(153)
Issuance of common stock upon public offering at $11.50 per share for cash, net of issuance costs of $556	—	—	6,500,000	1	69,708	—	—	69,709
Issuance of common stock under at the market ("ATM") equity offering program, net of issuance costs of $301	—	—	490,880	—	3,763	—	—	3,763
Issuance of common stock under employee stock purchase plan ("ESPP")	—	—	55,727	—	413	—	—	413
Unrealized gain on marketable securities, net of tax	—	—	—	—	—	109	—	109
Lapse of repurchase rights related to common stock issued pursuant to early exercises	—	—	182,195	—	63	—	—	63
Issuance of common stock upon exercise of stock options	—	—	281,024	—	452	—	—	452
Stock-based compensation	—	—	—	—	5,299	—	—	5,299
Net loss	—	—	—	—	—	—	(94,433)	(94,433)
Balance at December 31, 2019	—	$ —	36,332,956	$ 17	$ 355,291	$ 24	$ (220,988)	$ 134,344

See accompanying notes to financial statements.

Gritstone Oncology, Inc.
Statements of Cash Flows

(In thousands)

	Year Ended December 31,		
	2019	2018	2017
Operating activities			
Net loss	$ (94,433)	$ (64,775)	$ (41,377)
Adjustments to reconcile net loss to net cash used in operating activities:			
Depreciation and amortization	4,745	3,961	1,970
Net amortization of premiums and discounts on marketable securities	(1,349)	(552)	(158)
Stock-based compensation	5,299	2,995	1,126
Non-cash operating lease expense	6,382	—	—
Changes in operating assets and liabilities:			
Prepaid expenses and other current assets	37	(1,781)	(416)
Operating lease right-of-use assets	(3,328)	—	—
Deposits and other long-term assets	(351)	(818)	(78)
Accounts payable	45	3,249	2,273
Accrued compensation	650	1,724	1,190
Accrued and other non-current liabilities	9	(582)	810
Accrued research and development expenses	1,526	—	—
Deferred rent	—	(396)	(311)
Lease liability	54	—	—
Deferred revenue	(4,297)	18,813	—
Net cash used in operating activities	(85,011)	(38,162)	(34,971)
Investing activities			
Purchase of marketable securities	(80,979)	(102,160)	(63,228)
Maturities of marketable securities	112,993	48,720	41,467
Purchase of property and equipment	(16,173)	(5,663)	(11,522)
Disposition of property and equipment	—	—	31
Net cash provided by (used in) investing activities	15,841	(59,103)	(33,252)
Financing activities			
Proceeds from issuance of common stock, net of issuance costs	75,202	92,586	14
Payments of deferred financing costs	(807)	(3,080)	—
Proceeds from issuance of convertible preferred stock, net of issuance costs	—	20,935	95,798
Net cash provided by financing activities	74,395	110,441	95,812
Net increase in cash, cash equivalents and restricted cash	5,225	13,176	27,589
Cash, cash equivalents and restricted cash at beginning of period	53,175	39,999	12,410
Cash, cash equivalents and restricted cash at end of period	$ 58,400	$ 53,175	$ 39,999
Supplemental disclosures of non-cash investing and financing information			
Property and equipment purchases accrued but not yet paid	$ 1,232	$ 1,482	$ 900
Remeasurement of operating lease right-of-use asset for lease modification	$ 1,878	$ —	$ —
Assets acquired under leasing obligations	$ —	$ —	$ 9,300
Receivable from lessor funded financing	$ —	$ —	$ 1,226

See accompanying notes to financial statements.

1. Organization

Description of Business

Gritstone Oncology, Inc. ("Gritstone" or "the Company") is an immuno-oncology company developing personalized cancer immunotherapies to fight multiple cancer types. The Company was incorporated in the state of Delaware in August 2015, and is based in Emeryville, California and Cambridge, Massachusetts, with a manufacturing facility in Pleasanton, California. The Company operates in one segment.

2. Summary of Significant Accounting Policies

Basis of Presentation

The accompanying financial statements have been prepared in accordance with United States generally accepted accounting principles ("U.S. GAAP") and the rules and regulations of Securities and Exchange Commission ("SEC") for reporting.

Need for Additional Capital

The Company has incurred operating losses and has an accumulated deficit as a result of ongoing efforts to develop drug product candidates, including conducting preclinical and clinical trials and providing general and administrative support for these operations. The Company had an accumulated deficit of $221.0 million and $126.4 million as of December 31, 2019 and 2018, respectively. The Company had net losses of $94.4 million, $64.8 million, and $41.4 million for the years ended December 31, 2019, 2018, and 2017, respectively, and net cash used in operating activities of $85.0 million, $38.2 million, and $35.0 million for years ended December 31, 2019, 2018, and 2017, respectively. To date, none of the Company's drug candidates have been approved for sale. The Company has evaluated and concluded there are no conditions or events, considered in the aggregate, that raise substantial doubt about the Company's ability to continue as a going concern for a period of one year following the date that these financial statements are issued. Management expects operating losses to continue for the foreseeable future. As a result, the Company will need to raise additional capital. If sufficient funds on acceptable terms are not available when needed, the Company could be required to significantly reduce its operating expenses and delay, reduce the scope of, or eliminate one or more of its development programs. Failure to manage discretionary spending or raise additional financing, as needed, may adversely impact the Company's ability to achieve its intended business objectives.

Use of Estimates

The preparation of financial statements in conformity with U.S. GAAP requires management to make estimates and judgments that affect the reported amounts of assets and liabilities and disclosures of contingent assets and liabilities as of the date of the financial statements and the reported amounts of expenses during the reporting period. On an ongoing basis, management evaluates its estimates, including those related to preclinical and clinical study trial accruals, fair value of assets and liabilities, the fair value of right-of-use assets ("ROU Assets") and lease liabilities, revenue recognition, and the fair value of stock-based compensation. Management bases its estimates on historical experience and on various other market-specific and relevant assumptions that management believes to be reasonable under the circumstances. Actual results could differ from those estimates.

Fair Value of Financial Instruments

U.S. GAAP establishes a fair value hierarchy for instruments measured at fair value that distinguishes between assumptions based on market data (observable inputs) and the Company's own assumptions (unobservable inputs). Observable inputs are inputs that market participants would use in pricing the asset or liability based on market data obtained from sources independent of the Company. Unobservable inputs are inputs that reflect the Company's assumptions about the inputs that market participants would use in pricing the asset or liability, and are developed based on the best information available in the circumstances.

Fair value is established as the exchange price, or exit price, representing the amount that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants. As a basis for considering market participant assumptions in fair value measurements, an established three-tier fair value hierarchy distinguishes between the following:

- Level 1 inputs are quoted prices in active markets that are accessible at the market date for identical assets or liabilities.
- Level 2 inputs are inputs other than quoted prices included within Level 1 that are observable for the asset or liability, either directly or indirectly.
- Level 3 inputs are unobservable inputs that reflect the Company's own assumptions about the assumptions market participants would use in pricing the assets or liability. Financial assets and liabilities are classified in their entirety based on the lowest level of input that is significant to the fair value measurement.

To the extent that the valuation is based on models or inputs that are less observable or unobservable in the market, the determination of fair value requires more judgment. Accordingly, the degree of judgment exercised by the Company in determining fair value is greatest for instruments categorized in Level 3. A financial instrument's level within the fair value hierarchy is based on the lowest level of any input that is significant to the fair value instrument.

The carrying amounts reflected on the balance sheets for cash and cash equivalents, prepaid expenses and other current assets, accounts payable, accrued compensation and accrued liabilities approximate their fair values due to their short-term nature.

Cash, Cash Equivalents and Restricted Cash

Cash equivalents, which consist primarily of highly liquid investments with original maturities of three months or less when purchased, are stated at cost which approximates fair value. These assets include investments in money market funds that invest in U.S. Treasury obligations and certificates of deposit which are stated at fair value.

The Company has issued a letter of credit under a lease agreement which has been collateralized by a cash deposit for an equal amount and is recorded within deposits and other long-term assets on the balance sheet based on the term of the underlying lease. The following table provides a reconciliation of cash, cash equivalents and restricted cash reported within the balance sheets that sum to the total of the same amounts shown in the statements of cash flows (in thousands).

	December 31,	
	2019	2018
Cash and cash equivalents	$ 57,408	$ 52,183
Restricted cash	992	992
Total cash, cash equivalents and restricted cash	$ 58,400	$ 53,175

Marketable Securities

The Company invests its excess cash in investment grade short-term fixed income securities. Such investments in marketable securities are considered available for sale, and reported at fair value with unrealized gains and losses included as a component of accumulated other comprehensive income (loss). Marketable securities with maturities of greater than three months from the date of purchase but less than one year from the balance sheet date are classified as short-term, while marketable securities with maturities in one year or beyond one year from the balances sheet date are classified as long term. The amortized cost of debt securities is adjusted for amortization of premiums and accretion of discounts to maturity, which is included in interest income on the statements of operations and comprehensive loss. Realized gains and losses and declines in value judged to be other than temporary, if any, on available-for-sale securities are included in interest income, net. The cost of securities sold is determined using specific identification method.

The Company periodically evaluates whether declines in fair values of its marketable securities below their book value are other than temporary. This evaluation consists of several qualitative and quantitative factors regarding the severity and duration of the unrealized loss as well as the Company's ability and intent to hold the marketable security until a forecasted recovery occurs. Additionally, the Company assesses whether it has plans to sell the security or it is more likely than not it will be required to sell any marketable securities before recovery of its amortized cost basis. Factors considered include quoted market prices, recent financial

results and operating trends, implied values from any recent transactions or offers of investee securities, credit quality of debt instrument issuers, other publicly available information that may affect the value of the marketable security, duration and severity of the decline in value, and the Company's strategy and intentions for holding the marketable security. To date the Company has not recorded any impairment charges on its marketable securities related to other-than-temporary declines in market value.

Concentrations of Credit Risk and Other Risks and Uncertainties

Financial instruments that potentially subject the Company to concentrations of credit risk consist of cash, cash equivalents, and marketable securities. Cash, cash equivalents and marketable securities are invested through banks and other financial institutions in the United States. Such deposits may be in excess of federally insured limits. The Company maintains cash equivalents and marketable securities with various high-credit-quality and capitalized financial institutions. The Company has not experienced any credit losses in such accounts and does not believe it is exposed to any significant credit risk on these funds.

The Company's investment policy limits investments to certain types of securities issued by the U.S. government, its agencies, and institutions with investment-grade credit ratings and places restrictions on maturities and concentration by type and issuer. The Company is exposed to credit risk in the event of a default by the financial institutions holding its cash, cash equivalents, and marketable securities and issuers of marketable securities to the extent recorded on the balance sheets. Through December 31, 2019, the Company has no off-balance sheet concentrations of credit risk.

The Company is subject to a number of risks similar to those of other clinical-stage immunotherapy companies, including dependence on key individuals; the need to develop commercially viable therapeutics; competition from other companies, many of which are larger and better capitalized; and the need to obtain adequate additional financing to fund the development of its products. The Company currently depends on third-party suppliers for key materials and services used in its research and development manufacturing process, and is subject to certain risks related to the loss of these third-party suppliers or their inability to supply the Company with adequate materials and services.

Property and Equipment, Net

Property and equipment are stated at cost, less accumulated depreciation and amortization. Maintenance and repairs that do not improve or extend the lives of the respective assets are expensed to operations as incurred.

Depreciation is calculated using the straight-line method over the estimated useful lives of the respective assets, which are as follows:

Asset	Estimated Useful Life
Computer equipment and software	3 to 5 years
Furniture and fixtures	5 years
Laboratory equipment	5 to 7 years
Leasehold improvements	Shorter of useful life or lease term

Property and equipment for 2018 includes a leased building which did not meet the sale-leaseback criteria and was recorded at its fair value plus the cost of improvements made during the constriction period. The leased building was being depreciated over the lease term to a residual value that will approximate the remaining lease financing obligation at the end of the lease, and was derecognized on January 1, 2019 upon the Company's adoption of Topic 842 (see Note 6).

Long-Lived Assets

The Company evaluates long-lived assets, including property and equipment and right-of-use operating lease assets, for impairment whenever events or changes in business circumstances indicate that the carrying amount of the asset may not be fully recoverable. An impairment loss would be recognized when estimated undiscounted future cash flows expected to result from the use of the asset and its eventual disposition are less than its carrying amount. Impairment, if any, is measured as the amount by which the carrying amount of a long-lived asset exceeds its fair value. There were no indicators of impairment of long-lived assets and no impairment losses have been recorded for the periods presented.

Revenue Recognition

The Company analyzes its collaboration agreements to assess whether such arrangements involve joint operating activities performed by parties that are both active participants in the activities and exposed to significant risks and rewards dependent on the commercial success of such activities. This assessment is performed throughout the life of the arrangement based on changes in the responsibilities of all parties in the arrangement. For collaboration arrangements that are considered to be in the scope of the collaboration guidance and that contain multiple elements, the Company first determines which elements of the collaboration are deemed to be within the scope of the collaboration guidance and those that are more reflective of a vendor-customer relationship and, therefore, within the scope of the revenue with contracts with customer guidance. For elements of collaboration arrangements that are accounted for pursuant to the revenue from contracts with customer guidance, an appropriate recognition method is determined and applied consistently, generally by analogy to the revenue from contracts with customers guidance.

The terms of the licensing and collaboration agreements entered into typically include payment of one or more of the following: non-refundable, up-front fees; development, regulatory, and commercial milestone payments; payments for manufacturing supply services; and royalties on net sales of licensed products. Each of these payments results in license, collaboration, and other revenues, except for revenues from royalties on net sales of licensed products, which are classified as royalty revenues. The core principle of the accounting for revenue from contracts with customers guidance is to recognize revenues when promised goods or services are transferred to customers in an amount that reflects the consideration that is expected to be received in exchange for those goods or services.

In determining the appropriate amount of revenue to be recognized as the Company fulfills its obligations under each of its agreements, the Company performs the following steps: (i) identification of the promised goods or services in the contract; (ii) determination of whether the promised goods or services are performance obligations including whether they are distinct in the context of the contract; (iii) measurement of the transaction price, including the constraint on variable consideration; (iv) allocation of the transaction price to the performance obligations based on estimated selling prices; and (v) recognition of revenue when (or as) the Company satisfies each performance obligation.

Amounts received prior to satisfying the revenue recognition criteria are recorded as deferred revenue in the Company's balance sheets. If the related performance obligation is expected to be satisfied within the next twelve months this will be classified in current liabilities. Amounts recognized as revenue prior to receipt are recorded as contract assets in the Company's balance sheets. If the Company expects to have an unconditional right to receive consideration in the next twelve months, this will be classified in current assets. A net contract asset or liability is presented for each contract with a customer.

At contract inception, the Company assesses the goods or services promised in a contract with a customer and identifies those distinct goods and services that represent a performance obligation. A promised good or service may not be identified as a performance obligation if it is immaterial in the context of the contract with the customer, if it is not separately identifiable from other promises in the contract (either because it is not capable of being separated or because it is not separable in the context of the contract), or if the performance obligation does not provide the customer with a material right.

The Company considers the terms of the contract and its customary business practices to determine the transaction price. The transaction price is the amount of consideration to which the Company expects to be entitled in exchange for transferring promised goods or services to a customer. The consideration promised in a contract with a customer may include fixed amounts, variable amounts, or both. Variable consideration will only be included in the transaction price when it is not considered constrained, which is when it is probable that a significant reversal in the amount of cumulative revenue recognized will not occur.

If it is determined that multiple performance obligations exist, the transaction price is allocated at the inception of the agreement to all identified performance obligations based on the relative standalone selling prices. The relative selling price for each deliverable is estimated using objective evidence if it is available. If objective evidence is not available, the Company uses its best estimate of the selling price for the deliverable.

Revenue is recognized when, or as, the Company satisfies a performance obligation by transferring a promised good or service to a customer. An asset is transferred when, or as, the customer obtains control of that asset, which for a service, is considered to be as the services are received and used. The Company recognizes revenue over time by measuring the progress toward complete satisfaction of the relevant performance obligation using an appropriate input or output method based on the nature of the good or service promised to the customer.

After contract inception, the transaction price is reassessed at every period end and updated for changes such as resolution of uncertain events. Any change in the transaction price is allocated to the performance obligations on the same basis as at contract inception.

Management may be required to exercise considerable judgment in estimating revenue to be recognized. Judgment is required in identifying performance obligations, estimating the transaction price, estimating the stand-alone selling prices of identified performance obligations, which may include forecasted revenue, development timelines, reimbursement rates for personnel costs, discount rates and probabilities of technical and regulatory success, and estimating the progress towards satisfaction of performance obligations.

Stock-Based Compensation

The Company measures and recognizes compensation expense for all stock-based awards made to employees, directors, and non-employees based on the grant date estimated fair value of each award. Such expense is recognized on a straight-line basis over the requisite service period which is generally the vesting period for the entire award. Expense is adjusted for estimated forfeitures. Forfeitures of awards are estimated based on historical forfeiture experience and the experience of other companies in the same industry. The estimate of forfeitures will be adjusted over the service period to the extent that actual forfeitures differ, or are expected to differ, from prior estimates.

The Company estimates the fair value of stock option grants using the Black-Scholes option-pricing model ("the Black-Scholes model"). The Black-Scholes model requires management to make assumptions and judgments about the variables used in the calculation, including the expected term (weighted-average period of time that the options granted are expected to be outstanding), the expected volatility of common stock, an assumed risk-free interest rate, and expected dividends the Company may pay. Management uses the simplified calculation of the expected term. Volatility is based on an average of the historical volatilities of the common stock of entities with characteristics similar to the Company's. The risk-free rate is based on the U.S. Treasury yield curve in effect at the time of grant for periods corresponding with the expected life of the option. The Company uses an assumed dividend yield of zero as the Company has never paid dividends and has no current plans to pay any dividends on its common stock.

Research and Development Expenses

All research and development costs, including work performed by third parties, are expensed as incurred. Research and development costs consist of salaries and other personnel-related expenses, including associated non-cash stock-based compensation, consulting fees, laboratory supplies, and facility costs, as well as external research and development expenses incurred under arrangements with third parties, fees paid to other entities that conduct certain research and development activities on behalf of the Company, and costs incurred related to our Collaboration Agreement. Costs to develop the Company's technologies are recorded as research and development expense unless certain costs which meet the criteria to be capitalized as internal-use software costs is met. Payments made prior to the receipt of goods or services to be used in research and development are capitalized until the goods are received or services are realized or consumed. Such payments are evaluated for current or long-term classification based on when they will be realized.

The Company has and may continue to enter into license agreements to access and utilize certain technology. In each case, the Company evaluates of the license agreement results in the acquisition of an asset or a business. To date, none of the Company's license agreements have been considered to be acquisitions of businesses. For asset acquisitions, the upfront payments to acquire such licenses, as well as any future milestone payments, are immediately recognized as research and development expense when paid, provided that there is no alternative future use of the rights in other research and development projects. These license agreements may also include contingent consideration in the form of cash payments to be made for future milestone events. The Company assess whether such contingent consideration meets the definition of a derivative and to date the Company has determined that such contingent consideration are not derivatives.

Clinical and pre-clinical costs are a component of research and development expense. The Company accrues and expenses clinical and pre-clinical trial activities performed by third parties based upon actual work completed in accordance with agreements established with its service providers. The Company determines the actual costs through discussions with internal personnel and external service providers as to the progress or stage of completion of services and the agreed-upon fee to be paid for such services.

Leases

Prior to January 1, 2019, the Company rented its office space and facilities under non-cancelable operating lease agreements and recognizes related rent expense on a straight-line basis over the term of the lease. The Company's lease agreements contained rent holidays, scheduled rent increases, and renewal options. Rent holidays and scheduled rent increases were included in the determination of rent expense to be recorded ratably over the lease term. The Company did not assume renewals in its determination of the lease term unless they were deemed to be reasonably assured at the inception of the lease. The Company began recognizing rent expense on the date that it obtained the legal right to use and control the leased space. Deferred rent consisted of the difference between cash payments and the recognition of rent expense on a straight-line basis for the buildings the Company occupied.

Funding of leasehold improvements by the Company's landlord was accounted for as a tenant improvement allowance and recorded as current and non-current deferred rent liabilities and amortized on a straight-line basis as a reduction of rent expense over the term of the lease.

In certain arrangements, the Company was involved in the construction of improvements to buildings it is leasing. To the extent the Company was involved with the structural improvements of the construction project or takes construction risk, the Company was considered to be the owner of the building and related improvements for accounting purposes during the construction period. The Company recorded the fair value of the building and related improvements subject to the lease within property and equipment on the balance sheet. The Company also recorded a corresponding lease financing obligation on its balance sheet representing the amounts financed by the lessor for the building and lessor financed improvements. Lessor financed improvement incentives due but not yet received of $1.2 million at December 31, 2017 were recorded as prepaid expense and other current assets on the balance sheet. Such amounts were fully collected in April 2018. Once a construction project was complete, the Company considered the requirements for sale-leaseback accounting treatment. If the Company concludes the arrangement does not qualify for sale-leaseback accounting treatment, the building and related improvements remained on the Company's balance sheet and were subject to depreciation and assessment of impairment.

For such arrangements, at both pre and post the construction period, the Company bifurcated its lease payments into a portion allocated to the building and a portion allocated to the parcel of land on which the building had been built. The portion of the lease payments allocated to the land was treated for accounting purposes as operating lease payments, and therefore was recorded as rent expense in the statements of operations and comprehensive loss. The portion of the lease payments allocated to the building was further bifurcated into a portion allocated to interest expense and a portion allocated to reduce the lease financing obligation. The interest rate used for the lease financing obligation represents the Company's estimated incremental borrowing rate at the inception of the lease, adjusted to reduce any built in loss.

Subsequent to January 1, 2019, the Company determines whether the arrangement is or contains a lease at the inception of the arrangement and if such a lease is classified as a financing lease or operating lease. All of the Company's leases are classified as operating leases. Leases with a term greater than one year are included in operating lease ROU assets, lease liabilities, current portion, and lease liabilities, net of current portion in our balance sheet at December 31, 2019. The Company has elected not to recognize on the balance sheet leases with terms of one year or less. Lease liabilities and their corresponding ROU assets are recorded based on the present value of lease payments over the expected lease term. In determining the net present value of lease payments, the interest rate implicit in lease contracts is typically not readily determinable. As such, the Company utilizes the appropriate incremental borrowing rate, which is the rate incurred to borrow on a collateralized basis over a similar term an amount equal to the lease payments in a similar economic environment. Certain adjustments to the right-of-use asset may be required for items such as initial direct costs paid or incentives received and impairment charges if we determine the ROU asset is impaired.

The Company considers a lease term to be the noncancelable period that it has the right to use the underlying asset, including any periods where it is reasonably assured the Company will exercise the option to extend the contract. Periods covered by an option to extend are included in the lease term if the lessor controls the exercise of that option.

The Company recognizes lease expense on a straight-line basis over the expected lease term.

The Company has elected to not separate lease and non-lease components for its leased assets and accounts for all lease and non-lease components of its agreements as a single lease component. The lease components resulting in a ROU asset have been recorded on the balance sheet and amortized as lease expense on a straight-line basis over the lease term.

Income Taxes

The Company accounts for income taxes under the liability method. Under this method, deferred tax assets and liabilities are determined based on the differences between the financial reporting and tax bases of assets and liabilities and are measured using the enacted tax rates that will be in effect when the differences are expected to reverse. Valuation allowances are established when necessary to reduce deferred tax assets to the amounts expected to be realized.

The Company recognizes and measures uncertain tax positions using a two—step approach set forth in authoritative guidance. The first step is to evaluate the tax position taken or expected to be taken by determining whether the weight of available evidence indicates that it is more likely than not that the tax position will be sustained in an audit, including resolution of any related appeals or litigation processes. The second step is to measure the tax benefit as the largest amount that is more than 50% likely to be realized upon ultimate settlement. Significant judgment is required to evaluate uncertain tax positions. The Company evaluates uncertain tax positions on a regular basis. The evaluations are based on a number of factors, including changes in facts and circumstances, changes in tax law, correspondence with tax authorities during the course of the audit, and effective settlement of audit issues. The provision for income taxes includes the effects of any accruals that the Company believes are appropriate. It is the Company's policy to recognize interest and penalties related to income tax matters in income tax expense. Through December 31, 2019, the Company had not accrued interest or penalties related to uncertain tax positions.

Comprehensive Loss

Comprehensive loss includes net (loss) and certain changes in stockholders' equity that are excluded from net loss, primarily unrealized losses on the Company's marketable securities.

Net Loss Per Share

Basic net loss per share is calculated by dividing the net loss by the weighted-average number of shares of common stock outstanding during the period, without consideration for common stock equivalents. Diluted net loss per share is the same as basic net loss per share, since the effects of potentially dilutive securities are antidilutive given the net loss for each period presented.

Recently Issued Accounting Pronouncements

In June 2016, the FASB issued ASU 2016-13, *Financial Instruments - Credit Losses: Measurement of Credit Losses on Financial Instruments* ("ASU No. 2016-13"), which requires that expected credit losses relating to financial assets measured on an amortized cost basis and available-for-sale debt securities be recorded through an allowance for credit losses. ASU No. 2016-13 revises the measurement of credit losses for most financial instruments measured at amortized cost, including trade receivables, from an incurred loss methodology to an expected loss methodology which results in earlier recognition of credit losses. Under the incurred loss model, a loss is not recognized until it is probable that the loss-causing event has already occurred. The new standard introduces a forward-looking expected credit loss model that requires an estimate of the expected credit losses over the life of the instrument by considering all relevant information including historical experience, current conditions, and reasonable and supportable forecasts that affect collectability. In addition, this standard also modifies the impairment model for available-for-sale debt securities, which are measured at fair value, by eliminating the consideration for the length of time fair value has been less than amortized cost when assessing credit loss for a debt security and provides for reversals of credit losses through income upon credit improvement. The standard is effective for interim and annual periods beginning after December 15, 2019. We will apply the standard's provisions as a cumulative-effect adjustment to retained earnings as of the beginning of the first reporting period in which the guidance is adopted (modified-retrospective approach). A prospective transition approach is required for debt securities for which an other-than-temporary impairment had been recognized before the effective date. Based on the composition of our investment portfolio, which reflects our primary investment objective of capital preservation, current market conditions and historical credit loss activity, the adoption of this new standard is not expected to have a material impact on our financial statements or disclosures.

In August 2018, the FASB issued ASU No. 2018-15, *Intangibles (Topic 350): Customer's Accounting for Implementation Costs Incurred in a Cloud Computing Arrangement That Is a Service Contract*, which aligns the requirements for capitalizing implementation costs incurred in a hosting arrangement that is a service contract with the requirements for capitalizing implementation costs incurred to develop or obtain internal-use software. This new standard also requires customers to expense the capitalized implementation costs of a hosting arrangement that is a service contract over the term of the hosting arrangement. This standard is effective for the Company for annual reporting periods beginning after December 15, 2019, and interim periods within that year. This new standard can be applied either retrospectively or prospectively to all implementation costs incurred after the date of adoption. The adoption of this standard is not expected to have a material impact on the Company's financial statements and related disclosures.

In August 2018, the Financial Accounting Standards Board ("FASB") issued ASU No. 2018-13, *Fair Value Measurement (Topic 820): Disclosure Framework – Changes to the Disclosure Requirements for Fair Value Measurement* ("ASU No. 2018-13"). ASU No. 2018-13 eliminates, adds and modifies certain disclosure requirements for fair value measurements and requires companies to disclose certain information. The new standard will be effective for fiscal years, and interim periods within those year, beginning after December 15, 2019. The adoption of this standard is not expected to have a material impact on the Company's financial statements and related disclosures.

In November 2018, the FASB issued ASU No. 2018-18, *Collaborative Arrangements (Topic 808): Clarifying the Interaction between Topic 808 and Topic 606*, which clarifies that certain transactions between collaborative arrangement participants should be accounted for as revenue under the contract with customers guidance ("Topic 606") when the collaborative arrangement participant is a customer in the context of a unit of account. In those situations, all the guidance in Topic 606 should be applied, including recognition, measurement, presentation, and disclosure requirements. The standard adds unit-of-account guidance in Topic 808 to align with the guidance in Topic 606 (that is, a distinct good or service) when an entity is assessing whether the collaborative arrangement or a part of the arrangement is within the scope of Topic 606, and requires that in a transaction with a collaborative arrangement participant that is not directly related to sales to third parties, presenting the transaction together with revenue recognized under Topic 606 is precluded if the collaborative arrangement participant is not a customer. The standard is effective for interim and annual periods beginning after December 15, 2019, with early adoption permitted, including adoption in any interim period for public business entities for periods in which financial statements have not been issued. Amendments in the standard should be applied retrospectively to the date of initial application of Topic 606, but entities may elect to apply the amendments in this Update retrospectively either to all contracts or only to contracts that are not completed at the date of initial application of Topic 606, and should disclose the election. An entity may also elect to apply the practical expedient for contract modifications that is permitted for entities using the modified retrospective transition method in Topic 606. The Company is currently assessing the impact of this standard on its financial statements.

In December 2019, the FASB issued ASU 2019-12, *Income Taxes (Topic 740): Simplifying the Accounting for Income Taxes* ("ASU 2019-12"), which is intended to simplify various aspects related to accounting for income taxes by removing certain exceptions to the general principles in Topic 740. The pronouncement is effective for the Company for fiscal years beginning after December 15, 2021, and for interim periods within fiscal years beginning after December 15, 2022. Early adoption is permitted. The Company is currently in the process of evaluating the effects of the provisions of ASU 2019-12 on our financial statements.

Recently Adopted Accounting Pronouncements

In February 2016, the FASB issued ASU No. 2016-02, *Leases (Topic 842).* The new standard requires the recognition of lease liabilities and ROU assets on the balance sheet arising from lease transactions at the lease commencement date and the disclosure of key information about leasing arrangements. In July 2018, the FASB issued ASU 2018-11, *Leases (Topic 842) Targeted Improvements*, which provides an additional transition method in which the new lease standard is applied at the adoption date and recognized as a cumulative-effect adjustment to retained earnings without adjustment to comparative periods (collectively

"Topic 842"). The amendment has the same effective date and transition requirements as the new lease standard.

The Company adopted this standard on January 1, 2019 using the modified retrospective approach and elected the package of practical expedients permitted under transition guidance, which allowed the Company to carry forward its historical assessments of: 1) whether contracts are or contain leases, 2) lease classification and 3) initial direct costs, where applicable. The Company did not elect the practical expedient allowing the use-of-hindsight which would require the Company to reassess the lease term of its leases based on all facts and circumstances through the effective date and did not elect the practical expedient pertaining to land easements as this is not applicable to the current contract portfolio. The Company elected the post-transition practical expedient to not separate lease

components from non-lease components for all existing lease classes. The Company also elected a policy of not recording leases on its balance sheets when the leases have a term of 12 months or less and the Company is not reasonably certain to elect an option to purchase the leased asset.

The impact of the adoption of Topic 842 on the balance sheet as of January 1, 2019 was as follows (in thousands):

	December 31, 2018	Adjustments due to Adoption of Topic 842	January 1, 2019
Property and equipment, net	$ 29,494	$ (14,524)	$ 14,970
Operating lease right-of-use assets	—	14,224	14,224
Operating liabilities:			
Lease liabilities, current portion	—	2,200	2,200
Accrued liabilities	740	(475)	265
Deferred rent, net of current portion	1,353	(1,353)	—
Lease financing obligation, net of current portion	10,490	(10,490)	—
Lease liabilities, net of current portion	—	8,980	8,980
Accumulated deficit	(126,402)	(153)	(126,555)

The adjustments due to the adoption of Topic 842 primarily related to the recognition of operating lease ROU assets and lease liabilities for the Company's operating leases. In addition, the adoption of Topic 842 resulted in a change in classification of build-to-suit component of our lease in Pleasanton, California to an operating lease and resulted in the derecognition of the $15.4 million capitalized building and related accumulated depreciation of $0.9 million and $10.5 million financing lease obligation, as the Company had been deemed to own the building under legacy GAAP (Note 6). The Company also recorded an insignificant reduction to opening accumulated deficit as of January 1, 2019 as a result of the adoption of Topic 842.

The impact of the adoption of Topic 842 on the statements of operations and comprehensive loss was not material.

In June 2018, the FASB issued ASU No. 2018-07, *Compensation—Stock Compensation (Topic 718): Improvements to Nonemployee Share-Based Payment Accounting* ("ASU No. 2018-07"). ASU No. 2018-07 is intended to reduce cost and complexity and to improve financial reporting for share-based payments issued to non-employees (for example, service providers, external legal counsel, suppliers, etc.). The ASU expands the scope of Topic 718, *Compensation—Stock Compensation*, which currently only includes share-based payments issued to employees, to also include share-based payments issued to non-employees for goods and services. Consequently, the accounting for share-based payments to non-employees and employees will be substantially aligned. ASU No. 2018-07 is effective for annual and interim periods beginning after December 15, 2018. Early adoption of the standard is permitted. The standard will be applied in a retrospective approach for each period presented. The Company adopted the standard on January 1, 2019, which did not have a material impact on its financial statements and related disclosures.

3. Cash Equivalents and Marketable Securities

The amortized cost, unrealized gains and losses and fair values of cash equivalents and marketable securities were as follows (in thousands):

	December 31, 2019			
Description	**Amortized Cost**	**Unrealized Gains**	**Unrealized Losses**	**Fair Value**
Cash equivalents:				
Money market funds	$ 42,133	$ —	$ —	$ 42,133
Commercial paper	1,749	—	—	1,749
Corporate debt securities	2,500	—	—	2,500
Total cash equivalents	46,382	—	—	46,382
Short-term marketable securities:				
Certificates of deposit	631	—	—	631
Commercial paper	31,476	15	—	31,491
Corporate debt securities	38,237	15	(6)	38,246
Total short-term marketable securities	70,344	30	(6)	70,368
Total	$ 116,726	$ 30	$ (6)	$ 116,750

	December 31, 2018			
Description	**Amortized Cost**	**Unrealized Gains**	**Unrealized Losses**	**Fair Value**
Cash equivalents:				
Money market funds	$ 36,148	$ —	$ —	$ 36,148
Commercial paper	—	—	—	—
Corporate debt securities	12,047	—	—	12,047
Total cash equivalents	48,195	—	—	48,195
Short-term marketable securities:				
Commercial paper	45,244	—	(40)	45,204
Corporate debt securities	55,768	1	(46)	55,723
Total short-term marketable securities	101,012	1	(86)	100,927
Total	$ 149,207	$ 1	$ (86)	$ 149,122

As of December 31, 2019 and 2018, the Company had a total of $127.8 million and $153.1 million in cash, cash equivalents and marketable securities, which includes $57.4 million and $52.2 million in cash and cash equivalents and $70.4 million and $100.9 million in marketable securities, respectively.

All marketable securities held as of December 31, 2019, had contractual maturities of less than one year. There have been no realized gains or losses on marketable securities for the periods presented. None of the Company’s investments in marketable securities has been in an unrealized loss position for more than one year. The Company determined that it did have the ability and intent to hold all marketable securities that have been in a continuous loss position until maturity or recovery, thus there has been no recognition of any other-than-temporary impairment in the year ended December 31, 2019, 2018, or 2017.

See Note 4 for further information regarding the fair value of the Company's financial instruments.

4. Fair Value Measurements

The Company's financial assets and liabilities subject to fair value measurements on a recurring basis and the level of inputs used in such measurements were as follows (in thousands):

	December 31, 2019			
Description	**Total**	**Level 1**	**Level 2**	**Level 3**
Cash equivalents:				
Money market funds	$ 42,133	$ 42,133	$ —	$ —
Commercial paper	1,749	—	1,749	—
Corporate debt securities	2,500	—	2,500	—
Total cash equivalents	46,382	42,133	4,249	—
Short-term marketable securities:				
Certificates of deposit	631	—	631	—
Commercial paper	31,491	—	31,491	—
Corporate debt securities	38,246	—	38,246	—
Total short-term marketable securities	70,368	—	70,368	—
Total	$ 116,750	$ 42,133	$ 74,617	$ —

	December 31, 2018			
Description	**Total**	**Level 1**	**Level 2**	**Level 3**
Cash equivalents:				
Money market funds	$ 36,148	$ 36,148	$ —	$ —
Commercial paper	—	—	—	—
Corporate debt securities	12,047	—	12,047	—
Total cash equivalents	48,195	36,148	12,047	—
Short-term marketable securities:				
Commercial paper	45,204	—	45,204	—
Corporate debt securities	55,723	—	55,723	—
Total short-term marketable securities	100,927	—	100,927	—
Total	$ 149,122	$ 36,148	$ 112,974	$ —

The Company measures the fair value of money market funds based on quoted prices in active markets for identical securities. Commercial paper, certificates of deposit, and corporate debt securities are valued taking into consideration valuations obtained from third-party pricing services. The pricing services utilize industry standard valuation models, including both income and market-based approaches, for which all significant inputs are observable, either directly or indirectly, to estimate fair value. These inputs include reported trades of and broker/dealer quotes on the same or similar securities, issuer credit spreads; benchmark securities; prepayment/default projections based on historical data; and other observable inputs.

There were no transfers between Level 1 and Level 2 during the periods presented.

5. Property and Equipment, Net

Property and equipment and related accumulated depreciation and amortization are as follows (in thousands):

	December 31,	
	2019	2018
Computer equipment and software	$ 863	$ 470
Furniture and fixtures	2,007	935
Laboratory equipment	21,025	16,406
Leasehold improvements	11,102	3,063
Construction-in-progress	2,224	—
Buildings and related improvements capitalized under a lease financing transaction	—	15,371
	37,221	36,245
Less accumulated depreciation and amortization	(10,310)	(6,751)
Total property and equipment, net	$ 26,911	$ 29,494

Depreciation and amortization expense was $4.7 million, $4.0 million, and $2.0 million for the periods ended December 31, 2019, 2018, and 2017, respectively.

6. Commitments and Contingencies

Leases

In November 2015, the Company entered into an 84-month non-cancelable operating lease, effective March 2016, for a new facility in Emeryville, California, with laboratory and office space. In conjunction with signing the lease, the Company paid a cash security deposit of $50,000. The lease agreement includes an escalation clause for increased rent and a renewal provision allowing the Company to extend this lease for an additional three years at the prevailing rental rate. In September 2018, the Emeryville lease was amended whereby the Company entered into a 12-month operating lease for additional temporary space. The Company may terminate the temporary space lease agreement with 30 days advanced written notice to the Landlord.

In January 2019, the Company entered into a 120-month operating lease for a new facility in Emeryville, California with office and laboratory space for the Company's new principal executive offices. In conjunction with signing the lease, the Company paid a cash security deposit of $0.6 million, which is recorded as a deposit on the Company's balance sheet as of December 31, 2019. The lease agreement includes a free rent period, an escalation clause for increased rent and a renewal provision allowing the Company to extend this lease for an additional two five-year periods at the then market rental rate. The lessor provided the Company a tenant improvement allowance for a total of $4.0 million to complete the laboratory and office renovation. The Company's obligation to pay rent commenced on November 1, 2019. The Company has determined the tenant improvements to be lessee owned and therefore has recorded a $9.8 million ROU Asset and a $13.9 million lease liability on the balance sheet as of December 31, 2019.

In connection with the new lease agreement, the Company also entered into an agreement (the "Lease Termination Agreement") to early terminate the Company's existing lease dated November 2015, for its current premises. The current lease will terminate effective no later than 60 days after the rent commencement date under the new lease, which is October 2019. The Company accounted for the Lease Termination Agreement as a separate contract and recorded an adjustment of $1.8 million, which is included within the December 31, 2019 balance sheet, to the ROU Asset and lease liability to reflect the remaining term of the modified agreement through October 2019.

In February 2016, the Company entered into a 67-month non-cancellable operating lease effective October 2016 for a new facility in Cambridge, Massachusetts, with laboratory and office space. In conjunction with signing the lease, the Company paid a cash security deposit of $0.3 million. The lease agreement includes an escalation clause for increased rent and a renewal provision allowing the Company to extend this lease for an additional three years at the prevailing rental rate. The lessor provided the Company a tenant improvement allowance for a total of $2.1 million to complete laboratory and office renovations. The scope of these tenant improvements were considered to be "normal tenant improvements" under the lease accounting guidance. The Company recorded the

tenant allowance received as leasehold improvements under the property and equipment account and deferred rent liability on the accompanying balance sheets. Upon adoption of Topic 842, the deferred rent liability was reclassified against the ROU Asset on the balance sheet as of January 1, 2019.

In March 2017, the Company entered into a noncancelable lease (the Pleasanton Lease) to lease 42,620 square feet of office, cleanroom, and laboratory support manufacturing space in Pleasanton, California (the Pleasanton Facility). Subsequently, in April 2017, the Company took possession of the space. The Pleasanton Lease includes a free rent period, escalating rent payments and a term that expires on November 30, 2024. The Company has the option to extend the lease term for a period of five years at the then market rental rate. The Company's obligation to pay rent commenced on December 1, 2017. The Company obtained an irrevocable letter of credit in March 2017 in the initial amount of $1.0 million as a security deposit to the Pleasanton Lease, which may be drawn down by the landlord in the event the Company fails to fully and faithfully perform all of its obligations. The letter of credit may be reduced based on certain levels of cash and cash equivalents the Company holds. As of December 31, 2019, none of the irrevocable letter of credit amount has been drawn. The Pleasanton Lease further provides that the Company is obligated to pay to the landlord its proportionate share of certain basic operating costs, including taxes and operating expenses.

In connection with the Pleasanton Lease, the Company received a tenant improvement allowance of $1.2 million from the landlord for the costs associated with the design, development and construction of tenant improvements for the Pleasanton Facility building. The scope of the tenant improvements did not qualify under the lease accounting guidance as "normal tenant improvements" and the Company was deemed owner of the leased building during the construction period for accounting purposes. The Company had therefore capitalized the $9.3 million fair value of the leased building within property and equipment, net, and recognized a corresponding non-current lease financing obligation in the balance sheet as of December 31, 2018. The fair value of the leased building was estimated using a market approach that utilized comparable observable sales for similar assets (Level 2 inputs). The Company had also recognized building improvements totaling $6.1 million for additions to the leased building incurred by the Company during the construction period, of which $1.2 million were due but had not yet been received from the landlord as of December 31, 2017 and were recorded as an increase to the lease financing obligation and prepaid and other current assets on the balance sheet. Such amounts were subsequently reimbursed by the landlord in April 2018. In November 2017, construction on the Pleasanton Facility was substantially completed and the leased property was placed into service. The Company determined the completed construction project did not qualify for sale-leaseback accounting due to the collateral held by the landlord in the form of a letter of credit and instead was accounted for as a financing lease transaction. The leased building for the Pleasanton Facility and related improvements remain on the Company's balance sheet as of December 31, 2018 and rental payments associated with the Pleasanton Lease were allocated to operating lease expense for the ground underlying the leased building and principal and interest payments on the lease financing obligation.

Upon adoption of Topic 842, the Company analyzed the Pleasanton lease under the new guidance and determined that the lease would be classified as an operating lease under legacy GAAP. Additionally, given the Company had previously recognized the building and financing lease obligation solely as a result of the transactions build to suit designation under legacy GAAP, the Company derecognized the $14.5 million leased building and $10.5 million lease financing obligation from the balance sheet on January 1, 2019. The unamortized tenant improvement allowance of $4.0 million and was recognized as a component of ROU Assets on January 1, 2019. The Company also recorded a $0.2 million reduction to opening accumulated deficit as of January 1, 2019.

In September 2018, the Company entered into a 24-month non-cancellable operating lease for an additional facility in Cambridge, Massachusetts with laboratory and office space. In conjunction with signing the lease, the Company prepaid the first twelve months base rent in the amount of $1.3 million of which $0.9 million as of January 1, 2019 was reclassified to the ROU Asset on the balance sheet upon adoption of Topic 842. The Company also paid a cash security deposit of $0.3 million, which included $0.1 million for the last month's rent and was reclassified to the ROU Assets on the balance sheet upon adoption of Topic 842 on January 1, 2019. The remaining security deposit is recorded in deposits and other long-term assets on the Company's balance sheet as of December 31, 2019.

In July 2019, the Company amended its Cambridge, Massachusetts laboratory and office space facility lease. The amendment extended the original 24-month lease term ending in August 2020 by another 12 months through August 2021 and added additional leased laboratory and office space. Upon six months written notice, the Company has the right to terminate the amended lease agreement. The amendment provides for annual base rent of approximately $3.4 million, effective July 2019. In conjunction with signing the lease amendment, the Company prepaid an additional twelve months base rent for both the original leased space and the additional leased space in the amount of $3.2 million, which was reclassified to the ROU Asset on the balance sheet. The Company also paid a cash security deposit of $0.3 million, which included $0.1 million for the last month's rent and was reclassified to the ROU

Assets on the balance sheet. The remaining security deposit is recorded in deposits and other long-term assets on the Company's balance sheet as of December 31, 2019.

In May 2019, the Company entered into a 64-month non-cancellable operating lease for additional office space in Pleasanton, California. The lessor provided the Company a tenant improvement allowance for a total of $0.1 million to complete the office renovation. The Company's obligation to pay rent commenced on August 1, 2019. The Company has determined the tenant improvements to be lessee owned and therefore has recorded a $0.3 million ROU Asset and a $0.5 million lease liability on the balance sheet as of December 31, 2019.

The Company's operating leases include various covenants, indemnities, defaults, termination rights, security deposits and other provisions customary for lease transactions of this nature.

The components of lease costs, which were included in our statements of operations and comprehensive loss, were as follows (in thousands):

	Year ended December 31, 2019
Lease cost	
Operating lease cost	$ 6,382
Short-term lease cost	271
Total lease cost	$ 6,653

Supplemental information related to leases was as follows (in thousands):

	Year ended December 31, 2019
Cash paid for amounts included in the measurement of lease liabilities (in thousands):	
Operating cash flows from operating leases	$ 2,495
New right-of-use assets obtained in exchange for lease obligations (in thousands):	
Operating leases	$ 12,331
Weighted average remaining lease term (years):	
Operating leases	7.20
Weighted average discount rate:	
Operating leases	9.0%

As of December 31, 2019, minimum annual payments under the Company's operating lease agreements are as follows (in thousands):

	Lease Financing Obligation
Year ending December 31,	
2020	$ 5,366
2021	6,359
2022	3,742
2023	3,459
2024	3,449
Thereafter	12,530
Total minimum payments	34,905
Less: Amounts representing interest expense	(9,827)
Less: Amounts representing tenant improvement allowance	(1,588)
Present value of future minimum lease payments	23,490
Less: Current portion of lease liability	(2,505)
Noncurrent portion of lease liability	$ 20,985

The amounts representing the tenant improvement allowance are expected to be received by the Company in early 2020.

Rent expense was $6.7 million, $1.8 million, and $1.2 million for the years ended December 31, 2019, 2018, and 2017, respectively.

Agreements with CROs

In September 2017, the Company entered into a contract research and development agreement with a third-party contract research organization ("CRO") to provide research, analysis and antibody samples to further the Company's development of its drug candidates. The Company is obligated to pay the CRO certain milestone payments of up to $36.4 million on achievement of specified events. None of these events had occurred as of December 31, 2019. During the year ended December 31, 2019, the Company recognized an insignificant amount of research and development expense under the agreement. During 2018 and 2017, the Company recognized a total of $1.0 million and $0.1 million, respectively, of research and development expense under the agreement.

In May 2019, the Company entered into a contract research and testing agreement with a third-party contract research organization to provide antibody discovery related services. The Company is obligated to pay the CRO certain milestone payments of up to $34.8 million on achievement of specified events. None of these events had occurred as of December 31, 2019. The Company recognized a total of $1.0 million in research and development expense under the agreement during the year ended December 31, 2019.

Guarantees and Indemnifications

The Company, as permitted under Delaware law and in accordance with its certification of incorporation and bylaws, and pursuant to indemnification agreements with certain of its officers and directors, indemnifies its officers and directors for certain events or occurrences, subject to certain limits, which the officer or director is or was serving at the Company's request in such capacity. The term of the indemnification period lasts as long as an officer or director may be subject to any proceeding arising out of acts or omissions of such officer or director in such capacity. The maximum amount of potential future indemnification is unlimited; however, the Company currently holds director and officer liability insurance. This insurance limits the Company's exposure and may enable it to recover a portion of any future amounts paid. The Company believes that the fair value of these indemnification obligations is minimal. Accordingly, the Company has not recognized any liabilities relating to these obligations for any period presented.

7. Collaboration and License Agreements

bluebird bio, Inc.

In August 2018, the Company entered into a Research Collaboration and License Agreement ("Collaboration Agreement") with bluebird bio, Inc. ("bluebird"). Under the terms of the Collaboration Agreement, the Company will provide to bluebird tumor-specific targets across several tumor types and, in certain cases, T-cell receptors ("TCR") directed to those targets. The Company received a non-refundable upfront payment of $20.0 million and bluebird also concurrently acquired 768,115 shares of the Company's Series C convertible preferred stock for $10.0 million at $13.04 per share. Per the Collaboration Agreement, bluebird was also provided an option to acquire shares of the Company's common stock at the same price as all other investors in connection with the IPO. In October 2018, bluebird purchased 666,667 shares of the Company's common stock at the price to the public of $15.00 per share for a total of $10.0 million. Under the terms of the Collaboration Agreement, the Company is eligible to earn development, regulatory, and sales-based milestones in an amount of up to $1.2 billion, and single-digit royalties on sales of products that utilize the technology subject to the Collaboration Agreement. None of these events had occurred as of December 31, 2019 and no royalties were due from the sale of licensed products.

In August 2019, the Company entered into a First Amendment to the Research Collaboration and License Agreement which extended the timeline for the Company and bluebird to execute a Patient Selection Services Agreement from within one year to within two years after the Effective Date of the Research Collaboration and License Agreement. The amendment was entered into for administrative purposes and the Company determined the amendment was not a modification of contract under ASC 606.

bluebird may terminate the Collaboration Agreement by giving a 120 day prior written notice to the Company at any time after the effective date of the agreement. Unless terminated early the agreement has a term that ends upon the last payment owed by Gritstone on a licensed product. The Collaboration Agreement may be terminated for cause by either party based on uncured material breach by the other party or bankruptcy of the other party. Upon early termination, all ongoing activities under the agreement and all mutual collaboration, development and commercialization licenses and sublicenses will terminate. The licenses granted by the Company to bluebird under the licensed intellectual property will remain in effect in accordance with their respective terms. Additionally, all of bluebird's payment obligations that have not yet accrued related to future milestone and royalty payments will be reduced by fifty percent for the remainder of the agreement term.

The Company concluded that bluebird is a customer, and the contract is not subject to guidance on collaborative arrangements. This is because the Company granted to bluebird a license to its intellectual property, and provided research and development services, all of which are outputs of the Company's ongoing activities, in exchange for consideration.

The Company identified the following three material promises under the Collaboration Agreement: 1) transfer of a license to intellectual property and related technology know-how ("License and Know-How"); 2) the obligation to perform target selection and TCR generation services ("Research and Development Services"); and 3) participation on the Joint Steering Committee ("JSC"). The Company provided to bluebird standard indemnification and protection of licensed intellectual property, which is part of assurance that the license meets the contract's specifications and is not an obligation to provide goods or services.

The Company considered that the License and Know-How has standalone functionality, was considered to be functional intellectual property, and is capable of being distinct. However, the Company determined that the License and Know-How is not distinct from the Research and Development Services or participation on the JSC within the context of the agreement because bluebird is dependent on the Company to execute the Research and Development Services and participate on the JSC in order for bluebird to benefit from the License and Know-How. As such, the License and Know-How is combined with the Research and Development Services and participation on the JSC into a single performance obligation. As such, the transaction price under this arrangement will be allocated to this single performance obligation.

The Company has also determined that all other goods or services which are contingent upon bluebird reaching various milestones are not considered performance obligations at the inception of the arrangement.

The transaction price at the inception of the Collaboration Agreement consisted of the upfront payment of $20.0 million and the $10.0 million received from bluebird for the purchase of the Company's Series C convertible preferred stock. The sale of the Series C convertible preferred stock was not considered to be a performance obligation as it was a separate financing component of the transaction. Accordingly, $10.0 million of the transaction price was allocated to the issuance of 768,115 shares of Series C convertible preferred stock at fair value of $13.04 per share and recorded in stockholders' equity.

The variable consideration related to the remaining development, regulatory, and sales-based milestones payments has not been included in the initial transaction price and continues to be fully constrained as of December 31, 2019. As part of its evaluation of the constraint, the Company considered numerous factors, including that receipt of the milestones is outside the control of the Company and contingent upon initiation of clinical trials for early stage targets and bluebird's development efforts. Any variable consideration related to sales-based milestones (including royalties) will be recognized when the related sales occur as they were determined to relate predominantly to the License and Know-How granted to bluebird. The Company will re-evaluate the transaction price in each reporting period and as uncertain events are resolved or other changes in circumstances occur.

For revenue recognition purposes, the Company determined that the duration of the contract began on the effective date in August 2018 and ends upon completion of the Research and Development Services which is also when the participation on the JSC is no longer an obligation. The contract duration is defined as the period in which parties to the contract have present enforceable rights and obligations. The Company also analyzed the impact of bluebird terminating the agreement prior to August 2023 and determined, considering both quantitative and qualitative factors, that there were substantive non-monetary penalties to bluebird for doing so. We considered quantitative and qualitative factors to reach this conclusion.

Revenue is recognized when, or as, the Company satisfies its performance obligation by transferring the promised services to bluebird. Revenue will be recognized over time using a cost-based input method, based on internal labor cost effort to perform the research services, since the internal labor cost incurred over time is thought to best reflect the transfer of services to bluebird. In applying a cost-based input method of revenue recognition, we use actual costs incurred relative to budgeted costs to fulfill the

combined performance obligation. A cost-based input method of revenue recognition requires us to make estimates of costs to complete the performance obligation. The cumulative effect of any revisions to estimated costs to complete the performance obligation will be recorded in the period in which changes are identified and amounts can be reasonably estimated. A significant change in these assumptions and estimates could have a material impact on the timing and amount of revenue recognized in future periods.

For the year ended December 31, 2019, the Company recognized $4.3 million as collaboration revenue as a result of satisfying its performance obligation by transferring the promised services estimated by the labor cost incurred. A deferred revenue balance of $14.5 million is recorded on the balance sheet in both current and long-term liabilities as of December 31, 2019, which relates to the performance obligation identified, with such amounts to be recognized over the period the performance obligation is expected to be satisfied, which is currently expected to be through mid-2023.

Changes in the deferred revenue balance during the year ended December 31, 2019 are as follows (in thousands):

	Deferred Revenue
Balance at December 31, 2018	$ 18,813
Additions	—
Deductions	(4,297)
Balance at December 31, 2019	$ 14,516

There were no receivables or net contract assets recorded as of December 31, 2019 associated with the Collaboration Agreement.

The Company expensed all incremental costs of obtaining the Collaboration Agreement in 2018 as such amounts were insignificant.

Arbutus Biopharma Corporation

In October 2017, the Company entered into an Exclusive License Agreement with Arbutus Biopharma Corporation ("Arbutus") and Protiva Biotherapeutics Inc. a wholly owned subsidiary of Arbutus. Certain terms of the agreement were modified by amendment in July 2018. Under the license agreement, the Company has an exclusive license to utilize certain Arbutus intellectual property including patents and know-how relating to immunotherapy. Under this license agreement, the Company paid an upfront payment of $5.0 million which was included in research and development expenses during 2017. The Company also reimbursed Arbutus for materials and personnel costs totaling $0.2 million, which were included in research and development expenses during 2017. During 2019 and 2018, the Company reimbursed Arbutus for materials and personnel costs totaling $0.4 million and $0.4 million, respectively. The Company is obligated to pay Arbutus for services rendered and certain milestone payments up to an aggregate of $123.5 million on achievement of specified events, and royalties on sales of its licensed products. Following the acceptance of our investigational new drug application for GRANITE by the U.S. Food and Drug Administration, the Company made a $2.5 million development milestone payment to Arbutus in September 2018 that was recorded as research and development expense. In August 2019, a milestone was met following the initial patient treatment of SLATE in the Company's GO-005 clinical trial. In 2019, the Company recorded $3.0 million as research and development expense in connection with the milestone. None of the other events had occurred as of December 31, 2019, and no royalties were due from the sale of licensed products.

Non-Profit Hospital Cancer Center

In January 2016, the Company entered into an Exclusive License Agreement with a non-profit hospital cancer center. Under the license agreement, the Company has an exclusive license to utilize certain patents and know-how relating to immunotherapy for an insignificant upfront payment, cash milestone payments on achievement of specified events, and a low single digit royalty on sales of licensed products. The achievement of the milestones and payment of royalties is dependent upon obtaining regulatory approval. Upon achievement of a milestone related to the Company's Phase 1 clinical trial for GRANITE, GO-004, in December 2018 the Company recorded an insignificant amount to research and development expense for amounts owed to the Hospital Cancer Center, which was paid to the hospital in February 2019. None of the other events had occurred as of December 31, 2019 and no royalties were due from the sales of licensed products.

8. Balance Sheet Components

Prepaid Expenses and Other Assets

Prepaid expenses and other current assets consist of the following (in thousands):

	December 31, 2019	December 31, 2018
Prepaid insurance	$ 1,252	$ 966
Interest and other receivables	482	462
Prepaid research and development-related expenses	1,473	1,789
Prepaid rent	—	860
Other	290	449
Total prepaid expenses and other current assets	$ 3,497	$ 4,526

Deposits and Other Long-Term Assets

Deposits and other long-term assets consist of the following (in thousands):

	December 31, 2019	December 31, 2018
Lease security deposit	$ 1,201	$ 632
Prepaid research and development-related expenses	585	554
Restricted cash	992	992
Other	—	250
Total deposits and other long-term assets	$ 2,778	$ 2,428

Accrued Liabilities

Accrued current liabilities consist of the following (in thousands):

	December 31, 2019	December 31, 2018
Deferred rent	$ —	$ 445
Property and equipment	761	—
Other	280	295
Total accrued current liabilities	$ 1,041	$ 740

9. Stockholders' Equity

In connection with the completion of its IPO, on October 2, 2018, the Company's certificate of incorporation was amended and restated to provide for 300,000,000 authorized shares of common stock with a par value of $0.0001 per share and 10,000,000 authorized shares of preferred stock with a par value of $0.0001 per share.

The Company has 10,000,000 shares of preferred stock authorized for issuance, par value of $0.0001 per share. As of December 31, 2019 and 2018, no shares of preferred stock were issued and outstanding.

The Company has 300,000,000 shares of common stock authorized for issuance, par value of $0.0001 per share. Holders of the Company's common stock are entitled to one vote per share. As of December 31, 2019 and 2018, there were 36,332,956 and 28,823,130 shares of common stock issued and outstanding.

Sale of Common and Preferred Stock

The Company entered into a Series B preferred stock purchase agreement with certain investors in September 2017 and October 20, 2017, and upon approval by the Company's Board of Directors, the Company completed a Series B convertible preferred stock financing ("Series B") at a price per share of $10.76. The net cash proceeds totaled $95.8 million and 8,919,302 shares of Series B convertible preferred stock were issued. Issuance costs totaled $0.2 million and were recorded as a reduction of the proceeds.

The Company entered into a Series C preferred stock purchase agreement, with certain investors in June 2018, and upon approval by the Company's Board of Directors, the Company completed a Series C convertible preferred stock financing ("Series C") at a price per share of $13.04. The net cash proceeds totaled $8.9 million and 690,128 shares of Series C convertible preferred stock were issued. Issuance costs totaled $0.1 million and were recorded as a reduction of the proceeds. In July 2018, the Company sold an additional 153,360 shares of Series C convertible preferred stock at a price of $13.04 per share for net cash proceeds of $2.0 million. In August 2018, in conjunction with the Collaboration Agreement entered into with bluebird, the Company sold bluebird 768,115 shares of Series C convertible preferred stock at a price of $13.04 per share for gross proceeds of $10.0 million.

In October 2018, the Company closed its initial public offering ("IPO"), of 6,854,202 shares of common stock, including 187,535 shares sold pursuant to the underwriters' partial exercise of their option to purchase additional shares, at an offering price to the public of $15.00 per share. The Company received net proceeds of approximately $92.5 million, after deducting underwriting discounts and commissions and offering costs. In connection with the IPO, all of the Company's outstanding shares of convertible preferred stock were automatically converted into 19,409,132 shares of common stock. The related carrying value of $177.9 million was reclassified to common stock and additional paid-in capital.

In April 2019, the Company completed an underwritten public offering and sold and issued an aggregate of 6,500,000 shares of common stock at a price to the public of $11.50 per share. The Company received aggregate net proceeds from the offering of approximately $69.7 million, after deducting underwriting discounts and commissions and offering costs.

In October 2019, the Company filed a Registration Statement on Form S-3 (the "Shelf Registration Statement") with the SEC, covering the offering of up to $250.0 million of common stock, preferred stock, debt securities, warrants and units. The Shelf Registration Statement included a prospectus covering the offering, issuance and sale of up to $75.0 million of the Company's common stock from time to time through an at the market offering under the Securities Act of 1933, as amended (the "ATM Offering Program"). The SEC declared the Shelf Registration Statement effective on November 8, 2019.

In October 2019, the Company also entered into a sales agreement (the "Sales Agreement") with Cowen and Company, LLC ("Cowen") to sell shares of the Company's common stock, from time to time, with aggregate gross sales proceeds of up to $75.0 million, through an at the market offering under which Cowen will act as its sales agent Cowen is entitled to compensation for its services equal to up to 3.0% of the gross proceeds of any shares of common stock sold through Cowen under the Sales Agreement. In addition, the Company has agreed to reimburse a portion of the expenses of Cowen in connection with the offering up to a maximum of $50,000. During the year ended December 31, 2019, the Company issued and sold 490,880 shares of its common stock through its at the market offering and received net proceeds of approximately $3.8 million, after deducting commissions of $0.1 million and other offering expenses of $0.3 million.

10. Stock-Based Compensation

Award Incentive Plans

In August 2015, the Board of Directors approved the 2015 Equity Incentive Plan ("2015 Plan"). In February 2018, the Company's Board of Directors approved a 507,246 share increase in the number of shares to be reserved under the Company's 2015 Equity Incentive Plan. In connection with the Company's IPO and the effectiveness of the 2018 Award Incentive Plan ("2018 Plan"), the 2015 Plan terminated and no further awards will be granted under the 2015 Plan. The 92,815 shares of common stock shares that were then unissued and available for future issuance under the 2015 Plan became available under the 2018 Plan. The 2015 Plan will continue to govern all outstanding awards by their existing terms.

In September 2018, the Company's Board of Directors approved the 2018 Plan. Under the 2018 Plan, the Company may grant stock options, stock appreciation rights, restricted stock, restricted stock units and other certain awards to individuals who are employees, officers, directors or consultants of the Company. A total of 2,690,000 shares of our common stock are initially reserved for issuance pursuant to a variety of stock-based compensation awards, including stock options, stock appreciation rights, or SARs, restricted stock awards, restricted stock unit awards and other stock-based awards, plus the number of shares remaining available for future awards under the 2015 Plan, as of the effective date of the 2018 Plan. The number of shares of common stock reserved for issuance under the 2018 Plan will automatically increase on January 1 of each year, beginning on January 1, 2019 and continuing through and including January 1, 2028, by 4% of the total number of shares of our stock outstanding on December 31 of the preceding calendar year, or a lesser number of shares determined by the Company's Board of Directors. The maximum number of shares that may be issued upon the exercise of ISOs under the 2018 Plan is 45,000,000.

Prior to the Company's IPO, the grant date fair value of the Company's common stock was determined by the Company's Board of Directors with the assistance of management and an independent third-party valuation specialist.

Subsequent to the Company's IPO, the grant date fair value of each share of common stock underlying stock option awards is based on the closing price of our common stock as reported by the Nasdaq Select Global Market on the date of grant of the award.

The Company's Board of Directors has the authority to determine to whom options will be granted, the number of shares, the term, and the exercise price. If an individual owns stock representing 10% or more of the outstanding shares, the price of each share shall be at least 110% of the fair market value, as determined by the board of directors. Options granted have a term of up to 10 years and generally vest over a 4-year period with a straight-line vesting.

2018 Employee Stock Purchase Plan

In September 2018, the Company's Board of Directors approved the 2018 Employee Stock Purchase Plan ("2018 ESPP"). The 2018 ESPP also became effective in September 2018. A total of 282,334 shares were initially reserved for issuance under the 2018 ESPP. Additionally, the number of shares of common stock reserved for issuance under the 2018 ESPP will increase automatically each year, beginning on January 1, 2019 and continuing through and including January 1, 2028, by the lesser of (1) 1% of the shares of common stock outstanding on December 31 of the preceding calendar year or (2) such lesser number of shares determined by the Company's Board of Directors. The maximum number of shares that may be issued under the 2018 ESPP is 5,000,000. The offering periods are scheduled to start on the first trading day on or after June 1 or December 1 of each year. Contributions under the 2018 ESPP are limited to a maximum of 15% of an employee's eligible compensation.

The estimated fair value of stock purchase rights granted under the ESPP were calculated using the Black-Scholes option-pricing model using the following assumptions:

	Year ended December 31, 2019
Expected dividend yield	—%
Expected term	0.50 year
Risk-free interest rate	2.2%
Expected volatility	74.0%

Valuation of Stock Options

The fair value of each stock option granted to an employee or a director was estimated as of the date of grant using the Black-Scholes model with the following weighted-average assumptions:

	Year Ended December 31,		
	2019	2018	2017
Expected dividend yield	—%	—%	—%
Expected term	6.01 years	6.04 years	6.04 years
Risk-free interest rate	2.3%	2.8%	2.0%
Expected volatility	83.0%	88.0%	94.0%

Management's calculations are based on a grant date valuation approach. Using the Black-Scholes model, the weighted-average grant-date fair value of employee stock options granted was $8.08, $6.59, and $2.00 per share during the years ended December 31, 2019, 2018, and 2017, respectively.

Stock Option Activity

A summary of the 2015 Plan and 2018 Plan activity is as follows:

		Options Outstanding			
	Number of Shares Available for Issuance	Number of Shares	Weighted-Average Exercise Price	Weighted-Average Remaining Contractual Term (in years)	Aggregate Intrinsic Value (in thousands)
Balance at December 31, 2018	2,695,110	2,429,859	$ 5.31	8.86	$ 25,646
Authorized	1,160,000				
Granted	(1,312,610)	1,312,610	$ 11.30		
Exercised	—	(281,024)	$ 1.61		
Cancelled	295,484	(295,484)	$ 8.46		
Repurchased	13,899	—	$ 0.35		
Balance at December 31, 2019	2,851,883	3,165,961	$ 7.83	8.45	$ 8,875
Vested and exercisable – December 31, 2019		1,124,222	$ 5.16	7.88	$ 5,433
Vested and expected to vest – December 31, 2019		2,939,089	$ 7.54	8.38	$ 8,864

For the years ended December 31, 2019, 2018, and 2017, the total intrinsic value of stock option awards exercised was $2.97 million, $0.75 million, and $0.08 million, respectively, determined at the date of option exercise, and the total cash received upon exercise of stock options was not significant for either period. The aggregate intrinsic value was calculated as the difference between the exercise prices of the underlying stock option awards and the estimated fair value of the common stock on the date of exercise.

As of December 31, 2019, $11.5 million of total unrecognized compensation cost related to non-vested employee and consultant options is expected to be recognized over a weighted-average period of 2.76 years. The total fair value of shares vested during the year ended December 31, 2019 was $5.0 million.

Stock-based compensation expense and awards granted to non-employees was insignificant for the years ended December 31, 2019, 2018, and December 31, 2017.

Stock-Based Compensation Expense

Total stock-based compensation for all awards granted to employees and consultants and our 2018 ESPP Plan, before taxes, is as follows (in thousands):

	Year Ended December 31,		
	2019	2018	2017
Research and development expenses	$ 3,437	$ 2,081	$ 888
General and administrative expenses	1,862	914	238
Total	$ 5,299	$ 2,995	$ 1,126

11. Income Taxes

The effective tax rate for the years ended December 31, 2019, 2018 and 2017 is different from the federal statutory rate primarily due to the valuation allowance against deferred tax assets as a result of insufficient sources of income. The effective tax rate of the of the Company's provision for income taxes differs from the federal statutory rate as follows:

	Year Ended December 31,		
	2019	2018	2017
Statutory federal income tax rate	21.0%	21.0%	34.0%
State tax, net of federal benefit	4.2	4.3	2.2
Permanent differences	(0.8)	(1.0)	(2.3)
Effective change in enacted tax rate	—	—	(17.3)
Research and development tax credits	2.6	4.4	4.1
Other	(0.8)	(0.2)	—
Change in valuation allowance	(26.3)	(28.5)	(20.7)
Total provision for income taxes	—%	—%	—%

On December 22, 2017, the U.S. federal government enacted the Tax Cuts and Jobs Act (the "Tax Act"). The Tax Act contains, among other things, significant changes to corporate taxation, including reduction of the corporate tax rate from a top marginal rate of 35% to a flat rate of 21% for tax years beginning after December 31, 2017, limitation of the deduction for net operating losses to 80% of current year taxable income and elimination of net operating loss carrybacks, implementing a territorial tax system.

Pursuant to SAB 118, an entity may select between one of three scenarios to determine a reasonable estimate arising from the Tax Act. The scenarios are (i) a final estimate which effectively closes the measurement window; (ii) a reasonable estimate leaving the measurement window open for future revisions; and (iii) no estimate as the law is still being analyzed. The Company was able to provide a reasonable estimate for the revaluation of deferred taxes. As such, the Company recorded a $7.1 million reduction in deferred tax assets for the revaluation of deferred taxes in 2017 which was offset by a corresponding decrease to the Company's full valuation allowance. The ultimate impact of the Act did not differ materially from provision amounts recorded. Adjustments, if any, would not have impacted the statement of operations and comprehensive loss due to the full valuation allowance on the Company's deferred tax assets.

The Company uses the liability method of accounting for income taxes. Under this method, deferred tax assets and liabilities are determined based on the differences between the financial reporting and the tax bases of assets and liabilities and are measured using the enacted tax rates and laws that will be in effect when the differences are expected to reverse. The Company assesses the likelihood that the resulting deferred tax assets will be realized. A valuation allowance is provided when it is more likely than not that some portion or all of a deferred tax asset will not be realized.

In assessing the realizability of deferred tax assets, the Company considers whether it is more likely than not that some portion or all of the deferred tax assets will not be realized. The ultimate realization of deferred tax assets is dependent upon the generation of future taxable income during the periods in which the temporary differences representing net future deductible amounts become deductible. Due to the Company's history of losses, and lack of other positive evidence, the Company has determined that it is more likely than not that its net deferred tax assets will not be realized, and therefore, the net deferred tax assets are fully offset by a valuation allowance at December 31, 2019 and 2018. The deferred tax assets were primarily comprised of federal and state tax net operating losses and tax credit carryforwards. Utilization of the net operating loss and tax credit carryforwards may be subject to an annual limitation due to historical or future ownership percentage change rules provided by the Internal Review Code of 1986, and similar state provisions. The annual limitation may result in the expiration of certain net operating loss and tax credit carryforwards before their utilization. The valuation allowance increased by $24.9 million during 2019 and increased by $18.4 million during 2018.

The components of the net deferred tax assets/liabilities are as follows (in thousands):

	December 31,	
	2019	2018
Deferred tax assets:		
Federal and state net operating loss carryforwards	$ 45,228	$ 27,311
Research and development tax credits	6,205	4,503
Lease financing obligation	—	2,658
Lease liabilities	5,920	—
Accruals and other	2,172	1,387
Amortization	2,700	1,726
Deferred Revenue	3,659	—
Deferred tax liabilities:		
Other depreciation	(638)	(655)
Leased building depreciation	—	(2,446)
Operating lease right-of-use assets	(5,904)	—
Total net deferred tax assets	59,342	34,484
Less valuation allowance	(59,342)	(34,484)
Deferred tax assets, net of allowance	$ —	$ —

At December 31, 2019, the Company's federal and state income tax net operating loss carryforwards were approximately $180.8 million and $113.3 million, respectively, which may be subject to limitations as described below. If not utilized, the federal tax loss carryforwards will begin to expire in 2035 and the state tax loss carryforwards will begin to expire in 2035. Under the Tax Act, federal net operating losses generated after 2017 and in future years may be carried forward indefinitely, but the deductibility of such federal net operating losses is limited. The federal net operating losses generated after December 31, 2017 of $130.2 million are carried forward indefinitely. In addition, the Company has federal and certain California and Massachusetts research and development income tax credit carryforwards of $5.6 million, $3.4 million and $0.3 million, respectively. If not utilized, the federal research and development income tax credit carryforwards will begin to expire in 2035. The California research and development income tax credit carryforwards do not expire and can be carried forward indefinitely. The Massachusetts research and development income tax credit carryforwards will begin to expire in 2032.

The net operating loss ("NOL") and tax credit carryforwards are subject to review and possible adjustment by the Internal Revenue Service and state tax authorities and may become subject to an annual limitation in the event of certain cumulative changes in the ownership interest of significant stockholders over a three-year period in excess of 50%, as defined under Sections 382 and 383 of the Internal Revenue Code ("IRC") of 1986. This could limit the amount of tax attributes that can be utilized annually to offset future taxable income or tax liabilities. Subsequent ownership changes may further affect the limitation in future years. The Company completed an analysis through December 31, 2019 under IRC Sections 382 and 383 to determine if the Company's net operating loss carryforwards and research and development credits are limited due to a change in ownership. In connection with the Company's IPO which closed in October 2018, the Company did experience an ownership change pursuant to Section 382. There was no reduction in federal or California net operating loss carryforwards or research and development income tax credits as a result of this ownership change. Other than the change identified in connection with the Company's IPO, through December 31, 2019, the Company did not experience any other ownership change pursuant to Section 382.

The following table summarizes the activity related to the Company's unrecognized tax benefits (in thousands):

	December 31,		
	2019	2018	2017
Beginning of year—unrecognized tax benefits	$ 2,077	$ 1,089	$ 230
Decrease for tax positions taken during prior periods	(711)	(453)	(47)
Increases for tax positions taken during current period	1,244	1,441	906
End of year—unrecognized tax benefits	$ 2,610	$ 2,077	$ 1,089

If recognized, none of the unrecognized tax benefits as of December 31, 2019 and 2018 would reduce the annual effective tax rate, primarily due to corresponding adjustments to the valuation allowance. The Company does not expect any material changes to the estimated amount of liability associated with its uncertain tax positions within the next 12 months.

During the years ended December 31, 2019, 2018, and 2017, the Company did not recognize accrued interest and penalties related to unrecognized tax benefits.

The Company files income tax returns in the U.S. federal jurisdiction and various state jurisdictions. The Company is not currently under audit by the Internal Revenue Service or other similar state or local authorities. Due to the net operating loss carryforwards, all years remain open for income tax examination by tax authorities in the United States, various states and foreign tax jurisdictions in which the Company files tax returns.

12. Net Loss Per Common Share

Basic net loss per share is calculated by dividing the net loss by the weighted-average number of shares of common stock outstanding during the period, without consideration for common stock equivalents. Diluted net loss per share is the same as basic net loss per share, since the effects of potentially dilutive securities are antidilutive given the net loss for each period presented.

The following table sets forth the computation of the basic and diluted net loss per share (in thousands, except for share and per share amounts):

	Year Ended December 31,		
	2019	2018	2017
Numerator:			
Net loss	$ (94,433)	$ (64,775)	$ (41,377)
Denominator:			
Weighted-average common shares outstanding, basic and diluted	33,554,823	8,919,281	1,999,044
Net loss per share, basic and diluted	$ (2.81)	$ (7.26)	$ (20.70)

Since the Company was in a loss position for all periods presented, basic net loss per share is the same as diluted net loss per share for all periods as the inclusion of all potential common shares outstanding would have been anti-dilutive. Potentially dilutive securities that were not included in the diluted per share calculations because they would be anti-dilutive were as follows:

	December 31,		
	2019	2018	2017
Convertible preferred stock	—	—	17,797,529
Options issued and outstanding and ESPP shares issuable and outstanding	3,179,041	2,429,859	1,351,840
Early exercised common stock subject to future vesting	30,874	226,967	539,289
Warrants to purchase common stock	—	—	40,257
Total	3,209,915	2,656,826	19,728,915

13. Related-Party Transactions

During the year ended December 31, 2018, the Company issued 333,333 shares of common stock for total net proceeds of $5.0 million to certain stockholders considered to be related parties.

14. Defined Contribution Plan

The Company began sponsoring a 401(k) Plan in 2017 which provides that eligible employees can elect to contribute to the 401(k) Plan, subject to certain limitations, on a pretax basis. The Company matches up to 50% of the first 4% of each employee's contribution. During the years ended December 31, 2019 and 2018, expenses recognized for the 401(k) Plan were insignificant.

15. Subsequent Event

Subsequent to December 31, 2019, the Company issued an additional 568,369 shares of common stock through its ATM Offering Program resulting in net proceeds to the Company of approximately $5.6 million.

16. Selected Quarterly Financial Data (Unaudited)

The following tables show a summary of the Company's quarterly financial information for each of the four quarters of 2019 and 2018 and has been prepared in accordance with GAAP for interim financial reporting (in thousands, except per share amounts). In the opinion of management, all adjustments (consisting of normal recurring accruals) considered necessary for a fair presentation have been included.

	Quarter Ended			
	December 31, 2019	September 30, 2019	June 30, 2019	March 31, 2019
Collaboration revenue	$ 884	$ 984	$ 1,150	$ 1,347
Loss from operations	$ (28,313)	$ (28,484)	$ (22,214)	$ (18,929)
Net loss	$ (27,704)	$ (27,548)	$ (21,172)	$ (18,009)
Net loss per share, basic and diluted	$ (0.77)	$ (0.77)	$ (0.63)	$ (0.62)

	Quarter Ended			
	December 31, 2018	September 30, 2018	June 30, 2018	March 31, 2018
Collaboration revenue	$ 1,091	$ 96	$ —	$ —
Loss from operations	$ (18,027)	$ (18,614)	$ (15,504)	$ (13,439)
Net loss	$ (17,338)	$ (18,588)	$ (15,473)	$ (13,376)
Net loss per share, basic and diluted	$ (0.61)	$ (7.60)	$ (6.57)	$ (6.03)

Item 9. Changes in and Disagreements With Accountants on Accounting and Financial Disclosure.

None.

Item 9A. Controls and Procedures.

Conclusions Regarding the Effectiveness of Disclosure Controls and Procedures

As of December 31, 2019, management, with the participation of our Chief Executive Officer and Chief Financial Officer, performed an evaluation of the effectiveness of the design and operation of our disclosure controls and procedures as defined in Rules 13a-15(e) and 15d-15(e) of the Exchange Act. Our disclosure controls and procedures are designed to ensure that information required to be disclosed in the reports we file or submit under the Exchange Act is recorded, processed, summarized and reported within the time periods specified in the SEC's rules and forms, and that such information is accumulated and communicated to our management, including the Chief Executive Officer and the Chief Financial Officer, to allow timely decisions regarding required disclosures.

Any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving the desired control objective and management necessarily applies its judgment in evaluating the cost-benefit relationship of possible controls and procedures. Based on this evaluation, our Chief Executive Officer and Chief Financial Officer concluded that, as of December 31, 2019, the design and operation of our disclosure controls and procedures were effective at a reasonable assurance level.

Changes in Internal Control over Financial Reporting

There was no change in our internal control over financial reporting identified in connection with the evaluation required by Rule 13a-15(d) and 15d-15(d) of the Exchange Act that occurred during the year ended December 31, 2019 that has materially affected, or is reasonably likely to materially affect, our internal control over financial reporting, other than the implementation of a new General Ledger (GL) system for financial accounting and reporting to replace our legacy GL system. The implementation of this new system was not in response to any identified deficiency or material weakness in our internal control over financial reporting. The system implementation was designed, in part, to enhance the overall system of internal control over financial reporting through further automation of various business processes.

Management's Report on Internal Control over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting (as defined in Rule 13a-15(f) under the Exchange Act). Under the supervision of and with the participation of our Principal Executive Officer and Principal Financial Officer, our management assessed the effectiveness of our internal control over financial report as of December 31, 2019 based on the criteria set forth by the Committee of Sponsoring Organizations of the Treadway Commission in "Internal Control-Integrated Framework" (2013). Based on this assessment, management concluded that our internal control over financial reporting was effective as of December 31, 2019.

This Annual Report on Form 10-K does not include an attestation report of our independent registered public accounting firm on our internal control over financial reporting due to an exemption established by the JOBS Act for "emerging growth companies."

Item 9B. Other Information.

None.

PART III

Item 10. Directors, Executive Officers and Corporate Governance.

Information required by this item will be contained in our definitive proxy statement to be filed with the SEC on Schedule 14A in connection with our 2020 Annual Meeting of Stockholders (the "Proxy Statement"), which is expected to be filed not later than 120 days after December 31, 2019, and is incorporated herein by reference.

Item 11. Executive Compensation.

Information required by this item will be contained in the Proxy Statement and is incorporated herein by reference.

Item 12. Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters.

Information required by this item will be contained in the Proxy Statement and is incorporated herein by reference.

Item 13. Certain Relationships and Related Transactions, and Director Independence.

Information required by this item will be contained in the Proxy Statement and is incorporated herein by reference.

Item 14. Principal Accounting Fees and Services.

Information required by this item will be contained in the Proxy Statement and is incorporated herein by reference.

PART IV

Item 15. Exhibits, Financial Statement Schedules.

(a) The following documents are filed as part of this report:

1. Financial Statements

See Index to Financial Statements in Part II Item 8 of this Annual Report on Form 10-K.

2. Financial Statement Schedules

All schedules are omitted because they are not applicable or the required information is shown in the financial statements or notes thereto.

3. Exhibits

The documents listed in the Exhibit Index are incorporated by reference or are filed with this report, in each case as indicated therein (numbered in accordance with Item 601 of Regulation S-K).

Exhibit Number	Exhibit Description	Incorporated by Reference			Filed Herewith
		Form	Date	Number	
3.1	Amended and Restated Certificate of Incorporation, as amended.	8-K	10/02/2018	3.1	
3.2	Amended and Restated Bylaws.	8-K	10/02/2018	3.2	
4.1	Reference is made to exhibits 3.1 through 3.2.				
4.2	Form of Common Stock Certificate.	S-1/A	09/17/18	4.2	
4.3	Description of Common Stock.				X
10.1(a)†	License Agreement, dated as of October 16, 2017, by and among Gritstone Oncology, Inc., Arbutus Biopharma Corporation and its subsidiary Protiva Biotherapeutics Inc.	S-1	08/23/18	10.1(a)	
10.1(b)†	Amendment Number One to License Agreement, dated as of July 20, 2018, by and among Gritstone Oncology, Inc., Arbutus Biopharma Corporation and its subsidiary Protiva Biotherapeutics Inc.	S-1	08/23/18	10.1(b)	
10.2(a)#	2018 Incentive Award Plan.	S-8	10/02/18	99.2(A)	
10.2(b)#	Form of Stock Option Grant Notice and Stock Option Agreement under the 2018 Incentive Award Plan.	S-1/A	09/17/18	10.7(b)	
10.2(c)#	Form of Restricted Stock Award Grant Notice under the 2018 Incentive Award Plan.	S-1/A	09/17/18	10.7(c)	
10.2(d)#	Form of Restricted Stock Unit Award Grant Notice under the 2018 Incentive Award Plan.	S-1/A	09/17/18	10.7(d)	
10.3#	Employment Agreement by and between Gritstone Oncology, Inc. and Andrew Allen, M.D., Ph.D., effective as of September 27, 2018.	S-1/A	09/17/18	10.9	
10.4#	Employment Agreement by and between Gritstone Oncology, Inc. and Matthew Hawryluk, Ph.D., effective as of September 27, 2018.	S-1/A	09/17/18	10.10	
10.5#	Employment Agreement by and between Gritstone Oncology, Inc. and Karin Jooss, Ph.D., effective as of September 27, 2018.	S-1/A	09/17/18	10.11	
10.6#	Employment Agreement by and between Gritstone Oncology, Inc. and Raphaël Rousseau, M.D., Ph.D., effective as of September 27, 2018.	S-1/A	09/17/18	10.12	

10.7#	Employment Agreement by and between Gritstone Oncology, Inc. and Roman Yelensky, Ph.D., effective as of September 27, 2018.	S-1/A	09/17/18	10.13	
10.8#	Employment Agreement by and between Gritstone Oncology, Inc. and Jean-Marc Bellemin, effective as of September 27, 2018.	S-1/A	09/17/18	10.14	
10.9#	Employment Agreement by and between Gritstone Oncology, Inc. and Jayant Aphale, Ph.D., effective as of September 27, 2018.	S-1/A	09/17/18	10.15	
10.10#	Employment Agreement by and between Gritstone Oncology, Inc. and Erin Jones, effective as of September 27, 2018.	S-1/A	09/17/18	10.16	
10.11#	Employment Agreement by and between Gritstone Oncology, Inc. and Vijay Yabannavar, Ph.D., effective as of July 2, 2019.	10-Q	11/12/19	10.1	
10.12#	Non-Employee Director Compensation Program.	S-1/A	09/17/18	10.17	
10.13#	2018 Employee Stock Purchase Plan.	S-8	10/02/18	99.3	
10.14	Lease, dated as of February 11, 2016, by and between Gritstone Oncology, Inc. and BMR-Sidney Research Campus LLC.	S-1	08/23/18	10.4	
10.15	Office Building Net Lease, dated as of March 24, 2017, by and between Gritstone Oncology, Inc. and Hacienda Portfolio Venture, LLC.	S-1	08/23/18	10.5	
10.16	Office/Laboratory Lease, by and between Gritstone Oncology, Inc. and Emery Station West, LLC, effective as of January 28, 2019.	8-K	02/05/19	10.1	
10.17	Office/Laboratory Lease, by and between Gritstone Oncology, Inc. and MIL 21E, LLC, effective as of September 6, 2018.	10-Q	11/20/19	10.2	
10.18	First Amendment to Office/Laboratory Lease, by and between Gritstone Oncology, Inc. and MIL 21E, LLC, effective as of July 11, 2019.	10-Q	11/20/19	10.3	
10.19	Amended and Restated Investors' Rights Agreement dated as of June 29, 2018, by and among Gritstone Oncology, Inc. and the investors listed therein.	S-1	08/23/18	10.2	
10.20	Sales Agreement, dated October 15, 2019, by and between Gritstone Oncology, Inc. and Cowen and Company, LLC.	S-3	10/15/19	1.2	
10.21	Form of Indemnification Agreement.	S-1/A	09/17/18	10.18	
23.1	Consent of Independent Registered Public Accounting Firm				X
31.1	Certification of Chief Executive Officer of Gritstone Oncology, Inc., as required by Rule 13a-14(a) or Rule 15d-14(a) under the Securities Exchange Act of 1934, as amended.				X
31.2	Certification of Chief Financial Officer of Gritstone Oncology, Inc., as required by Rule 13a-14(a) or Rule 15d-14(a) under the Securities Exchange Act of 1934, as amended.				X
32.1*	Certification by the Chief Executive Officer and Chief Financial Officer, as required by Rule 13a-14(b) or Rule 15d-14(b) under the Securities Exchange Act of 1934, as amended, and Section 1350 of Chapter 36 of Title 18 of the United States Code (18 U.S.C. §1350).				X
101.INS	XBRL Instance Document				X
101.SCH	XBRL Taxonomy Extension Schema Document				X

101.CAL	XBRL Taxonomy Extension Calculation Linkbase Document	X
101.DEF	XBRL Taxonomy Extension Definition Linkbase Document	X
101.LAB	XBRL Taxonomy Extension Labels Linkbase Document	X
101.PRE	XBRL Taxonomy Extension Presentation Linkbase Document	X

† Confidential treatment has been granted for certain information contained in this exhibit. Such information has been omitted and filed separately with the SEC.

# Indicates management contract or compensatory plan.

* The certification attached as Exhibit 32.1 that accompanies this Annual Report on Form 10-K is not deemed filed with the SEC and is not to be incorporated by reference into any filing of Gritstone Oncology, Inc. under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended, whether made before or after the date of this Annual Report on Form 10-K, irrespective of any general incorporation language contained in such filing.

Item 16. Form 10-K Summary

None.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, as amended, the Registrant has duly caused this Annual Report on Form 10-K to be signed on its behalf by the undersigned, thereunto duly authorized.

GRITSTONE ONCOLOGY, INC.

Date: March 11, 2020

By: /s/ Andrew Allen
Andrew Allen, M.D., Ph.D.
President and Chief Executive Officer
(Principal Executive Officer)

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

Name	Title	Date
/s/ Andrew Allen Andrew Allen, M.D., Ph.D.	President and Chief Executive Officer (Principal Executive Officer)	March 11, 2020
/s/ Jean-Marc Bellemin Jean-Marc Bellemin	Chief Financial Officer (Principal Financial Officer)	March 11, 2020
/s/ Richard Heyman Richard A. Heyman, Ph.D.	Director	March 11, 2020
/s/ Judith Li Judith J. Li	Director	March 11, 2020
/s/ Steve Krognes Steve Krognes	Director	March 11, 2020
/s/ Nicholas Simon Nicholas Simon	Director	March 11, 2020
/s/ Elaine Jones Elaine Jones	Director	March 11, 2020
/s/ Tom Woiwode Tom Woiwode	Director	March 11, 2020

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BOARD OF DIRECTORS

Andrew Allen, M.D., Ph.D.
Co-founder, President and
Chief Executive Officer
Gritstone Oncology, Inc.

Richard A. Heyman, Ph.D.
Executive Chairman and
Co-founder of Metacrine

Elaine V. Jones, Ph.D.
Former Vice President and Senior Partner
Pfizer Ventures

Steve Krognes
Chief Financial Officer
Denali Therapeutics

Judith J. Li
Partner
Lilly Asia Ventures (LAV)

Nicholas Simon
Senior Managing Director
Blackstone Life Sciences

Tom Woiwode, Ph.D.
Managing Director
Versant Ventures

SCIENTIFIC ADVISORY BOARD

Timothy A. Chan, M.D., Ph.D.

James L. Gulley, M.D., Ph.D.

Graham Lord, M.D., Ph.D.

Naiyer A. Rizvi, M.D.

Alessandro Sette, Dr. Biol. Sci.

Jean-Charles Soria, M.D., Ph.D.

Eugene Zhukovsky, Ph.D.

EXECUTIVE MANAGEMENT

Andrew Allen, M.D., Ph.D.
Co-founder, President and
Chief Executive Officer

Jean-Marc Bellemin, M.B.A.
Executive Vice President and
Chief Financial Officer

Mike Forcht, Ed.D., M.B.A.
Senior Vice President,
People and Corporate Services

Matthew Hawryluk, Ph.D., M.B.A.
Executive Vice President and
Chief Business Officer

Erin E. Jones, M.S.
Executive Vice President,
Global Regulatory Affairs and Quality

Karin Jooss, Ph.D.
Executive Vice President, Research
and Chief Scientific Officer

Raphaël F. Rousseau, M.D., Ph.D.
Executive Vice President and
Chief Medical Officer

Rahsaan Thompson, J.D.
Executive Vice President and
General Counsel

Vijay Yabannavar, Ph.D.
Executive Vice President,
Manufacturing and Technical Operations

Roman Yelensky, Ph.D.
Executive Vice President and
Chief Technology Officer

OBTAINING FINANCIAL STATEMENTS

A copy of our Annual Report on Form 10-K is posted to our website. You may also obtain a copy by written or email request to:

Gritstone Oncology, Inc.
5959 Horton Street, Suite 300
Emeryville, CA 94608

Attn: Investor Relations
Email: ir@gritstone.com

ANNUAL MEETING

June 18, 2020 at 9:00am PT

Our virtual shareholder meeting may be accessed at www.virtualshareholdermeeting.com/GRTS2020 using the 16-digit control number which is included on the Notice of Internet Availability of Proxy Materials and your proxy card.

TRADING INFORMATION

The common stock of Gritstone Oncology, Inc. is traded on the Nasdaq Global Select Market under the symbol GRTS.

TRANSFER AGENT

Information regarding stock certificates, change of address, ownership transfer or other stock matters can be obtained from:

American Stock Transfer & Trust LLC
6201 15th Avenue
Brooklyn, NY 11219
www.astfinancial.com

Email: help@astfinancial.com
Phone: (800) 937-5449 or (718) 921-8124

INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

Ernst & Young LLP
275 Shoreline Drive, Suite 600
Redwood City, CA 94065
Phone: (650) 802-4500

About Gritstone Oncology:

Gritstone Oncology (Nasdaq: GRTS), a clinical-stage biotechnology company, is developing the next generation of cancer immunotherapies to fight multiple cancer types. Gritstone develops its products by leveraging two key pillars—first, a proprietary machine learning-based platform, Gritstone EDGE™, which is designed to predict, from a routine tumor biopsy, the tumor-specific neoantigens (TSNA) that are presented on a patient's tumor cells; and second, the ability to develop and manufacture potent immunotherapies utilizing patients' TSNA to potentially drive the patient's immune system to specifically attack and destroy tumors. The company's "off the shelf" shared neoantigen-based immunotherapy, SLATE, and its individualized neoantigen-based immunotherapy, GRANITE, are being evaluated in Phase 1 clinical studies. Novel tumor-specific antigens can also provide targets for bispecific antibody (BiSAb) therapeutics for solid tumors, and Gritstone's BiSAb program is currently in lead optimization. For more information, please visit gritstoneoncology.com.

Forward-Looking Statements:

This report contains forward-looking statements including, but not limited to, statements related to our preclinical and clinical product candidates, GRANITE, SLATE, and our bispecific antibody program. All statements other than statements of historical facts contained in this report, including statements regarding the timing of immunogenicity and clinical data for GRANITE and SLATE, identification of a development candidate for our bispecific antibody program, our future results of operations and financial position, business strategy, prospective products, availability of funding, clinical trial results, product approvals and regulatory pathways, timing and likelihood of success, plans and objectives of management for future operations, future results of current and anticipated products, and our ability to create value are forward-looking statements. Because forward-looking statements are inherently subject to risks, uncertainties and other important factors that may cause our actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by the forward-looking statements. The events and circumstances reflected in our forward-looking statements may not be achieved or occur and actual results could differ materially from those projected in the forward-looking statements.

Except as required by applicable law, we do not plan to publicly update or revise any forward-looking statements contained herein, whether as a result of any new information, future events, changed circumstances or otherwise. For a further description of the risks and uncertainties that could cause actual results to differ from those expressed in these forward-looking statements, as well as risks relating to the business of the company in general, see Gritstone's periodic filings with the Securities and Exchange Commission (the "SEC"), including its Annual Report filed on March 11, 2020 and any current and periodic reports filed thereafter.

DESIGN: HANE CHOW, INC.

5959 Horton Street
Suite 300
Emeryville, CA 94608
(510) 871-6100

www.gritstoneoncology.com