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As filed with the Securities and Exchange Commission on June 4, 2013

Registration No. 333-188605

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

Amendment No. 2
to
FORM S-1
REGISTRATION STATEMENT
UNDER
THE SECURITIES ACT OF 1933

bluebird bio, Inc.

(Exact name of registrant as specified in its charter)

Delaware	2836	13-3680878
(State or other jurisdiction of incorporation or organization)	(Primary Standard Industrial Classification Code Number)	(I.R.S. Employer Identification Number)

840 Memorial Drive, 4th Floor
Cambridge, MA 02139
(617) 491-5601
(Address, including zip code, and telephone number, including area code, of registrant's principal executive offices)

Nick Leschly
President and Chief Executive Officer
bluebird bio, Inc.
840 Memorial Drive, 4th Floor
Cambridge, MA 02139
(617) 491-5601
(Name, address, including zip code, and telephone number, including area code, of agent for service)

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

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

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

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

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

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

Large accelerated filer ☐	Accelerated filer ☐	Non-accelerated filer ☒ (Do not check if a smaller reporting company)	Smaller reporting company ☐

CALCULATION OF REGISTRATION FEE

Title of each class of securities to be registered	Amount to be Registered(1)	Proposed Maximum Offering Price Per Share(2)	Proposed Maximum Aggregate Offering Price(2)	Amount of Registration Fee(3)
Common stock, $0.01 par value	5,750,000	$16.00	$92,000,000.00	$12,548.80

(1) Includes 750,000 shares which the underwriters have the option to purchase.

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

(3) Of this amount, $11,764.50 was previously paid in connection with the initial filing of this Registration Statement on May 14, 2013.

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

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

Subject to completion, dated June 4, 2013

Prospectus

5,000,000 shares

Common stock

This is an initial public offering of common stock by bluebird bio, Inc. We are selling 5,000,000 shares of common stock. The estimated initial public offering price is between $14.00 and $16.00 per share.

Prior to this offering, there has been no public market for our common stock. We have applied for listing of our common stock on The Nasdaq Global Market under the symbol “BLUE.”

We are an “emerging growth company” under applicable Securities and Exchange Commission rules and will be subject to reduced public company reporting requirements.

	Per share	Total
Initial public offering price	$	$
Underwriting discounts and commissions(1)	$	$
Proceeds to bluebird bio, before expenses	$	$

(1) The underwriters will receive compensation in addition to the underwriting discount. See “Underwriting” beginning on page 192.

We have granted the underwriters an option for a period of 30 days to purchase up to 750,000 additional shares of common stock.

Investing in our common stock involves a high degree of risk. See “ Risk factors” beginning on page 13.

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

The underwriters expect to deliver the shares of common stock to investors on or about , 2013.

J.P. Morgan **BofA Merrill Lynch**

Cowen and Company

Canaccord Genuity **Wedbush PacGrow Life Sciences**

, 2013

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

No action is being taken in any jurisdiction outside the United States to permit a public offering of our common stock or possession or distribution of this prospectus in that jurisdiction. Persons who come into possession of this prospectus in jurisdictions outside the United States are required to inform themselves about and to observe any restrictions as to this offering and the distribution of this prospectus applicable to that jurisdiction.

Prospectus summary

Overview

We are a clinical-stage biotechnology company focused on transforming the lives of patients with severe genetic and orphan diseases using gene therapy. Many diseases have a genetic aspect whereby a mutated gene linked to a disease is passed down from generation to generation. Genes produce proteins that perform a vast array of functions within all living organisms, through a process called gene expression. A mutation, or alteration, in the gene or in sequences that control the expression of that gene can cause proteins to be produced aberrantly in the cell, which can cause disease. Gene therapy seeks to introduce a functional copy of the defective gene into a patient's own cells, a process called gene transfer. Gene therapy thereby has the potential to change the way these patients are treated by correcting the underlying genetic defect that is the *cause* of their disease, rather than offering solutions that only address their *symptoms*. Accordingly, we believe gene therapy has the potential to provide transformative disease modifying effects with life-long clinical benefits based on a single therapeutic administration.

In the gene transfer process, a functional gene is delivered and incorporated into a patient's cells through a delivery system called a vector, which are most commonly based on naturally-occurring viruses that have been modified to take advantage of the virus' natural ability to introduce genes into cells. However, unlike naturally-occurring viruses, which replicate following infection of a target cell and have the capacity to infect new cells, viral vectors are modified to be non-replicating by deleting that portion of the viral genome responsible for replication. Gene transfer using a viral vector is called transduction and the resulting gene-modified cells are described as transduced cells.

A growing body of gene therapy-based clinical data, the establishment of regulatory guidelines to govern the development and approval of gene therapy products and increased investment from the biopharmaceutical industry suggest that the time is now for gene therapy to emerge as an important new therapeutic modality for patients with significant unmet medical need. We believe we are particularly well-positioned to drive the continued advancement of gene therapy technology for the treatment of severe genetic and orphan diseases. We have assembled extensive expertise in viral vector design, manufacturing and gene transfer, a broad intellectual property estate, an experienced management team and a world-class group of scientific advisors and key opinion leaders. We refer to our viral vector and gene transfer technology and know-how as our gene therapy platform.

We and our scientific collaborators have generated what we believe is human proof-of-concept data for our gene therapy platform in two underserved diseases, each of which has been granted orphan drug status by U.S. and European regulatory authorities. We expect to initiate in late 2013 a Phase II/III clinical study of our most advanced product candidate, Lenti-D, to evaluate its safety and efficacy in subjects with childhood cerebral adrenoleukodystrophy, or CCALD, a rare, hereditary neurological disorder affecting young boys that is often fatal. We also expect to initiate in mid-2013 a Phase I/II clinical study in the United States and have initiated a Phase I/II clinical study in Europe of our next most advanced product candidate, LentiGlobin, to evaluate its safety and efficacy in subjects with ß-thalassemia major and, in the European clinical study, sickle cell disease, or SCD, which are rare, hereditary blood disorders that often lead to severe anemia

and shortened lifespans. In addition, in March 2013, we announced a global strategic collaboration with Celgene Corporation to discover, develop and commercialize novel, disease-altering gene therapies in oncology.

Our gene therapy platform and process

Our gene therapy platform is based on viral vectors that utilize a modified, non-replicating version of the Human Immunodeficiency Virus Type 1, or HIV-1 virus, that has been stripped of all of the components required for it to self-replicate and infect additional cells. The HIV-1 virus is part of the lentivirus family of viruses, as a result of which we refer to our vectors as lentiviral vectors. Our lentiviral vectors are used to introduce a functional copy of a gene to the patient's own isolated blood stem cells, called hematopoietic stem cells, or HSCs, which reside in a patient's bone marrow and are capable of differentiating into a wide range of cell types. HSCs are dividing cells, thus our approach allows for sustained expression of the modified gene as we are able to take advantage of a lifetime of replication of the gene-modified HSCs. Additionally, we have developed a proprietary cell-based vector manufacturing process that is both reproducible and scalable. We believe our innovations in viral vector design and related manufacturing processes are important steps towards advancing the field of gene therapy and in realizing its full potential on a commercial scale, a concept we refer to as the industrialization of gene therapy.

We believe our lentiviral vectors have certain advantages over other viral vectors used for gene therapy, including the ability to achieve long-term, sustained expression of the modified gene and reduced risk of insertional oncogenesis, the process whereby the corrected gene inserted near a gene that is important in cell growth or division, and this insertion results in uncontrolled cell division also known as cancer. Although our initial focus is in CCALD, ß-thalassemia and SCD, we believe our gene therapy platform has broad therapeutic potential in a variety of indications. We believe our vectors can be used to introduce virtually any gene and have the potential to be manufactured on a commercial scale reproducibly and reliably, as each new vector is produced using substantially the same process. We also take advantage of lentivirus' ability to transduce HSCs more efficiently than other vectors, such as those derived from another virus used in gene therapy approaches, called adeno-associated virus, or AAV, which gives us the potential to address diseases in a variety of cell lineages that are derived from HSCs, such as microglia (useful for CCALD), red blood cells (useful for ß-thalassemia and SCD), T cells (useful for cancer and immunology) and others.

Based in part on these features, we believe our gene therapy platform has several potential advantages over current treatment options for CCALD, ß-thalassemia and SCD, including the following:

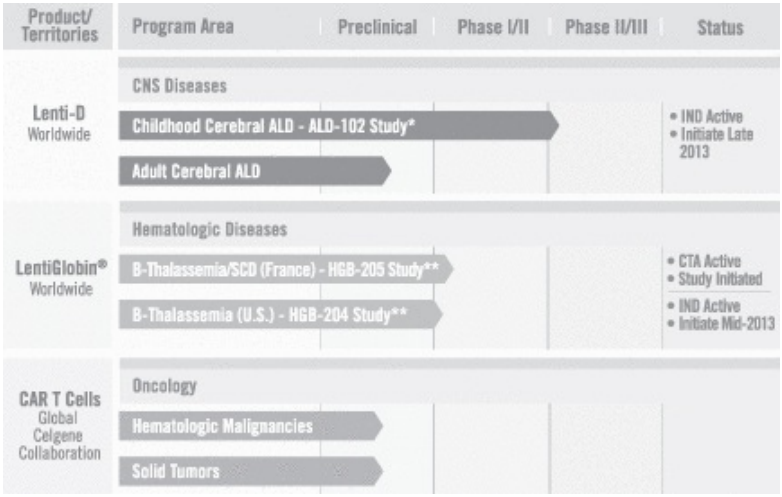
- **Single administration with potential life-long benefit.** Our process allows us to potentially arrest, correct or treat a disease with a single therapeutic administration.
- **We know exactly what gene to insert.** We are initially pursuing diseases where the genetic abnormality is known and is found in a single gene, known as monogenic diseases, thus mitigating against the uncertainty of the disease biology.
- **Existing practice of transplanting cells from a donor provides proof-of-concept for our approach.** Clinical proof-of-concept already exists for the diseases we are targeting via

allogeneic hematopoietic stem cell transplant, or HSCT, an approach of treating a patient with HSCs contributed by a donor that contain a functioning copy of the gene underlying the disease.

- **We use the patient's own cells.** By using the patient's own isolated HSCs, we believe our approach will eliminate many of the challenges associated with allogeneic HSCT, such as the limited availability of optimally matched donors and risks of transplant rejection that often result in serious adverse events, such as graft-versus-host disease, or GVHD.
- **We modify our target cells outside the patient's body.** By inserting the new functional deoxyribonucleic acid, or DNA, into the cells outside the patient's body, or *ex vivo*, thereby creating a gene-modified cell, we reduce the risk of adverse events and remove one of the key biological complexities of any therapeutic—getting a drug directly to the target cells.
- **Administration of our drug product is consistent with existing stem cell transplant practices.** The final step of our process, in which patients are myeloablated and then transfused with the finished drug product, is consistent with widely-adopted stem cell transplant clinical practices and infrastructure already in use.
- **Value proposition to patients, families, providers and payors.** Given the potentially dramatic clinical and life-long benefits anticipated from such therapies delivered through a single administration, we believe the value proposition for patients, families, providers and payors would be significant.

Our product candidate pipeline

Below is a summary of key information on our development programs:



* The Phase II/III ALD-102 Study is our first clinical study of our current Lenti-D viral vector and product candidate. See "Business—Our Lenti-D product candidate."

** The Phase I/II HGB-205 and HGB-204 Studies are our first clinical studies of our current LentiGlobin viral vector and product candidate. See "Business—Our LentiGlobin product candidate."

Our Lenti-D product candidate

Our most advanced product candidate is called Lenti-D, which we are developing initially to treat patients with CCALD, a rare, hereditary neurological disorder affecting young boys that is often fatal. CCALD is caused by mutations in the ABCD1 gene, which encodes for a protein called the ALD protein, or ALDP, which in turn plays a critical role in the breakdown and metabolism of very long-chain fatty acids, or VLCFA. Without functional ALDP, VLCFA accumulate in cells, including neural cells, which causes damage to the myelin sheath, a protective and insulating membrane that surrounds nerve cells in the brain. CCALD is characterized by progressive destruction of myelin, leading to severe loss of neurological function and eventual death. The worldwide incidence rate for adrenoleukodystrophy, or ALD, the superset of CCALD, is approximately one in 20,000 newborn males; CCALD accounts for about 30-40% of patients diagnosed with ALD.

Our approach involves the *ex vivo* insertion of a functional copy of the ABCD1 gene via an HIV-1 based lentiviral vector into the patient's own HSCs to correct the aberrant expression of ALDP in patients with CCALD. HSCs derived from the patient's own body are called autologous HSCs. We refer to autologous HSCs that have been modified to carry the functional copy of the ABCD1 gene as the final Lenti-D drug product, or our Lenti-D product candidate.

We performed a non-interventional retrospective data collection study, called the ALD-101 Study, from a total of 136 CCALD patients to assess the course of disease in patients who were left untreated and patients who received allogeneic HSCT. A non-interventional retrospective data collection study involves an examination of historical clinical records from patients with the pertinent condition in order to assess the typical course of the condition and the efficacy and safety of treatment options. We believe the ALD-101 Study is the most comprehensive natural history study ever conducted to characterize clinical outcomes in CCALD. Our analysis identified the Neurological Function Score, or NFS, Loes Score and gadolinium enhancement as the three most common cognitive, behavioral, functional and radiological modalities utilized to assess patients with CCALD. A comparison of data from treated and untreated patient cohorts in this data collection study provided a framework with which to correlate patterns in these modalities with the eventual stabilization or progression of disease in these patients. We believe the results of this study support our approach of using autologous, gene-modified HSCs to treat CCALD, especially in light of several significant safety concerns commonly associated with the current standard of care, allogeneic HSCT. Results from a Phase I/II study in four patients with CCALD conducted by our scientific collaborators in France with an earlier generation lentiviral vector supplied by a third party provide additional proof-of-concept support for our approach, and were helpful in the design of our own trials to evaluate the efficacy and safety of Lenti-D.

In April 2013, the U.S. Food and Drug Administration, or the FDA, informed us that the Investigational New Drug application, or IND, we filed in March 2013 for a Phase II/III clinical study to evaluate our Lenti-D product candidate in preserving neurological function and stabilizing cerebral demyelination in subjects with CCALD, which we refer to as the ALD-102 Study, is now active. Up to 15 patients will be enrolled to obtain at least 12 evaluable subjects that will be followed over a 24-month period for the onset of major functional disabilities, or MFDs, and other key assessments of disease progression. We expect to initiate the ALD-102 Study in the United States in late 2013. If successful, we believe the results of this study could support

submission of a Biologics License Application, or BLA, and a Marketing Authorization Application, or MAA, filing for our Lenti-D product candidate; however, there can be no assurance that regulatory agencies will not require one or more additional clinical studies prior to granting regulatory approval.

Our LentiGlobin product candidate

Our next most advanced product candidate is called LentiGlobin, which we are developing to treat patients with ß-thalassemia and SCD. ß-thalassemia is a rare hereditary blood disorder caused by a genetic abnormality of the ß-globin gene resulting in defective red blood cells. Symptoms of ß-thalassemia can include severe anemia, splenomegaly, marrow expansion, bone deformities and iron overload in major organs. It has been estimated that about 1.5% (80 to 90 million people) of the global population are carriers of ß-thalassemia, with about 60,000 symptomatic individuals born annually, the great majority in the developing world. According to Thalassemia International Federation, about 288,000 patients with ß-thalassemia major are alive and registered as receiving regular treatment around the world, of which it is estimated that about 15,000 live in the United States and Europe. SCD is a hereditary blood disorder resulting from a mutation in the ß-globin gene that causes polymerization of hemoglobin proteins and abnormal red blood cell function. SCD is characterized by anemia, vaso-occlusive crisis (a common complication of SCD in which there is severe pain due to obstructed blood flow in the bones, joints, lungs, liver, spleen, kidney, eye, or central nervous system), infections, stroke, overall poor quality of life and early death in a large subset of patients. The global incidence of SCD is estimated to be 250,000-300,000 births annually, and the global prevalence of the disease is estimated to be about 20-25 million.

Our approach involves the insertion of a single codon variant of the normal ß-globin gene, referred to as T87Q, into the patient's own HSCs via an HIV-1 based lentiviral vector to restore expression of the ß-globin protein required for hemoglobin production. The codon variant is also used as a biomarker to quantify expression levels of ß-globin protein derived from the vector ($ß^{A\_T87Q}$-globin), and provides strong anti-sickling properties in the context of SCD. We refer to the gene-modified HSCs as the final LentiGlobin drug product, or our LentiGlobin product candidate.

In a Phase I/II study of patients with ß-thalassemia major being conducted by our scientific collaborators in France with an earlier generation of our LentiGlobin vector called HPV569, data have provided initial evidence of transfusion independence following treatment with gene modified HSCs. Going forward, we plan to use our new LentiGlobin vector for our studies based on higher transduction efficiency and expression of ß-globin protein in target cells as compared to the HPV569 vector. We have initiated this study in France using a revised clinical protocol based on the use of LentiGlobin instead of HPV569. This Phase I/II continuation study, which we refer to as the HGB-205 Study, will enroll up to seven additional subjects with ß-thalassemia major or SCD to evaluate transfusion requirements post-transplant, as well as the number of hospitalization days post-transplant discharge. In SCD patients only, efficacy will also be measured based on the number of vaso-occlusive crises or acute chest syndrome events.

We also expect to initiate in mid-2013 a Phase I/II clinical study in the United States to evaluate our LentiGlobin product candidate in increasing hemoglobin production and eliminating or reducing transfusion dependence in patients with ß-thalassemia major, which we refer to as the HGB-204 Study. Up to 15 adults will be enrolled to evaluate production of hemoglobin containing

ß$^{A\text{-}T87Q}$-globin for the six-month period between 18 and 24 months post-transplant, followed by long-term monitoring to assess safety and efficacy beyond the initial 24 months. We expect to submit an IND with the FDA in 2014 to evaluate LentiGlobin in patients with SCD.

Our strategic alliance with Celgene

In March 2013, we announced a global strategic collaboration with Celgene Corporation to discover, develop and commercialize novel, disease-altering gene therapies in oncology. The collaboration will focus on applying gene therapy technology to genetically modify a patient's own T cells to target and destroy cancer cells. Such modified T cells, which are called chimeric antigen receptor, or CAR, cells, have been shown to have beneficial effects in human clinical trials for patients with B cell lymphomas. The multi-year research and development collaboration has the potential to lead to the development and commercialization of multiple CAR T cell products. See "Business—Our strategic alliance with Celgene."

Our strategy

Our objective is to develop and commercialize a next generation of products based on the transformative potential of gene therapy to treat patients with severe genetic and orphan diseases. Central to this effort is a collective determination within our Company to provide these patients with hope for a better life in the face of limited or no long-term safe and effective treatment options. Specifically, our business strategy is based on the following principles:

- Relentlessly focus on serving our patients.
- Be the world's biggest gene therapy geeks, with world-class expertise in the field of gene therapy.
- Leverage our platform and technical expertise to build a gene therapy product engine for severe genetic and orphan diseases.
- Develop and commercialize drugs in our core disease areas and partner selectively to expand the scope of our pipeline.
- Pursue indications with high unmet medical need and greater probability of clinical, regulatory and commercial success.

Risks related to our business

Our ability to implement our business strategy is subject to numerous risks that you should be aware of before making an investment decision. These risks are described more fully in the section entitled "Risk factors" immediately following this prospectus summary. These risks include, among others:

- We have incurred significant losses since our inception, which we anticipate will continue for the foreseeable future. We have never generated revenue from product sales and may never be profitable.
- Failure to obtain additional funding when needed may force us to delay, limit or terminate our product development efforts or other operations.
- Our gene therapy product candidates are based on a novel technology, which makes it difficult to predict the time and cost of product candidate development and subsequently for obtaining regulatory approval.

- We may find it difficult to enroll patients in our clinical studies, which could delay or prevent clinical studies of our product candidates.
- If our product candidates fail to demonstrate safety and efficacy to the satisfaction of regulatory authorities we may incur additional costs or experience delays in completing, or ultimately be unable to complete, the development and commercialization of our product candidates.
- No gene therapy products have been approved in the United States and only one product has been approved in Europe.
- Neither our current viral vectors nor our product candidates have ever been evaluated in human clinical studies, and we may experience unexpected results in the future.
- In previous clinical studies involving viral vectors for gene therapy, some subjects experienced serious adverse events, including the development of leukemia due to vector-related insertional oncogenesis.
- We expect to rely on third parties to conduct the majority of our current vector production, product manufacturing and clinical development. If they fail to meet deadlines or perform in an unsatisfactory manner our business could be harmed.
- The commercial success of any current or future product candidate will depend upon the degree of market acceptance by physicians, patients, third-party payors and others in the medical community.
- If we are unable to obtain or protect intellectual property rights related to our product candidates, we may not be able to compete effectively in our markets.
- Provisions in our collaboration agreement with Celgene Corporation may prevent or delay a change in control.

Corporate information

We were incorporated in Delaware in April 1992 under the name Genetix Pharmaceuticals, Inc., and subsequently changed our name to bluebird bio, Inc. in September 2010. Our principal executive offices are located at 840 Memorial Drive, 4th Floor, Cambridge, MA 02139, and our telephone number is (617) 491-5601. Our website address is www.bluebirdbio.com. The information contained in, or that can be accessed through, our website is not part of this prospectus.

We are an ‘‘emerging growth company,’’ as defined in the Jumpstart Our Business Startups Act of 2012. We will remain an emerging growth company until the earlier of (1) the last day of the fiscal year (a) following the fifth anniversary of the completion of this offering, (b) in which we have total annual gross revenue of at least $1.0 billion or (c) in which we are deemed to be a large accelerated filer, which means the market value of our common stock that is held by non-affiliates exceeds $700 million as of the prior June 30th, and (2) the date on which we have issued more than $1.0 billion in non-convertible debt during the prior three-year period.

We use “Lenti-D” and the bluebird bio logo as trademarks in the United States and other countries. We use and have registered “LentiGlobin” and “bluebird bio” in the United States.

This prospectus contains references to our trademarks and to trademarks belonging to other entities. Solely for convenience, trademarks and trade names referred to in this prospectus, including logos, artwork, and other visual displays, may appear without the ® or ™ symbols, but such references are not intended to indicate, in any way, that we will not assert, to the fullest extent under applicable law, our rights or the rights of the applicable licensor to these trademarks and trade names. We do not intend our use or display of other companies' trade names or trademarks to imply a relationship with, or endorsement or sponsorship of us by, any other companies. Except where the context requires otherwise, in this prospectus "Company," "bluebird," "we," "us" and "our" refer to bluebird bio, Inc.

The offering

Common stock offered by us	5,000,000 shares
Common stock to be outstanding after this offering	21,869,488 shares
Option to purchase additional shares	The underwriters have an option for a period of 30 days to purchase up to 750,000 additional shares of our common stock.
Use of proceeds	We estimate that the net proceeds from this offering will be approximately $66.8 million, or approximately $77.2 million if the underwriters exercise their option to purchase additional shares in full, at an assumed initial public offering price of $15.00 per share, the midpoint of the price range set forth on the cover of this prospectus, after deducting the estimated underwriting discounts and commissions and estimated offering expenses payable by us. We intend to use the net proceeds from this offering to fund direct research and development expenses for our Phase II/III clinical study for our Lenti-D product candidate and our Phase I/II clinical studies for our LentiGlobin product candidate. We intend to use remaining amounts for general and administrative expenses (including personnel-related costs), potential future development programs, early-stage research and development, capital expenditures and working capital and other general corporate purposes. We may also use a portion of the net proceeds to in-license, acquire or invest in complementary gene therapy businesses, technologies, products or assets. See “Use of proceeds.”
Risk factors	You should read the “Risk factors” section of this prospectus for a discussion of factors to consider carefully before deciding to invest in shares of our common stock.
Proposed Nasdaq Global Market symbol	BLUE

The number of shares of common stock to be outstanding after this offering is based on 480,978 shares of common stock outstanding as of May 31, 2013 (which includes 116,612 shares of unvested restricted stock subject to repurchase by us) and 16,388,510 additional shares of our common stock issuable upon conversion of all of our outstanding shares of preferred stock upon closing of this offering.

The number of shares of our common stock to be outstanding after this offering excludes the following:

- 3,839,025 shares of common stock issuable upon the exercise of outstanding stock options as of May 31, 2013 having a weighted-average exercise price of $3.69 per share;

- 440,346 shares of common stock issuable upon the exercise of outstanding warrants as of May 31, 2013 having a weighted-average exercise price of $9.24 per share;
- 358,869 shares of common stock reserved for issuance pursuant to future equity awards under our 2010 Stock Option and Grant Plan, which will become available for issuance under our 2013 Stock Option and Incentive Plan immediately prior to this offering; and
- 955,000 shares of common stock reserved for issuance (including the above-referenced shares reserved for issuance under our 2010 Stock Option and Grant Plan) pursuant to future equity awards under our 2013 Stock Option and Incentive Plan, which will become effective immediately prior to this offering.

Except as otherwise indicated, all information contained in this prospectus:

- reflects the conversion of all of our outstanding shares of preferred stock into an aggregate of 16,388,510 shares of common stock upon the closing of this offering;
- assumes the adoption of our amended and restated certificate of incorporation and amended and restated by-laws upon the completion of this offering;
- assumes that the underwriters do not exercise their option to purchase additional shares;
- assumes no exercise of outstanding options or warrants after May 31, 2013; and
- reflects a one-for-18.967 reverse stock split of our common stock that became effective on June 3, 2013.

Summary consolidated financial data

The following summary consolidated financial data for the years ended December 31, 2012 and 2011 are derived from our audited consolidated financial statements appearing elsewhere in this prospectus. The summary consolidated financial data as of March 31, 2013 and for the three months ended March 31, 2012 and 2013 have been derived from our unaudited consolidated financial statements included elsewhere in this prospectus. In our opinion, these unaudited financial statements have been prepared on a basis consistent with our audited consolidated financial statements and contain all adjustments, consisting only of normal and recurring adjustments, necessary for a fair presentation of such consolidated financial data. You should read this data together with our audited consolidated financial statements and related notes appearing elsewhere in this prospectus and the information under the captions "Selected consolidated financial data" and "Management's discussion and analysis of financial condition and results of operations." Our historical results are not necessarily indicative of our future results, and our operating results for the three-month period ended March 31, 2013 are not necessarily indicative of the results that may be expected for the fiscal year ending December 31, 2013 or any other interim periods or any future year or period.

	Year ended December 31,		Three months ended March 31,	
(in thousands, except per share data)	**2011**	**2012**	**2012**	**2013**
			(unaudited)	
Consolidated statements of operations data:				
Revenue:				
Collaboration revenue	$ —	$ —	$ —	$ 1,042
Research and license fees	640	340	85	85
Grant revenue	242	—	—	—
	882	340	85	1,127
Expenses:				
Research and development	11,409	17,210	3,858	5,284
General and administrative	4,615	6,846	1,363	2,324
Total expenses	16,024	24,056	5,221	7,608
Loss from operations	(15,142)	(23,716)	(5,136)	(6,481)
Other income (expense), net	(456)	46	68	(63)
Net loss	$ (15,598)	$ (23,670)	$ (5,068)	$ (6,544)
Net loss per share applicable to common stockholders—basic and diluted(1)	$ (171.59)	$ (13.79)	$ (28.49)	$ (19.94)
Weighted-average number of common shares used in net loss per share applicable to common stockholders—basic and diluted	120	262	223	328
Pro forma net loss per share applicable to common stockholders—basic and diluted (unaudited)(1)		$ (1.81)		$ (0.39)
Pro forma weighted-average number of common shares used in net loss per share applicable to common stockholders —basic and diluted (unaudited)		13,112		16,717

(in thousands)	As of March 31, 2013		
	Actual	Pro Forma(2)	Pro Forma Adjusted (3)(4)
		(unaudited)	
Consolidated balance sheet data:			
Cash and cash equivalents	$131,836	$ 131,836	$ 198,586
Working capital	105,390	105,390	172,140
Total assets	137,459	137,459	204,209
Preferred stock	122,177	—	—
Common stock and additional paid-in capital	15,966	138,399	205,149
Total stockholders' (deficit) equity	(61,595)	58,501	125,251

(1) See Notes 2 and 15 within the notes to our consolidated financial statements appearing elsewhere in this prospectus for a description of the method used to calculate basic and diluted net loss per share of common stock and pro forma basic and diluted net loss per share of common stock.

(2) Pro forma to reflect the conversion of all outstanding shares of our preferred stock into shares of our common stock, and the reclassification of our outstanding warrants to purchase our Series B preferred stock to our common stock, upon the closing of this offering.

(3) Pro forma as adjusted to further reflect the sale of shares of our common stock offered in this offering, assuming an initial public offering price of $15.00 per share, the midpoint of the price range set forth on the cover of this prospectus, after deducting underwriting discounts and commissions and estimated offering expenses payable by us.

(4) A $1.00 increase (decrease) in the assumed initial public offering price of $15.00 per share, the midpoint of the price range set forth on the cover of this prospectus, would increase (decrease) the pro forma as adjusted amount of each of cash and cash equivalents and total stockholders' (deficit) equity by approximately $4.7 million, assuming that the number of shares offered by us, as set forth on the cover of this prospectus, remains the same and after deducting underwriting discounts and commissions and estimated offering expenses payable by us. A 1,000,000 share increase in the number of shares offered by us together with a concomitant $1.00 increase in the assumed initial public offering price of $15.00 per share, the midpoint of the price range set forth on the cover of this prospectus, would increase each of cash and cash equivalents and total stockholders' (deficit) equity by approximately $19.5 million after deducting underwriting discounts and commissions and any estimated offering expenses payable by us. Conversely, a 1,000,000 share decrease in the number of shares offered by us together with a concomitant $1.00 decrease in the assumed initial public offering price of $15.00 per share, the midpoint of the price range set forth on the cover of this prospectus, would decrease each of cash and cash equivalents and total stockholders' (deficit) equity by approximately $17.7 million after deducting underwriting discounts and commissions and any estimated offering expenses payable by us.

Risk factors

An investment in shares of our common stock involves a high degree of risk. You should carefully consider the following information about these risks, together with the other information appearing elsewhere in this prospectus, including our financial statements and related notes thereto, before deciding to invest in our common stock. The occurrence of any of the following risks could have a material adverse effect on our business, financial condition, results of operations and future growth prospects. In these circumstances, the market price of our common stock could decline, and you may lose all or part of your investment.

Risks related to our financial condition and capital requirements

We have incurred significant losses since our inception and anticipate that we will continue to incur significant losses for the foreseeable future.

We are a clinical-stage biotechnology company, and we have not yet generated significant revenues. We have incurred net losses in each year since our inception in 1992, including net losses of $15.6 million and $23.7 million for the years ended December 31, 2011 and 2012, respectively, and $6.5 million for the three months ended March 31, 2013. As of March 31, 2013, we had an accumulated deficit of $79.9 million.

We have devoted most of our financial resources to research and development, including our clinical and preclinical development activities. To date, we have financed our operations primarily through the sale of equity securities and convertible debt and, to a lesser extent, through grants from governmental agencies and charitable foundations. The amount of our future net losses will depend, in part, on the rate of our future expenditures and our ability to obtain funding through equity or debt financings, strategic collaborations or additional grants. We have not completed pivotal clinical studies for any product candidate and it will be several years, if ever, before we have a product candidate ready for commercialization. Even if we obtain regulatory approval to market a product candidate, our future revenues will depend upon the size of any markets in which our product candidates have received approval, and our ability to achieve sufficient market acceptance, reimbursement from third-party payors and adequate market share for our product candidates in those markets.

We expect to continue to incur significant expenses and increasing operating losses for the foreseeable future. We anticipate that our expenses will increase substantially if and as we:

- continue our research and preclinical and clinical development of our product candidates;
- expand the scope of our current clinical studies for our product candidates;
- initiate additional preclinical, clinical or other studies for our product candidates, including under our collaboration agreement with Celgene Corporation;
- further develop the manufacturing process for our vectors or our product candidates;
- change or add additional manufacturers or suppliers;
- seek regulatory and marketing approvals for our product candidates that successfully complete clinical studies;
- establish a sales, marketing and distribution infrastructure to commercialize any products for which we may obtain marketing approval;
- seek to identify and validate additional product candidates;

- acquire or in-license other product candidates and technologies;
- make milestone or other payments under any in-license agreements;
- maintain, protect and expand our intellectual property portfolio;
- attract and retain skilled personnel;
- create additional infrastructure to support our operations as a public company and our product development and planned future commercialization efforts; and
- experience any delays or encounter issues with any of the above.

The net losses we incur may fluctuate significantly from quarter to quarter and year to year, such that a period-to-period comparison of our results of operations may not be a good indication of our future performance. In any particular quarter or quarters, our operating results could be below the expectations of securities analysts or investors, which could cause our stock price to decline.

We have never generated any revenue from product sales and may never be profitable.

Our ability to generate revenue and achieve profitability depends on our ability, alone or with strategic collaboration partners, to successfully complete the development of, and obtain the regulatory approvals necessary to commercialize our product candidates. We do not anticipate generating revenues from product sales for the foreseeable future, if ever. Our ability to generate future revenues from product sales depends heavily on our success in:

- completing research and preclinical and clinical development of our product candidates;
- seeking and obtaining regulatory and marketing approvals for product candidates for which we complete clinical studies;
- developing a sustainable, scalable, reproducible, and transferable manufacturing process for our vectors and product candidates;
- establishing and maintaining supply and manufacturing relationships with third parties that can provide adequate (in amount and quality) products and services to support clinical development and the market demand for our product candidates, if approved;
- launching and commercializing product candidates for which we obtain regulatory and marketing approval, either by collaborating with a partner or, if launched independently, by establishing a sales force, marketing and distribution infrastructure;
- obtaining market acceptance of our product candidates and gene therapy as a viable treatment option;
- addressing any competing technological and market developments;
- implementing additional internal systems and infrastructure, as needed;
- identifying and validating new gene therapy product candidates;
- negotiating favorable terms in any collaboration, licensing or other arrangements into which we may enter;

- maintaining, protecting and expanding our portfolio of intellectual property rights, including patents, trade secrets and know-how; and
- attracting, hiring and retaining qualified personnel.

Even if one or more of the product candidates that we develop is approved for commercial sale, we anticipate incurring significant costs associated with commercializing any approved product candidate. Our expenses could increase beyond expectations if we are required by the U.S. Food and Drug Administration, or the FDA, the European Medicines Agency, or the EMA, or other regulatory agencies, domestic or foreign, to perform clinical and other studies in addition to those that we currently anticipate. Even if we are able to generate revenues from the sale of any approved products, we may not become profitable and may need to obtain additional funding to continue operations.

Even if this offering is successful, we will need to raise additional funding, which may not be available on acceptable terms, or at all. Failure to obtain this necessary capital when needed may force us to delay, limit or terminate our product development efforts or other operations.

We are currently advancing our Lenti-D and LentiGlobin product candidates through clinical development and other product candidates through preclinical development. Developing gene therapy products is expensive, and we expect our research and development expenses to increase substantially in connection with our ongoing activities, particularly as we advance our product candidates in clinical studies.

As of March 31, 2013, our cash and cash equivalents were $131.8 million. We estimate that the net proceeds from this offering will be approximately $66.8 million, assuming an initial public offering price of $15.00 per share, the midpoint of the price range set forth on the cover of this prospectus, after deducting estimated underwriting discounts and commissions and offering expenses payable by us. We expect that the net proceeds from this offering and our existing cash and cash equivalents will be sufficient to fund our current operations through at least the end of 2015. However, our operating plan 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, government or other third-party funding, marketing and distribution arrangements and other collaborations, strategic alliances and licensing arrangements or a combination of these approaches. In any event, we will require additional capital to obtain regulatory approval for, and to commercialize, our product candidates. Raising funds in the current economic environment may present additional challenges. Even if we believe we have sufficient funds for our current or future operating plans, we may seek additional capital if market conditions are favorable or if we have specific strategic considerations.

Any additional fundraising efforts may divert our management from their day-to-day activities, which may adversely affect our ability to develop and commercialize 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. Moreover, the terms of any financing may adversely affect the holdings or the rights of our stockholders and the issuance of additional securities, whether equity or debt, by us, or the possibility of such issuance, may cause the market price of our shares to decline. The sale of additional equity or convertible securities would dilute all of our stockholders. The incurrence of indebtedness would result in increased fixed payment obligations and we may be required to agree to certain restrictive covenants, 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. We could also be required to seek funds through arrangements with collaborative partners or otherwise at an earlier stage than otherwise would be desirable and we may be required to relinquish rights to some of our technologies or product candidates or otherwise agree to terms unfavorable to us, any of which may have a material adverse effect on our business, operating results and prospects.

If we are unable to obtain funding on a timely basis, we may be required to significantly curtail, delay or discontinue one or more of our research or development programs or the commercialization of any product candidates or be unable to expand our operations or otherwise capitalize on our business opportunities, as desired, which could materially affect our business, financial condition and results of operations.

Risks related to the discovery and development of our product candidates

Our gene therapy product candidates are based on a novel technology, which makes it difficult to predict the time and cost of product candidate development and subsequently obtaining regulatory approval. At the moment, no gene therapy products have been approved in the United States and only one product has been approved in Europe.

We have concentrated our therapeutic product research and development efforts on our gene therapy platform, and our future success depends on the successful development of this therapeutic approach. There can be no assurance that any development problems we experience in the future related to our gene therapy platform will not cause significant delays or unanticipated costs, or that such development problems can be solved. We may also experience delays in developing a sustainable, reproducible and scalable manufacturing process or transferring that process to commercial partners, which may prevent us from completing our clinical studies or commercializing our products on a timely or profitable basis, if at all.

In addition, the clinical study requirements of the FDA, the EMA and other regulatory agencies and the criteria these regulators use to determine the safety and efficacy of a product candidate vary substantially according to the type, complexity, novelty and intended use and market of the potential products. The regulatory approval process for novel product candidates such as ours can be more expensive and take longer than for other, better known or extensively studied pharmaceutical or other product candidates. At the moment, only one gene therapy product, UniQure's Glybera, which received marketing authorization from the EMA in 2012, has been approved in the Western world, which makes it difficult to determine how long it will take or how much it will cost to obtain regulatory approvals for our product candidates in either Europe or the United States. Approvals by the EMA may not be indicative of what the FDA may require for approval.

Regulatory requirements governing gene and cell therapy products have changed frequently and may continue to change in the future. For example, the FDA has established the Office of Cellular, Tissue and Gene Therapies within its Center for Biologics Evaluation and Research, or CBER, to consolidate the review of gene therapy and related products, and the Cellular, Tissue and Gene Therapies Advisory Committee to advise CBER on its review. Gene therapy clinical studies conducted at institutions that receive funding for recombinant DNA research from the U.S. National Institutes of Health, or the NIH, are also subject to review by the NIH Office of Biotechnology Activities' Recombinant DNA Advisory Committee, or the RAC. Although the FDA decides whether individual gene therapy protocols may proceed, the RAC review process can impede the initiation of a clinical study, even if the FDA has reviewed the study and approved its

initiation. Conversely, the FDA can put an investigational new drug application, or IND, on clinical hold even if the RAC has provided a favorable review. Also, before a clinical study can begin at an NIH-funded institution, that institution's institutional review board, or IRB, and its Institutional Biosafety Committee will have to review the proposed clinical study to assess the safety of the study. In addition, adverse developments in clinical trials of gene therapy products conducted by others may cause the FDA or other regulatory bodies to change the requirements for approval of any of our product candidates.

These regulatory review committees and advisory groups and the new guidelines they promulgate may lengthen the regulatory review process, require us to perform additional studies, increase our development costs, lead to changes in regulatory positions and interpretations, delay or prevent approval and commercialization of these treatment candidates or lead to significant post-approval limitations or restrictions. As we advance our product candidates, we will be required to consult with these regulatory and advisory groups, and comply with applicable guidelines. If we fail to do so, we may be required to delay or discontinue development of our product candidates. Delay or failure to obtain, or unexpected costs in obtaining, the regulatory approval necessary to bring a potential product to market could decrease our ability to generate sufficient product revenue to maintain our business.

We may find it difficult to enroll patients in our clinical studies, which could delay or prevent clinical studies of our product candidates.

Identifying and qualifying patients to participate in clinical studies of our product candidates is critical to our success. The timing of our clinical studies depends on the speed at which we can recruit patients to participate in testing our product candidates. We have experienced delays in some of our clinical studies, and we may experience similar delays in the future. If patients are unwilling to participate in our gene therapy studies because of negative publicity from adverse events in the biotechnology or gene therapy industries or for other reasons, including competitive clinical studies for similar patient populations, the timeline for recruiting patients, conducting studies and obtaining regulatory approval of potential products may be delayed. These delays could result in increased costs, delays in advancing our product development, delays in testing the effectiveness of our technology or termination of the clinical studies altogether.

We may not be able to identify, recruit and enroll a sufficient number of patients, or those with required or desired characteristics to achieve diversity in a study, to complete our clinical studies in a timely manner. Patient enrollment is affected by factors including:

- severity of the disease under investigation;
- design of the study protocol;
- size of the patient population;
- eligibility criteria for the study in question;
- perceived risks and benefits of the product candidate under study;
- proximity and availability of clinical study sites for prospective patients;
- availability of competing therapies and clinical studies;
- efforts to facilitate timely enrollment in clinical studies;
- patient referral practices of physicians; and
- ability to monitor patients adequately during and after treatment.

In particular, each of the conditions for which we plan to evaluate our current product candidates are rare genetic disorders with limited patient pools from which to draw for clinical studies. It has been estimated that about 1.5% (80 to 90 million people) of the global population are carriers of ß-thalassemia, with about 60,000 symptomatic individuals born annually, the great majority in the developing world. According to Thalassemia International Federation, about 288,000 patients with ß-thalassemia major are alive and registered as receiving regular treatment around the world, of which it is estimated that about 15,000 live in the United States and Europe. The global incidence of SCD is estimated to be 250,000-300,000 births annually with a global prevalence estimated to be about 20-25 million. The worldwide incidence rate for adrenoleukodystrophy, or ALD, the superset of CCALD, is approximately one in 20,000 newborn males. CCALD accounts for about 30-40% of patients diagnosed with ALD. Further, because newborn screening for CCALD is not widely adopted, and it can be difficult to diagnose CCALD in the absence of a genetic screen, we may have difficulty finding patients who are eligible to participate in our study. The eligibility criteria of our clinical studies will further limit the pool of available study participants. Additionally, the process of finding and diagnosing patients may prove costly. Finally, our treatment process requires that the patient be near one of our transduction facilities, as the hematopoietic stem cells, or HSCs, have limited viability following harvest and cannot be transported long distances.

Our current product candidates are being developed to treat rare conditions. We plan to seek initial marketing approval in the United States and Europe. We may not be able to initiate or continue clinical studies if we cannot enroll a sufficient number of eligible patients to participate in the clinical studies required by the FDA or the EMA or other regulatory agencies. Our ability to successfully initiate, enroll and complete a clinical study in any foreign country is subject to numerous risks unique to conducting business in foreign countries, including:

- difficulty in establishing or managing relationships with contract research organizations, or CROs, and physicians;
- different standards for the conduct of clinical studies;
- our inability to locate qualified local consultants, physicians and partners; and
- the potential burden of complying with a variety of foreign laws, medical standards and regulatory requirements, including the regulation of pharmaceutical and biotechnology products and treatment.

If we have difficulty enrolling a sufficient number of patients to conduct our clinical studies as planned, we may need to delay, limit or terminate ongoing or planned clinical studies, any of which would have an adverse effect on our business.

We may encounter substantial delays in our clinical studies or we may fail to demonstrate safety and efficacy to the satisfaction of applicable regulatory authorities.

Before obtaining marketing approval from regulatory authorities for the sale of our product candidates, we must conduct extensive clinical studies to demonstrate the safety and efficacy of the product candidates in humans. Clinical testing is expensive, time-consuming and uncertain as to outcome. We cannot guarantee that any clinical studies will be conducted as planned or completed on schedule, if at all. A failure of one or more clinical studies can occur at any stage of testing. Events that may prevent successful or timely completion of clinical development include:

- delays in reaching a consensus with regulatory agencies on study design;
- delays in reaching agreement on acceptable terms with prospective CROs and clinical study sites;

- delays in obtaining required Institutional Review Board, or IRB, approval at each clinical study site;
- delays in recruiting suitable patients to participate in our clinical studies;
- imposition of a clinical hold by regulatory agencies, after an inspection of our clinical study operations or study sites;
- failure by our CROs, other third parties or us to adhere to clinical study requirements;
- failure to perform in accordance with the FDA's good clinical practices, or GCP, or applicable regulatory guidelines in other countries;
- delays in the testing, validation, manufacturing and delivery of our product candidates to the clinical sites;
- delays in having patients complete participation in a study or return for post-treatment follow-up;
- clinical study sites or patients dropping out of a study;
- occurrence of serious adverse events associated with the product candidate that are viewed to outweigh its potential benefits; or
- changes in regulatory requirements and guidance that require amending or submitting new clinical protocols.

Any inability to successfully complete preclinical and clinical development could result in additional costs to us or impair our ability to generate revenues from product sales, regulatory and commercialization milestones and royalties. In addition, if we make manufacturing or formulation changes to our product candidates, we may need to conduct additional studies to bridge our modified product candidates to earlier versions. Clinical study delays could also shorten any periods during which we may have the exclusive right to commercialize our product candidates or allow our competitors to bring products to market before we do, which could impair our ability to successfully commercialize our product candidates and may harm our business and results of operations.

If the results of our clinical studies are inconclusive or if there are safety concerns or adverse events associated with our product candidates, we may:

- be delayed in obtaining marketing approval for our product candidates, if at all;
- obtain approval for indications or patient populations that are not as broad as intended or desired;
- obtain approval with labeling that includes significant use or distribution restrictions or safety warnings;
- be subject to changes with the way the product is administered;
- be required to perform additional clinical studies to support approval or be subject to additional post-marketing testing requirements;
- have regulatory authorities withdraw their approval of the product or impose restrictions on its distribution in the form of a modified risk evaluation and mitigation strategy;

- be subject to the addition of labeling statements, such as warnings or contraindications;
- be sued; or
- experience damage to our reputation.

Treatment with our product candidates involves chemotherapy and myeloablative treatments, which can cause side effects or adverse events that are unrelated to our product candidate, but may still impact the success of our clinical studies. Additionally, our product candidates could potentially cause other adverse events that have not yet been predicted. The inclusion of critically ill patients in our clinical studies may result in deaths or other adverse medical events due to other therapies or medications that such patients may be using. As described above, any of these events could prevent us from achieving or maintaining market acceptance of our product candidates and impair our ability to commercialize our products.

We have not tested any of our current viral vectors or product candidates derived from these viral vectors in clinical studies. Success in early clinical studies may not be indicative of results obtained in later studies.

Neither our current viral vectors nor our product candidates have ever been evaluated in human clinical studies, and we may experience unexpected results in the future. Earlier gene therapy clinical studies, which we believe serve as proof-of-concept for our product candidates, utilized lentiviral vectors similar to ours. However, these studies should not be relied upon as evidence that our future clinical studies will succeed. Study designs and results from previous studies are not necessarily predictive of our future clinical study designs or results, and initial results may not be confirmed upon full analysis of the complete study data. Our product candidates may also fail to show the desired safety and efficacy in later stages of clinical development despite having successfully advanced through initial clinical studies.

There is a high failure rate for drugs and biologics proceeding through clinical studies. A number of companies in the pharmaceutical and biotechnology industries have suffered significant setbacks in later stage clinical studies even after achieving promising results in earlier stage clinical studies. Data obtained from preclinical and clinical activities are subject to varying interpretations, which may delay, limit or prevent regulatory approval. In addition, regulatory delays or rejections may be encountered as a result of many factors, including changes in regulatory policy during the period of product development.

The results from our ALD-102 Study may not be sufficiently robust to support the submission of marketing approval for our Lenti-D product candidate. Before we submit Lenti-D for marketing approval, the FDA and the EMA may require us to conduct additional clinical studies, or evaluate subjects for an additional follow-up period.

The FDA has advised us that our ALD-102 Study, which is a single-arm, open-label study to evaluate the safety and efficacy of our Lenti-D product candidate to halt the progression of CCALD, may not be deemed to be a pivotal study or may not provide sufficient support for a Biologics License Application, or BLA, submission. The FDA normally requires two pivotal clinical studies to approve a drug or biologic product, and thus the FDA may require that we conduct additional clinical studies of Lenti-D prior to a BLA submission. The FDA typically does not consider a single clinical study to be adequate to serve as a pivotal study unless it is, among other things, well-controlled and demonstrates a clinically meaningful effect on mortality, irreversible morbidity, or prevention of a disease with potentially serious outcome, and a confirmatory study

would be practically or ethically impossible. Due to the nature of CCALD and the limited number of patients with this condition, a placebo-controlled and blinded study is not practicable for ethical and other reasons. However, it is still possible that, even if we achieve favorable results in the ALD-102 Study, the FDA may require us to conduct a second clinical study, possibly involving a larger sample size or a different clinical study design, particularly if the FDA does not find the results from the ALD-102 Study to be sufficiently persuasive to support a BLA submission. The FDA may also require that we conduct a longer follow-up period of subjects treated with our Lenti-D product candidate prior to accepting our BLA submission.

In addition, the ALD-102 Study was not designed to achieve a statistically significant efficacy determination. Rather, we expect that safety and efficacy will be evaluated in light of the data collected in our retrospective data collection study, the ALD-101 Study. However, due to the nature of this retrospective data collection study, and the limited number of patients with this condition, the FDA has advised us that the ALD-101 Study is not sufficiently robust to serve as a conventional historical control group and as a basis of comparison against the results of the ALD-102 Study. Thus, we expect that the FDA will assess the totality of the safety and efficacy data from our ALD-102 Study in reviewing any future BLA submission for our Lenti-D product candidate. Based on this assessment, the FDA may require that we conduct additional preclinical or clinical studies prior to submitting or approving a BLA for this indication.

It is possible that the FDA or the EMA may not consider the results of this study to be sufficient for approval of Lenti-D for this indication. If the FDA or the EMA requires additional studies, we would incur increased costs and delays in the marketing approval process, which may require us to expend more resources than we have available. In addition, it is possible that the FDA and the EMA may have divergent opinions on the elements necessary for a successful BLA and Marketing Authorization Application, or MAA, respectively, which may cause us to alter our development, regulatory and/or commercialization strategies.

In previous clinical studies involving viral vectors for gene therapy, some subjects experienced serious adverse events, including the development of leukemia due to vector-related insertional oncogenesis. If our vectors demonstrate a similar effect, we may be required to halt or delay further clinical development of our product candidates.

A significant risk in any gene therapy product based on viral vectors is that the vector will insert near cancer-causing oncogenes leading to uncontrolled clonal proliferation of mature cancer cells in the patient. For example, in 2003, 20 subjects treated for X-linked severe combined immunodeficiency in two gene therapy studies using a murine gamma-retroviral vector showed correction of the disease, but the studies were terminated after five subjects developed leukemia (four of whom were subsequently cured). The cause of these adverse events was shown to be insertional oncogenesis, which is the process whereby the corrected gene inserts near a gene that is important in a critical cellular process like growth or division, and this insertion results in the development of a cancer (often leukemia). Using molecular diagnostic techniques, it was determined that clones from these subjects showed retrovirus insertion in proximity to the promoter of the LMO2 proto-oncogene. Earlier generation retroviruses like the one used in these two studies have been shown to preferentially integrate in regulatory regions of genes that control cell growth.

These well-publicized adverse events led to the development of new viral vectors, such as lentiviral vectors, with improved safety profiles. In published studies, lentiviral vectors have demonstrated an improved safety profile over gamma-retroviral vectors, with no known events

of gene therapy-related adverse events, which we believe is due to a number of factors including the tendency of these vectors to integrate within genes rather than in areas that control gene expression, as well as their lack of strong viral enhancers. However, it should be noted that in our Phase I/II study (the LG001 Study) of autologous HSCs transduced *ex vivo* using an earlier generation of our LentiGlobin vector, called HPV569, we initially observed in one patient that a disproportionate number of the cells expressing our functional gene had the same insertion site. Tests showed that this partial clonal dominance contained an insertion of the functional gene in the HMGA2 gene that persisted for a period of two to three years. Although there was some initial concern that the observed clonal dominance might represent a pre-leukemic event, there have been no adverse clinical consequences of this event, or any signs of cancer, in over five years since the observation was made. The presence of the HMGA2 clone has steadily declined in this patient over time to the point that it is no longer the most common clone observed in this patient.

The risk of insertional oncogenesis remains a significant concern for gene therapy and we cannot assure that it will not occur in any of our planned or future clinical studies. There is also the potential risk of delayed adverse events following exposure to gene therapy products due to persistent biological activity of the genetic material or other components of products used to carry the genetic material. The FDA has stated that lentiviral vectors possess characteristics that may pose high risks of delayed adverse events. If any such adverse events occur, further advancement of our clinical studies could be halted or delayed, which would have a material adverse effect on our business and operations.

Even if we complete the necessary preclinical and clinical studies, we cannot predict when or if we will obtain regulatory approval to commercialize a product candidate or the approval may be for a more narrow indication than we expect.

We cannot commercialize a product until the appropriate regulatory authorities have reviewed and approved the product candidate. Even if our product candidates demonstrate safety and efficacy in clinical studies, the regulatory agencies may not complete their review processes in a timely manner, or we may not be able to obtain regulatory approval. Additional delays may result if an FDA Advisory Committee or other regulatory authority recommends non-approval or restrictions on approval. In addition, we may experience delays or rejections based upon additional government regulation from future legislation or administrative action, or changes in regulatory agency policy during the period of product development, clinical studies and the review process. Regulatory agencies also may approve a treatment candidate for fewer or more limited indications than requested or may grant approval subject to the performance of post-marketing studies. In addition, regulatory agencies may not approve the labeling claims that are necessary or desirable for the successful commercialization of our treatment candidates. For example, the development of our product candidates for pediatric use is an important part of our current business strategy, and if we are unable to obtain regulatory approval for the desired age ranges, our business may suffer.

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

Even if we obtain regulatory approval in a jurisdiction, the regulatory authority may still impose significant restrictions on the indicated uses or marketing of our product candidates, or impose ongoing requirements for potentially costly post-approval studies or post-market surveillance. For example, the holder of an approved BLA is obligated to monitor and report adverse events and any failure of a product to meet the specifications in the BLA. The FDA

typically advises that patients treated with gene therapy undergo follow-up observations for potential adverse events for a 15-year period. The holder of an approved BLA must also submit new or supplemental applications and obtain FDA approval for certain changes to the approved product, product labeling or manufacturing process. Advertising and promotional materials must comply with FDA rules and are subject to FDA review, in addition to other potentially applicable federal and state laws.

In addition, product manufacturers and their facilities are subject to payment of user fees and continual review and periodic inspections by the FDA and other regulatory authorities for compliance with good manufacturing practices, or GMP, and adherence to commitments made in the BLA. If we or 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, a regulatory agency may impose restrictions relative to that product or the manufacturing facility, including requiring recall or withdrawal of the product from the market or suspension of manufacturing.

If we fail to comply with applicable regulatory requirements following approval of any of our product candidates, a regulatory agency may:

- issue a warning letter asserting that we are in violation of the law;
- seek an injunction or impose civil or criminal penalties or monetary fines;
- suspend or withdraw regulatory approval;
- suspend any ongoing clinical studies;
- refuse to approve a pending BLA or supplements to a BLA submitted by us;
- seize product; or
- refuse to allow us to enter into supply contracts, including government contracts.

Any government investigation of alleged violations of law could require us to expend significant time and resources in response and could generate negative publicity. The occurrence of any event or penalty described above may inhibit our ability to commercialize our product candidates and generate revenues.

Risks related to our reliance on third parties

We expect to rely on third parties to conduct some or all aspects of our vector production, product manufacturing, protocol development, research and preclinical and clinical testing, and these third parties may not perform satisfactorily.

We do not expect to independently conduct all aspects of our vector production, product manufacturing, protocol development, research and preclinical and clinical testing. We currently rely, and expect to continue to rely, on third parties with respect to these items.

Any of these third parties may terminate their engagements with us at any time. If we need to enter into alternative arrangements, it could delay our product development activities. Our reliance on these third parties for research and development activities will reduce our control over these activities but will not relieve us of our responsibility to ensure compliance with all required regulations and study protocols. For example, for product candidates that we develop and commercialize on our own, we will remain responsible for ensuring that each of our IND-enabling studies and clinical studies are conducted in accordance with the study plan and protocols.

If these third parties do not successfully carry out their contractual duties, meet expected deadlines or conduct our studies in accordance with regulatory requirements or our stated study plans and protocols, we will not be able to complete, or may be delayed in completing, the preclinical and clinical studies required to support future IND submissions and approval of our product candidates.

Reliance on third-party manufacturers entails risks to which we would not be subject if we manufactured the product candidates ourselves, including:

- the inability to negotiate manufacturing agreements with third parties under commercially reasonable terms;
- reduced control as a result of using third-party manufacturers for all aspects of manufacturing activities;
- termination or nonrenewal of manufacturing agreements with third parties in a manner or at a time that is costly or damaging to us; and
- disruptions to the operations of our third-party manufacturers or suppliers caused by conditions unrelated to our business or operations, including the bankruptcy of the manufacturer or supplier.

Any of these events could lead to clinical study delays or failure to obtain regulatory approval, or impact our ability to successfully commercialize future products. Some of these events could be the basis for FDA action, including injunction, recall, seizure or total or partial suspension of production.

We and our contract manufacturers are subject to significant regulation with respect to manufacturing our products. The manufacturing facilities on which we rely may not continue to meet regulatory requirements and have limited capacity.

We currently have relationships with a limited number of suppliers for the manufacturing of our viral vectors and product candidates. Each supplier may require licenses to manufacture such components if such processes are not owned by the supplier or in the public domain and we may be unable to transfer or sublicense the intellectual property rights we may have with respect to such activities.

All entities involved in the preparation of therapeutics for clinical studies or commercial sale, including our existing contract manufacturers for our product candidates, are subject to extensive regulation. Components of a finished therapeutic product approved for commercial sale or used in late-stage clinical studies must be manufactured in accordance with GMP. These regulations govern manufacturing processes and procedures (including record keeping) and the implementation and operation of quality systems to control and assure the quality of investigational products and products approved for sale. Poor control of production processes can lead to the introduction of adventitious agents or other contaminants, or to inadvertent changes in the properties or stability of our product candidates that may not be detectable in final product testing. We or our contract manufacturers must supply all necessary documentation in support of a BLA on a timely basis and must adhere to the FDA's good laboratory practices, or GLP, and GMP regulations enforced by the FDA through its facilities inspection program. Some of our contract manufacturers have not produced a commercially-approved product and therefore have not obtained the requisite FDA approvals to do so. Our facilities and quality systems and the facilities and quality systems of some or all of our third-party contractors must pass a pre-approval inspection for compliance with the

applicable regulations as a condition of regulatory approval of our product candidates or any of our other potential products. In addition, the regulatory authorities may, at any time, audit or inspect a manufacturing facility involved with the preparation of our product candidates or our other potential products or the associated quality systems for compliance with the regulations applicable to the activities being conducted. If these facilities do not pass a pre-approval plant inspection, FDA approval of the products will not be granted.

The regulatory authorities also may, at any time following approval of a product for sale, audit our manufacturing facilities or those of our third-party contractors. If any such inspection or audit identifies a failure to comply with applicable regulations or if a violation of our product specifications or applicable regulations occurs independent of such an inspection or audit, we or the relevant regulatory authority may require remedial measures that may be costly and/or time-consuming for us or a third party to implement and that may include the temporary or permanent suspension of a clinical study or commercial sales or the temporary or permanent closure of a facility. Any such remedial measures imposed upon us or third parties with whom we contract could materially harm our business.

If we or any of our third-party manufacturers fail to maintain regulatory compliance, the FDA can impose regulatory sanctions including, among other things, refusal to approve a pending application for a new drug product or biologic product, or revocation of a pre-existing approval. As a result, our business, financial condition and results of operations may be materially harmed.

Additionally, if supply from one approved manufacturer is interrupted, there could be a significant disruption in commercial supply. An alternative manufacturer would need to be qualified through a BLA supplement which could result in further delay. The regulatory agencies may also require additional studies if a new manufacturer is relied upon for commercial production. Switching manufacturers may involve substantial costs and is likely to result in a delay in our desired clinical and commercial timelines.

These factors could cause the delay of clinical studies, regulatory submissions, required approvals or commercialization of our product candidates, cause us to incur higher costs and prevent us from commercializing our products successfully. Furthermore, if our suppliers fail to meet contractual requirements, and we are unable to secure one or more replacement suppliers capable of production at a substantially equivalent cost, our clinical studies may be delayed or we could lose potential revenue.

We expect to rely on third parties to conduct, supervise and monitor our clinical studies, and if these third parties perform in an unsatisfactory manner, it may harm our business.

We expect to rely on CROs and clinical study sites to ensure our clinical studies are conducted properly and on time. While we will have agreements governing their activities, we will have limited influence over their actual performance. We will control only certain aspects of our CROs' activities. Nevertheless, we will be responsible for ensuring that each of our clinical studies is conducted in accordance with the applicable protocol, legal, regulatory and scientific standards, and our reliance on the CROs does not relieve us of our regulatory responsibilities.

We and our CROs are required to comply with the FDA's GCPs for conducting, recording and reporting the results of IND-enabling studies and clinical studies to assure that the data and reported results are credible and accurate and that the rights, integrity and confidentiality of clinical study participants are protected. The FDA enforces these GCPs through periodic

inspections of study sponsors, principal investigators and clinical study sites. If we or our CROs fail to comply with applicable GCPs, the clinical data generated in our future clinical studies may be deemed unreliable and the FDA may require us to perform additional clinical studies before approving any marketing applications. Upon inspection, the FDA may determine that our clinical studies did not comply with GCPs. In addition, our future clinical studies will require a sufficient number of test subjects to evaluate the safety and effectiveness of our product candidates. Accordingly, if our CROs fail to comply with these regulations or fail to recruit a sufficient number of patients, we may be required to repeat such clinical studies, which would delay the regulatory approval process.

Our CROs are not our employees, and we are therefore unable to directly monitor whether or not they devote sufficient time and resources to our clinical and nonclinical programs. These CROs may also have relationships with other commercial entities, including our competitors, for whom they may also be conducting clinical studies or other drug development activities that could harm our competitive position. If our CROs do not successfully carry out their contractual duties or obligations, fail to meet expected deadlines, or if the quality or accuracy of the clinical data they obtain is compromised due to the failure to adhere to our clinical protocols or regulatory requirements, or for any other reasons, our clinical studies may be extended, delayed or terminated, and we may not be able to obtain regulatory approval for, or successfully commercialize our product candidates. As a result, our financial results and the commercial prospects for our product candidates would be harmed, our costs could increase, and our ability to generate revenues could be delayed.

We also expect to rely on other third parties to store and distribute our vectors and products for any clinical studies that we may conduct. Any performance failure on the part of our distributors could delay clinical development or marketing approval of our product candidates or commercialization of our products, if approved, producing additional losses and depriving us of potential product revenue.

Our reliance on third parties requires us to share our trade secrets, which increases the possibility that a competitor will discover them or that our trade secrets will be misappropriated or disclosed.

Because we rely on third parties to manufacture our vectors and our product candidates, and because we collaborate with various organizations and academic institutions on the advancement of our gene therapy platform, we must, at times, share trade secrets with them. We seek to protect our proprietary technology in part by entering into confidentiality agreements and, if applicable, material transfer agreements, collaborative research agreements, consulting agreements or other similar agreements with our collaborators, advisors, employees and consultants prior to beginning research or disclosing proprietary information. These agreements typically limit the rights of the third parties to use or disclose our confidential information, such as trade secrets. Despite the contractual provisions employed when working with third parties, the need to share trade secrets and other confidential information 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. Given that our proprietary position is based, in part, on our know-how and trade secrets, a competitor’s discovery of our trade secrets or other unauthorized use or disclosure would impair our competitive position and may have a material adverse effect on our business.

In addition, these agreements typically restrict the ability of our collaborators, advisors, employees and consultants to publish data potentially relating to our trade secrets. Our academic

collaborators typically have rights to publish data, provided that we are notified in advance and may delay publication for a specified time in order to secure our intellectual property rights arising from the collaboration. In other cases, publication rights are controlled exclusively by us, although in some cases we may share these rights with other parties. We also conduct joint research and development programs that may require us to share trade secrets under the terms of our research and development partnerships or similar agreements. Despite our efforts to protect our trade secrets, our competitors may discover our trade secrets, either through breach of these agreements, independent development or publication of information including our trade secrets in cases where we do not have proprietary or otherwise protected rights at the time of publication. A competitor's discovery of our trade secrets would impair our competitive position and have an adverse impact on our business.

Risks related to commercialization of our product candidates

We intend to rely on third-party manufacturers to produce our vector, product candidates and other key materials, but we have not entered into binding agreements with any such manufacturers to support commercialization. Additionally, these manufacturers do not have experience producing our vectors and product candidates at commercial levels and may not achieve the necessary regulatory approvals or produce our vectors and products at the quality, quantities, locations and timing needed to support commercialization.

We have not yet secured manufacturing capabilities for commercial quantities of our viral vectors or established transduction facilities in the desired commercialization regions to support commercialization of our products. Although we intend to rely on third-party manufacturers for commercialization, we have only entered into agreements with such manufacturers to support our clinical studies. We may be unable to negotiate binding agreements with the manufacturers to support our commercialization activities at commercially reasonable terms.

No manufacturer currently has the experience or ability to produce our vectors and product candidates at commercial levels. We are currently developing a scalable manufacturing process for LentiGlobin, which we plan to transfer to one or more contract manufacturers. We may run into technical or scientific issues related to manufacturing or development that we may be unable to resolve in a timely manner or with available funds. Although we have been able to produce our Lenti-D vector at commercial scale, we have not completed the characterization and validation activities necessary for commercial and regulatory approvals. If our manufacturing partners do not obtain such regulatory approvals, our commercialization efforts will be harmed.

Additionally, since the HSCs have a limited window of stability following extraction from the patient, we must set up transduction facilities in the regions where we wish to commercialize our product. Currently, we rely on academic institutions and one third-party contract manufacturer in the United States and Europe, respectively, to produce our product candidates for our clinical studies. Since a portion of our target patient populations will be outside the United States and Europe, we will need to set up additional transduction facilities that can replicate our transduction process. Establishment of such facilities may be impeded by technical, quality, or regulatory issues related to these new sites and we may also run into technical or scientific issues related to transfer of our transduction process or other developmental issues that we may be unable to resolve in a timely manner or with available funds.

Even if we timely develop a manufacturing process and successfully transfer it to the third-party vector and product manufacturers, if such third-party manufacturers are unable to produce

the necessary quantities of viral vectors and our product candidates, or in compliance with GMP, or in compliance with pertinent regulatory requirements, and within our planned time frame and cost parameters, the development and sales of our products, if approved, may be materially harmed.

In addition, any significant disruption in our supplier relationships could harm our business. We source key materials from third parties, either directly through agreements with suppliers or indirectly through our manufacturers who have agreements with suppliers. There are a small number of suppliers for certain key materials that are used to manufacture our product candidates. Such suppliers may not sell these key materials to our manufacturers at the times we need them or on commercially reasonable terms. We do not have any control over the process or timing of the acquisition of these key materials by our manufacturers. Moreover, we currently do not have any agreements for the commercial production of these key materials.

If we are unable to establish sales and marketing capabilities or enter into agreements with third parties to market and sell our product candidates, we may be unable to generate any revenues.

We have no experience selling and marketing our product candidates. To successfully commercialize any products that may result from our development programs, we will need to develop these capabilities, either on our own or with others. We may enter into collaborations with other entities to utilize their mature marketing and distribution capabilities, but we may be unable to enter into marketing agreements on favorable terms, if at all. If our future collaborative partners do not commit sufficient resources to commercialize our future products, if any, and we are unable to develop the necessary marketing capabilities on our own, we will be unable to generate sufficient product revenue to sustain our business. We will be competing with many companies that currently have extensive and well-funded marketing and sales operations. Without an internal team or the support of a third party to perform marketing and sales functions, we may be unable to compete successfully against these more established companies.

We face intense competition and rapid technological change and the possibility that our competitors may develop therapies that are more advanced or effective than ours, which may adversely affect our financial condition and our ability to successfully commercialize our product candidates.

We are engaged in gene therapy, which is a rapidly changing field. We have competitors both in the United States and internationally, including major multinational pharmaceutical companies, biotechnology companies and universities and other research institutions. Some of the pharmaceutical and biotechnology companies we expect to compete with include GlaxoSmithKline plc, Sangamo BioSciences Inc., HemaQuest Pharmaceuticals, Inc., Merck & Co., Inc., Novartis AG and GlycoMimetics Inc. In addition, many universities and private and public research institutes are active in our target disease areas.

Many of our competitors have substantially greater financial, technical and other resources, such as larger research and development staff and experienced marketing and manufacturing organizations. Competition may increase further as a result of advances in the commercial applicability of technologies and greater availability of capital for investment in these industries. Our competitors may succeed in developing, acquiring or licensing on an exclusive basis, products that are more effective or less costly than any product candidate that we may develop, or achieve earlier patent protection, regulatory approval, product commercialization and market penetration than us. Additionally, technologies developed by our competitors may render our

potential product candidates uneconomical or obsolete, and we may not be successful in marketing our product candidates against competitors.

Even if we are successful in achieving regulatory approval to commercialize a product candidate faster than our competitors, we may face competition from biosimilars due to the changing regulatory environment. In the United States, the Biologics Price Competition and Innovation Act of 2009 created an abbreviated approval pathway for biological products that are demonstrated to be "highly similar," or biosimilar, to or "interchangeable" with an FDA-approved biological product. This new pathway could allow competitors to reference data from biological products already approved after 12 years from the time of approval. In his proposed budget for fiscal year 2014, President Obama proposed to cut this 12-year period of exclusivity down to seven years. He also proposed to prohibit additional periods of exclusivity due to minor changes in product formulations, a practice often referred to as "evergreening." In Europe, the European Commission has granted marketing authorizations for several biosimilars pursuant to a set of general and product class-specific guidelines for biosimilar approvals issued over the past few years. In Europe, a competitor may reference data from biological products already approved, but will not be able to get on the market until ten years after the time of approval. This 10-year period will be extended to 11 years if, during the first eight of those 10 years, the marketing authorization holder obtains an approval for one or more new therapeutic indications that bring significant clinical benefits compared with existing therapies. In addition, companies may be developing biosimilars in other countries that could compete with our products. If competitors are able to obtain marketing approval for biosimilars referencing our products, our products may become subject to competition from such biosimilars, with the attendant competitive pressure and consequences. Expiration or successful challenge of our applicable patent rights could also trigger competition from other products, assuming any relevant exclusivity period has expired.

In addition, although our product candidates have been granted orphan drug status by the FDA and EMA, there are limitations to the exclusivity. In the United States, the exclusivity period for orphan drugs is seven years, while pediatric exclusivity adds six months to any existing patents or exclusivity periods. In Europe, orphan drugs may be able to obtain 10 years of marketing exclusivity and up to an additional two years on the basis of qualifying pediatric studies. However, orphan exclusivity may be reduced to six years if the drug no longer satisfies the original designation criteria. Additionally, a marketing authorization holder may lose its orphan exclusivity if it consents to a second orphan drug application or cannot supply enough drug. Orphan drug exclusivity also can be lost when a second applicant demonstrates its drug is "clinically superior" to the original orphan drug.

Finally, as a result of the expiration or successful challenge of our patent rights, we could face more litigation with respect to the validity and/or scope of patents relating to our competitors' products. The availability of our competitors' products could limit the demand, and the price we are able to charge, for any products that we may develop and commercialize.

The commercial success of any current or future product candidate will depend upon the degree of market acceptance by physicians, patients, third-party payors and others in the medical community.

Ethical, social and legal concerns about gene therapy and genetic research could result in additional regulations restricting or prohibiting the products and processes we may use. Even with the requisite approvals, the commercial success of our product candidates will depend in

part on the medical community, patients, and third-party payors accepting gene therapy products in general, and our product candidates in particular, as medically useful, cost-effective, and safe. Any product that we bring to the market may not gain market acceptance by physicians, patients, third-party payors and others in the medical community. If these products do not achieve an adequate level of acceptance, we may not generate significant product revenue and may not become profitable. The degree of market acceptance of these product candidates, if approved for commercial sale, will depend on a number of factors, including:

- the potential efficacy and potential advantages over alternative treatments;
- the prevalence and severity of any side effects, including any limitations or warnings contained in a product's approved labeling;
- the prevalence and severity of any side effects resulting from the chemotherapy and myeloablative treatments associated with the procedure by which our product candidates are administered;
- relative convenience and ease of administration;
- the willingness of the target patient population to try new therapies and of physicians to prescribe these therapies;
- the strength of marketing and distribution support and timing of market introduction of competitive products;
- publicity concerning our products or competing products and treatments; and
- sufficient third-party insurance coverage or reimbursement.

Even if a potential product displays a favorable efficacy and safety profile in preclinical and clinical studies, market acceptance of the product will not be known until after it is launched. Our efforts to educate the medical community and third-party payors on the benefits of the product candidates may require significant resources and may never be successful. Such efforts to educate the marketplace may require more resources than are required by the conventional technologies marketed by our competitors.

If we obtain approval to commercialize our product candidates outside of the United States, a variety of risks associated with international operations could materially adversely affect our business.

If any of our product candidates are approved for commercialization, we may enter into agreements with third parties to market them on a worldwide basis or in more limited geographical regions. We expect that we will be subject to additional risks related to entering into international business relationships, including:

- different regulatory requirements for approval of drugs and biologics in foreign countries;
- reduced protection for intellectual property rights;
- unexpected changes in tariffs, trade barriers and regulatory requirements;
- economic weakness, including inflation, or political instability in particular foreign economies and markets;
- compliance with tax, employment, immigration and labor laws for employees living or traveling abroad;

- foreign currency fluctuations, which could result in increased operating expenses and reduced revenues, and other obligations incident to doing business in another country;
- workforce uncertainty in countries where labor unrest is more common than in the United States;
- production shortages resulting from any events affecting raw material supply or manufacturing capabilities abroad; and
- business interruptions resulting from geopolitical actions, including war and terrorism, or natural disasters including earthquakes, typhoons, floods and fires.

The insurance coverage and reimbursement status of newly-approved products is uncertain. Failure to obtain or maintain adequate coverage and reimbursement for new or current products could limit our ability to market those products and decrease our ability to generate revenue.

The availability and extent of reimbursement by governmental and private payors is essential for most patients to be able to afford expensive treatments, such as stem cell transplants. Sales of our product candidates will depend substantially, both domestically and abroad, on the extent to which the costs of our product candidates will be paid by health maintenance, managed care, pharmacy benefit and similar healthcare management organizations, or reimbursed by government health administration authorities, private health coverage insurers and other third-party payors. If reimbursement is not available, or is available only to limited levels, we may not be able to successfully commercialize our product candidates. Even if coverage is provided, the approved reimbursement amount may not be high enough to allow us to establish or maintain pricing sufficient to realize a sufficient return on our investment.

There is significant uncertainty related to the insurance coverage and reimbursement of newly approved products. In the United States, the principal decisions about reimbursement for new medicines are typically made by the Centers for Medicare & Medicaid Services, or CMS, an agency within the U.S. Department of Health and Human Services, as CMS decides whether and to what extent a new medicine will be covered and reimbursed under Medicare. Private payors tend to follow CMS to a substantial degree. It is difficult to predict what CMS will decide with respect to reimbursement for fundamentally novel products such as ours, as there is no body of established practices and precedents for these new products. Reimbursement agencies in Europe may be more conservative than CMS. For example, a number of cancer drugs have been approved for reimbursement in the United States and have not been approved for reimbursement in certain European countries. In addition, costs or difficulties associated with the reimbursement of Glybera could create an adverse environment for reimbursement of other gene therapies.

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, Canada, and other countries has 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. In general, the prices of medicines under such systems are substantially lower than in the United States. Other countries allow companies to fix their own prices for medicines, 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

products may be reduced compared with the United States and may be insufficient to generate commercially reasonable revenues 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 level of reimbursement for new products approved 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 any of our product candidates, due to the trend toward managed healthcare, the increasing influence of health maintenance organizations and additional legislative changes. The downward pressure on healthcare costs in general, particularly prescription drugs and surgical procedures and other treatments, has become very intense. As a result, increasingly high barriers are being erected to the entry of new products.

Due to the novel nature of our technology and the potential for our product candidates to offer therapeutic benefit in a single administration, we face uncertainty related to pricing and reimbursement for these product candidates.

Our target patient populations are relatively small, as a result of which the pricing and reimbursement of our product candidates, if approved, must be adequate to support commercial infrastructure. If we are unable to obtain adequate levels of reimbursement, our ability to successfully market and sell our product candidates will be adversely affected. The manner and level at which reimbursement is provided for services related to our product candidates (e.g., for administration of our product to patients) is also important. Inadequate reimbursement for such services may lead to physician resistance and adversely affect our ability to market or sell our products.

If the market opportunities for our product candidates are smaller than we believe they are, our revenues may be adversely affected and our business may suffer. Because the target patient populations of our product candidates are small, we must be able to successfully identify patients and achieve a significant market share to maintain profitability and growth.

We focus our research and product development on treatments for severe genetic and orphan diseases. Our projections of both the number of people who have these diseases, as well as the subset of people with these diseases who have the potential to benefit from treatment with our product candidates, are based on estimates. These estimates may prove to be incorrect and new studies may change the estimated incidence or prevalence of these diseases. The number of patients in the United States, Europe and elsewhere may turn out to be lower than expected, may not be otherwise amenable to treatment with our products, or new patients may become increasingly difficult to identify or gain access to, all of which would adversely affect our results of operations and our business.

Risks related to our business operations

Negative public opinion and increased regulatory scrutiny of gene therapy and genetic research may damage public perception of our product candidates or adversely affect our ability to conduct our business or obtain regulatory approvals for our product candidates.

Public perception may be influenced by claims that gene therapy is unsafe, and gene therapy may not gain the acceptance of the public or the medical community. In particular, our success will depend upon physicians specializing in the treatment of those diseases that our product

candidates target prescribing treatments that involve the use of our product candidates in lieu of, or in addition to, existing treatments they are already familiar with and for which greater clinical data may be available. More restrictive government regulations or negative public opinion would have a negative effect on our business or financial condition and may delay or impair the development and commercialization of our product candidates or demand for any products we may develop. For example, in 2003, 20 subjects treated for X-linked severe combined immunodeficiency in two gene therapy studies using a murine gamma-retroviral vector showed correction of the disease, but the studies were terminated after five subjects developed leukemia (four of whom were subsequently cured). Although none of our current product candidates utilize these gamma-retroviruses, our product candidates use a viral delivery system. Adverse events in our clinical studies, even if not ultimately attributable to our product candidates (such as the many adverse events that typically arise from the transplant process) and the resulting publicity could result in increased governmental regulation, unfavorable public perception, potential regulatory delays in the testing or approval of our potential product candidates, stricter labeling requirements for those product candidates that are approved and a decrease in demand for any such product candidates.

Our future success depends on our ability to retain key employees, consultants and advisors and to attract, retain and motivate qualified personnel.

We are highly dependent on principal members of our executive team and key employees listed under “Management” located elsewhere in this prospectus, the loss of whose services may adversely impact the achievement of our objectives. While we have entered into employment agreements with each of our executive officers, any of them could leave our employment at any time, as all of our employees are “at will” employees. Recruiting and retaining other qualified employees, consultants and advisors for our business, including scientific and technical personnel, will also be critical to our success. There is currently a shortage of skilled executives in our industry, which is likely to continue. As a result, competition for skilled personnel is intense and the turnover rate can be high. We may not be able to attract and retain personnel on acceptable terms given the competition among numerous pharmaceutical and biotechnology companies for individuals with similar skill sets. In addition, failure to succeed in preclinical or clinical studies may make it more challenging to recruit and retain qualified personnel. The inability to recruit or loss of the services of any executive, key employee, consultant or advisor may impede the progress of our research, development and commercialization objectives.

We will need to expand our organization and we may experience difficulties in managing this growth, which could disrupt our operations.

As of March 31, 2013, we had 50 full-time employees. As we mature and undertake the activities required under our collaboration with Celgene, we expect to expand our full-time employee base and to hire more consultants and contractors. Our management may need to divert a disproportionate amount of its attention away from our day-to-day activities and devote a substantial amount of time to managing these growth activities. We may not be able to effectively manage the expansion of our operations, which may result in weaknesses in our infrastructure, operational mistakes, loss of business opportunities, loss of employees and reduced productivity among remaining employees. For example, in the past there have been errors in the preparation of our financial statements and there can be no assurance that other errors will not occur in the future as we grow. Our expected growth could require significant capital expenditures and may divert financial resources from other projects, such as the development of additional product candidates. If our management is unable to effectively

manage our growth, our expenses may increase more than expected, our ability to generate and/or grow revenues could be reduced, and we may not be able to implement our business strategy. Our future financial performance and our ability to commercialize product candidates and compete effectively will depend, in part, on our ability to effectively manage any future growth.

Our employees, principal investigators, consultants and commercial partners may engage in misconduct or other improper activities, including non-compliance with regulatory standards and requirements and insider trading.

We are exposed to the risk of fraud or other misconduct by our employees, principal investigators, consultants and commercial partners. Misconduct by these parties could include intentional failures to comply with the regulations of the FDA and non-U.S. regulators, provide accurate information to the FDA and non-U.S. regulators, comply with healthcare fraud and abuse laws and regulations in the United States and abroad, report financial information or data accurately or disclose unauthorized activities to us. In particular, sales, marketing and business arrangements in the healthcare industry are subject to extensive laws and regulations intended to prevent fraud, misconduct, kickbacks, self-dealing and other abusive practices. These laws and regulations may restrict or prohibit a wide range of pricing, discounting, marketing and promotion, sales commission, customer incentive programs and other business arrangements. Such misconduct could also involve the improper use of information obtained in the course of clinical studies, which could result in regulatory sanctions and cause serious harm to our reputation. We have adopted a code of conduct applicable to all of our employees, but it is not always possible to identify and deter employee misconduct, and the precautions we take to detect and prevent this activity may not be effective in controlling unknown or unmanaged risks or losses or in protecting us from governmental investigations or other actions or lawsuits stemming from a failure to comply with these laws or regulations. If any such actions are instituted against us, and we are not successful in defending ourselves or asserting our rights, those actions could have a significant impact on our business, including the imposition of significant fines or other sanctions.

We face potential product liability, and, if successful claims are brought against us, we may incur substantial liability and costs. If the use of our product candidates harms patients, or is perceived to harm patients even when such harm is unrelated to our product candidates, our regulatory approvals could be revoked or otherwise negatively impacted and we could be subject to costly and damaging product liability claims.

The use of our product candidates in clinical studies and the sale of any products for which we obtain marketing approval exposes us to the risk of product liability claims. Product liability claims might be brought against us by consumers, healthcare providers, pharmaceutical companies or others selling or otherwise coming into contact with our products. There is a risk that our product candidates may induce adverse events. If we cannot successfully defend against product liability claims, we could incur substantial liability and costs. In addition, regardless of merit or eventual outcome, product liability claims may result in:

- impairment of our business reputation;
- withdrawal of clinical study participants;
- costs due to related litigation;
- distraction of management’s attention from our primary business;

- substantial monetary awards to patients or other claimants;
- the inability to commercialize our product candidates; and
- decreased demand for our product candidates, if approved for commercial sale.

We carry product liability insurance of $5,000,000 per occurrence and $5,000,000 aggregate limit. We believe our product liability insurance coverage is sufficient in light of our current clinical programs; however, we may not be able to maintain insurance coverage at a reasonable cost or in sufficient amounts to protect us against losses due to liability. If and when we obtain marketing approval for product candidates, we intend to expand our insurance coverage to include the sale of commercial products; however, we may be unable to obtain product liability insurance on commercially reasonable terms or in adequate amounts. On occasion, large judgments have been awarded in class action lawsuits based on drugs or medical treatments that had unanticipated adverse effects. A successful product liability claim or series of claims brought against us could cause our stock price to decline and, if judgments exceed our insurance coverage, could adversely affect our results of operations and business.

Patients with the diseases targeted by our product candidates are often already in severe and advanced stages of disease and have both known and unknown significant pre-existing and potentially life-threatening health risks. During the course of treatment, patients may suffer adverse events, including death, for reasons that may be related to our product candidates. Such events could subject us to costly litigation, require us to pay substantial amounts of money to injured patients, delay, negatively impact or end our opportunity to receive or maintain regulatory approval to market our products, or require us to suspend or abandon our commercialization efforts. Even in a circumstance in which we do not believe that an adverse event is related to our products, the investigation into the circumstance may be time-consuming or inconclusive. These investigations may interrupt our sales efforts, delay our regulatory approval process in other countries, or impact and limit the type of regulatory approvals our product candidates receive or maintain. As a result of these factors, a product liability claim, even if successfully defended, could have a material adverse effect on our business, financial condition or results of operations.

If we fail to comply with environmental, health and safety laws and regulations, we could become subject to fines or penalties or incur costs that could have a material adverse effect on the success of our business.

We are subject to numerous environmental, health and safety laws and regulations, including those governing laboratory procedures and the handling, use, storage, treatment and disposal of hazardous materials and wastes. Our operations involve the use of hazardous and flammable materials, including chemicals and biological materials. Our operations also produce hazardous waste products. We generally contract with third parties for the disposal of these materials and wastes. We cannot eliminate the risk of contamination or injury from these materials. In the event of contamination or injury resulting from our use of hazardous materials, we could be held liable for any resulting damages, and any liability could exceed our resources. We also could incur significant costs associated with civil or criminal fines and penalties.

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 or other work-related injuries, this insurance may not provide adequate coverage against potential liabilities. In addition, we may incur substantial costs in order to comply with current or future

environmental, health and safety laws and regulations. These current or future laws and regulations may impair our research, development or production efforts. Failure to comply with these laws and regulations also may result in substantial fines, penalties or other sanctions.

We may not be successful in our efforts to identify or discover additional product candidates.

The success of our business depends primarily upon our ability to identify, develop and commercialize products based on our gene therapy platform. Although our Lenti-D and LentiGlobin product candidates are currently in clinical development, our research programs, including those subject to our collaboration with Celgene, may fail to identify other potential product candidates for clinical development for a number of reasons. Our research methodology may be unsuccessful in identifying potential product candidates or our potential product candidates may be shown to have harmful side effects or may have other characteristics that may make the products unmarketable or unlikely to receive marketing approval.

If any of these events occur, we may be forced to abandon our development efforts for a program or programs, which would have a material adverse effect on our business and could potentially cause us to cease operations. Research programs to identify new product candidates require substantial technical, financial and human resources. We may focus our efforts and resources on potential programs or product candidates that ultimately prove to be unsuccessful.

We may use our financial and human resources to pursue a particular research program or product candidate and fail to capitalize on programs or product candidates that may be more profitable or for which there is a greater likelihood of success.

Because we have limited resources, we may forego or delay pursuit of opportunities with certain programs or product candidates or for indications that later prove to have greater commercial potential. Our resource allocation decisions may cause us to fail to capitalize on viable commercial products or profitable market opportunities. Our spending on current and future research and development programs for product candidates may not yield any commercially viable products. If we do not accurately evaluate the commercial potential or target market for a particular product candidate, we may relinquish valuable rights to that product candidate through strategic collaboration, licensing or other royalty arrangements in cases in which it would have been more advantageous for us to retain sole development and commercialization rights to such product candidate, or we may allocate internal resources to a product candidate in a therapeutic area in which it would have been more advantageous to enter into a partnering arrangement.

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

As a public company, we will incur significant legal, accounting and other expenses that we did not incur as a private company. In addition, the Sarbanes-Oxley Act, as well as rules subsequently implemented by the Securities and Exchange Commission, or SEC, and The Nasdaq Global Market have imposed various requirements on public companies. In July 2010, the Dodd-Frank Wall Street Reform and Consumer Protection Act, or the Dodd-Frank Act, was enacted. There are significant corporate governance and executive compensation related provisions in the Dodd-Frank Act that require the SEC to adopt additional rules and regulations in these areas such as “say on pay” and proxy access. Recent legislation permits smaller “emerging growth companies” to implement many of these requirements over a longer period and up to five years from the pricing of this offering. We intend to take advantage of this new

legislation but cannot guarantee that we will not be required to implement these requirements sooner than budgeted or planned and thereby incur unexpected expenses. Stockholder activism, the current political environment and the current high level of government intervention and regulatory reform may lead to substantial new regulations and disclosure obligations, which may lead to additional compliance costs and impact the manner in which we operate our business in ways we cannot currently anticipate. Our management and other personnel will need to devote a substantial amount of time to these compliance initiatives. Moreover, these rules and regulations will increase our legal and financial compliance costs and will make some activities more time-consuming and costly. For example, we expect these rules and regulations to make it more difficult and more expensive for us to obtain director and officer liability insurance and we may be required to incur substantial costs to maintain our current levels of such coverage. We estimate that we will annually incur approximately $1.0 million to $3.0 million in additional expenses to comply with the requirements imposed on us as a public company.

Unfavorable global economic conditions could adversely affect our business, financial condition or results of operations.

Our results of operations could be adversely affected by general conditions in the global economy and in the global financial markets. The recent global financial crisis caused extreme volatility and disruptions in the capital and credit markets. A severe or prolonged economic downturn, such as the recent global financial crisis, could result in a variety of risks to our business, including, weakened demand for our product candidates and our ability to raise additional capital when needed on acceptable terms, if at all. This is particularly true in Europe, which is undergoing a continued severe economic crisis. A weak or declining economy could also strain our suppliers, possibly resulting in supply disruption, or cause our customers to delay making payments for our services. Any of the foregoing could harm our business and we cannot anticipate all of the ways in which the current economic climate and financial market conditions could adversely impact 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.

Earthquakes 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, that damaged critical infrastructure, such as the manufacturing facilities of our third-party contract manufacturers, or that otherwise disrupted operations, it may be difficult or, in certain cases, impossible for us to continue our business for a substantial period of time. The disaster recovery and business continuity plans we have in place 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.

Risks related to our intellectual property

If we are unable to obtain or protect intellectual property rights related to our product candidates, we may not be able to compete effectively in our markets.

We rely upon a combination of patents, trade secret protection and confidentiality agreements to protect the intellectual property related to our product candidates. The strength

of patents in the biotechnology and pharmaceutical field involves complex legal and scientific questions and can be uncertain. The patent applications that we own or in-license may fail to result in issued patents with claims that cover our product candidates in the United States or in other foreign countries. There is no assurance that all of the potentially relevant prior art relating to our patents and patent applications has been found, which can invalidate a patent or prevent a patent from issuing from a pending patent application. Even if patents do successfully issue and even if such patents cover our product candidates, third parties may challenge their validity, enforceability or scope, which may result in such patents being narrowed or invalidated. Furthermore, even if they are unchallenged, our patents and patent applications may not adequately protect our intellectual property, provide exclusivity for our product candidates or prevent others from designing around our claims. Any of these outcomes could impair our ability to prevent competition from third parties, which may have an adverse impact on our business.

If the patent applications we hold or have in-licensed with respect to our programs or product candidates fail to issue, if their breadth or strength of protection is threatened, or if they fail to provide meaningful exclusivity for our product candidates, it could dissuade companies from collaborating with us to develop product candidates, and threaten our ability to commercialize, future products. Several patent applications covering our product candidates have been filed recently. We cannot offer any assurances about which, if any, patents will issue, the breadth of any such patent or whether any issued patents will be found invalid and unenforceable or will be threatened by third parties. Any successful opposition to these patents or any other patents owned by or licensed to us could deprive us of rights necessary for the successful commercialization of any product candidates that we may develop. Further, if we encounter delays in regulatory approvals, the period of time during which we could market a product candidate under patent protection could be reduced. Since patent applications in the United States and most other countries are confidential for a period of time after filing, and some remain so until issued, we cannot be certain that we were the first to file any patent application related to a product candidate. Furthermore, if third parties have filed such patent applications, an interference proceeding in the United States can be initiated by a third party to determine who was the first to invent any of the subject matter covered by the patent claims of our applications. In addition, patents have a limited lifespan. In the United States, the natural expiration of a patent is generally 20 years after it is filed. Various extensions may be available however the life of a patent, and the protection it affords, is limited. Even if patents covering our product candidates are obtained, once the patent life has expired for a product, we may be open to competition from generic medications.

In addition to the protection afforded by patents, we rely on trade secret protection and confidentiality agreements to protect proprietary know-how that is not patentable or that we elect not to patent, processes for which patents are difficult to enforce and any other elements of our product candidate discovery and development processes that involve proprietary know-how, information or technology that is not covered by patents. However, trade secrets can be difficult to protect. We seek to protect our proprietary technology and processes, in part, by entering into confidentiality agreements with our employees, consultants, scientific advisors and contractors. We also seek to preserve the integrity and confidentiality of our data and trade secrets by maintaining physical security of our premises and physical and electronic security of our information technology systems. While we have confidence in these individuals, organizations and systems, agreements or security measures may be breached, and we may not have adequate remedies for any breach. In addition, our trade secrets may otherwise become known or be independently discovered by competitors.

Although we expect all of our employees and consultants to assign their inventions to us, and all of our employees, consultants, advisors and any third parties who have access to our proprietary know-how, information or technology to enter into confidentiality agreements, we cannot provide any assurances that all such agreements have been duly executed or that our trade secrets and other confidential proprietary information will not be disclosed or that competitors will not otherwise gain access to our trade secrets or independently develop substantially equivalent information and techniques. Misappropriation or unauthorized disclosure of our trade secrets could impair our competitive position and may have a material adverse effect on our business. Additionally, if the steps taken to maintain our trade secrets are deemed inadequate, we may have insufficient recourse against third parties for misappropriating the trade secret. In addition, others may independently discover our trade secrets and proprietary information. For example, the FDA, as part of its Transparency Initiative, is currently considering whether to make additional information publicly available on a routine basis, including information that we may consider to be trade secrets or other proprietary information, and it is not clear at the present time how the FDA's disclosure policies may change in the future, if at all.

Further, the laws of some foreign countries do not protect proprietary rights to the same extent or in the same manner as the laws of the United States. As a result, we may encounter significant problems in protecting and defending our intellectual property both in the United States and abroad. If we are unable to prevent material disclosure of the non-patented intellectual property related to our technologies to third parties, and there is no guarantee that we will have any such enforceable trade secret protection, we may not be able to establish or maintain a competitive advantage in our market, which could materially adversely affect our business, results of operations and financial condition.

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

Our commercial success depends in part on our avoiding infringement of the patents and proprietary rights of third parties. There is a substantial amount of litigation, 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 and *inter partes* reexamination proceedings before the U.S. Patent and Trademark Office, or U.S. PTO, and corresponding foreign patent offices. Numerous U.S. and foreign issued patents and pending patent applications, which are owned by third parties, exist in the fields in which we are pursuing development candidates. As the biotechnology and pharmaceutical industries expand 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.

Third parties may assert that we are employing their proprietary technology without authorization. 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. Because patent applications can take many years to issue, there may be currently pending patent applications which may later result in issued patents that our product candidates may infringe. In addition, third parties may obtain patents in the future and claim that use of our technologies infringes upon these patents. If any third-party patents were held by a court of competent jurisdiction to cover the manufacturing process of any of our product candidates, any molecules formed during the manufacturing process or any final product itself, the holders of any such patents may be able to block our ability to commercialize such product candidate unless we obtained a license under the applicable patents, or until such patents expire.

Similarly, if any third-party patents were held by a court of competent jurisdiction to cover aspects of our formulations, processes for manufacture or methods of use, including combination therapy, the holders of any such patents may be able to block our ability to develop and commercialize the applicable product candidate unless we obtained a license or until such patent expires. In either case, such a license may not be available on commercially reasonable terms or at all.

Parties making claims against us may obtain injunctive or other equitable relief, which could effectively block our ability to further develop and commercialize one or more of our product 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. In the event of a successful claim of infringement against us, we may have to pay substantial damages, including treble damages and attorneys' fees for willful infringement, pay royalties, redesign our infringing products or obtain one or more licenses from third parties, which may be impossible or require substantial time and monetary expenditure.

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

Presently we have rights to the intellectual property, through licenses from third parties and under patents that we own, to develop our gene therapy product candidates. Because our programs may involve additional product candidates that may require the use of proprietary rights held by third parties, the growth of our business will likely depend in part on our ability to acquire, in-license or use these proprietary rights. In addition, our product candidates may require specific formulations to work effectively and efficiently and these rights may be held by others. 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. 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.

For example, we sometimes collaborate with U.S. and foreign academic institutions to accelerate our preclinical research or development under written agreements with these institutions. Typically, these institutions 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 right of first negotiation for intellectual property, we may be unable to negotiate a license within the specified time frame 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.

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. If we are unable to successfully obtain rights to required third-party intellectual property rights, our business, financial condition and prospects for growth could suffer.

If we fail to comply with our obligations in the agreements under which we license intellectual property rights from third parties or otherwise experience disruptions to our business relationships with our licensors, we could lose license rights that are important to our business.

We are a party to a number of intellectual property license agreements that are important to our business and expect to enter into additional license agreements in the future. Our existing license agreements impose, and we expect that future license agreements will impose, various diligence, milestone payment, royalty and other obligations on us. If we fail to comply with our obligations under these agreements, or we are subject to a bankruptcy, the licensor may have the right to terminate the license, in which event we would not be able to market products covered by the license. See "Business—License agreements" for a description of our license agreements with Inserm-Transfert, Institut Pasteur, Stanford University, the Massachusetts Institute of Technology and Research Development Foundation, which includes a description of the termination provisions of these agreements.

We may need to obtain licenses from third parties to advance our research or allow commercialization of our product candidates, and we have done so from time to time. We may fail to obtain any of these licenses at a reasonable cost or on reasonable terms, if at all. In that event, we may be required to expend significant time and resources to develop or license replacement technology. If we are unable to do so, we may be unable to develop or commercialize the affected product candidates, which could harm our business significantly. We cannot provide any assurances that third-party patents do not exist which might be enforced against our current product candidates or future products, resulting in either an injunction prohibiting our sales, or, with respect to our sales, an obligation on our part to pay royalties and/or other forms of compensation to third parties.

In many cases, patent prosecution of our licensed technology is controlled solely by the licensor. If our licensors fail to obtain and maintain patent or other protection for the proprietary intellectual property we license from them, we could lose our rights to the intellectual property or our exclusivity with respect to those rights, and our competitors could market competing products using the intellectual property. In certain cases, we control the prosecution of patents resulting from licensed technology. In the event we breach any of our obligations related to such prosecution, we may incur significant liability to our licensing partners. Licensing of intellectual property is of critical importance to our business and involves complex legal, business and scientific issues and is complicated by the rapid pace of scientific discovery in our industry. Disputes may arise regarding intellectual property subject to a licensing agreement, including:

- 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 under our collaborative development relationships;
- our diligence obligations under the license agreement and what activities satisfy those diligence obligations;
- the ownership of inventions and know-how resulting from the joint creation or use of intellectual property by our licensors and us and our partners; and
- the priority of invention of patented technology.

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

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

Competitors may infringe our patents or the patents of our licensors. To counter infringement or unauthorized use, we may be required to file infringement claims, which can be expensive and time-consuming. In addition, in an infringement proceeding, a court may decide that a patent of ours or our licensors is not valid, is unenforceable and/or is not infringed, or may refuse to stop the other party from using the technology at issue on the grounds that our patents do not cover the technology in question. An adverse result in any litigation or defense proceedings could put one or more of our patents at risk of being invalidated or interpreted narrowly and could put our patent applications at risk of not issuing.

Interference proceedings provoked by third parties or brought by us 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. 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. We may not be able to prevent, alone or with our licensors, misappropriation of our intellectual property rights, particularly in countries where the laws may not protect those rights as fully as in the United States.

Furthermore, because of the substantial amount of discovery required in connection with intellectual property litigation, there is a risk that some of our confidential information could be compromised by disclosure during this type of litigation. 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.

Recent patent reform legislation could increase the uncertainties and costs surrounding the prosecution of our patent applications and the enforcement or defense of our issued patents.

On September 16, 2011, the Leahy-Smith America Invents Act, or the Leahy-Smith Act, was signed into law. The Leahy-Smith Act includes a number of significant changes to U.S. patent law, including provisions that affect the way patent applications will be prosecuted and may also affect patent litigation. The U.S. PTO is currently developing regulations and procedures to govern administration of the Leahy-Smith Act, and many of the substantive changes to patent law associated with the Leahy-Smith Act, and in particular, the first to file provisions, were enacted March 16, 2013. However, it is not clear what, if any, impact the Leahy-Smith Act will have on the operation of our business. However, the Leahy-Smith Act and its implementation could increase the uncertainties and costs surrounding the prosecution of our patent applications and the enforcement or defense of our issued patents, all of which could have a material adverse effect on our business and financial condition.

We may be subject to claims that our employees, consultants or independent contractors have wrongfully used or disclosed confidential information of third parties or that our employees have wrongfully used or disclosed alleged trade secrets of their former employers.

We employ individuals who were previously employed at universities or other biotechnology or pharmaceutical companies, including our competitors or potential competitors. Although we try to ensure that our employees, consultants and independent contractors do not use the proprietary information or know-how of others in their work for us, we may be subject to claims that we or our employees, consultants or independent contractors have inadvertently or otherwise used or disclosed intellectual property, including trade secrets or other proprietary information, of any of our employee's former employer or other third parties. Litigation may be necessary to defend against these claims. If we fail in defending any such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights or personnel, which could adversely impact our business. Even if we are successful in defending against such claims, litigation could result in substantial costs and be a distraction to management and other employees.

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. We have had in the past, and we may also have to in the future, ownership disputes arising, for example, from conflicting obligations of consultants or others who are involved in developing our product candidates. 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 as exclusive ownership of, or right to use, valuable intellectual property. 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 be a distraction to management and other employees.

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

Periodic maintenance fees, renewal fees, annuity fees and various other governmental fees on patents and/or applications will be due to be paid to the U.S. PTO and various governmental patent agencies outside of the United States in several stages over the lifetime of the patents and/or applications. We have systems in place to remind us to pay these fees, and we employ an outside firm and rely on our outside counsel to pay these fees due to non-U.S. patent agencies. The U.S. PTO and various non-U.S. governmental patent agencies require compliance with a number of procedural, documentary, fee payment and other similar provisions during the patent application process. We employ reputable law firms and other professionals to help us comply, and 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 non-compliance can result in abandonment or lapse of the patent or patent application, resulting in partial or complete loss of patent rights in the relevant jurisdiction. In such an event, our competitors might be able to enter the market and this circumstance would have a material adverse effect on our business.

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

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

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

As is the case with other biotechnology companies, our success is heavily dependent on intellectual property, particularly patents. Obtaining and enforcing patents in the biotechnology industry involve both technological and legal complexity, and is therefore obtaining and enforcing biotechnology patents is costly, time-consuming and inherently uncertain. In addition, the United States has recently enacted and is currently implementing wide-ranging patent reform legislation. Recent U.S. Supreme Court rulings have narrowed the scope of patent protection available in certain circumstances and weakened the rights of patent owners in certain situations. In addition to increasing uncertainty with regard to our ability to obtain patents in the future, this combination of events has created uncertainty with respect to the value of patents, once obtained. Depending on decisions by the U.S. Congress, the federal courts, and the U.S. PTO, the laws and regulations governing patents could change in unpredictable ways that would weaken our ability to obtain new patents or to enforce our existing patents and patents that we might obtain in the future.

We have not yet registered trademarks for a commercial trade name for Lenti-D and failure to secure such registrations could adversely affect our business.

We have not yet registered trademarks for a commercial trade name for Lenti-D. During trademark registration proceedings, we may receive rejections. Although we would be given an opportunity to respond to those rejections, we may be unable to overcome such rejections. In addition, in the U.S. PTO and in comparable agencies in many foreign jurisdictions, third parties are given an opportunity to oppose pending trademark applications and to seek to cancel registered trademarks. Opposition or cancellation proceedings may be filed against our trademarks, and our trademarks may not survive such proceedings. Moreover, any name we

propose to use with our product candidates in the United States must be approved by the FDA, regardless of whether we have registered it, or applied to register it, as a trademark. The FDA typically conducts a review of proposed product names, including an evaluation of potential for confusion with other product names. If the FDA objects to any of our proposed proprietary product names, we may be required to expend significant additional resources in an effort to identify a suitable substitute name that would qualify under applicable trademark laws, not infringe the existing rights of third parties and be acceptable to the FDA.

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

Filing, prosecuting and defending patents on product candidates 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 products and our patents or other intellectual property rights may not be effective or sufficient to prevent them from competing.

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

Risks related to this offering and ownership of our common stock

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

Prior to this offering, there has not been a public market for our common stock. An active trading market for our common stock may not develop following this offering. You may not be able to sell your shares quickly or at the market price if trading in our common stock is not active. The initial public offering price for the shares will be determined by negotiations between us and the representative of the underwriters and may not be indicative of prices that will prevail in the trading market.

The market price of our common stock is likely to be volatile. Our stock price could be subject to wide fluctuations in response to a variety of factors, including the following:

- adverse results or delays in preclinical or clinical studies;
- reports of adverse events in other gene therapy products or clinical studies of such products;
- inability to obtain additional funding;
- any delay in filing an IND or BLA for any of our product candidates and any adverse development or perceived adverse development with respect to the FDA's review of that IND or BLA;
- failure to develop successfully and commercialize our product candidates;
- failure to maintain our existing strategic collaborations or enter into new collaborations;
- failure by us or our licensors and strategic collaboration partners to prosecute, maintain or enforce our intellectual property rights;
- changes in laws or regulations applicable to future products;
- inability to obtain adequate product supply for our product candidates or the inability to do so at acceptable prices;
- adverse regulatory decisions;
- introduction of new products, services or technologies by our competitors;
- failure to meet or exceed financial projections we may provide to the public;
- failure to meet or exceed the financial projections of the investment community;
- the perception of the pharmaceutical industry by the public, legislatures, regulators and the investment community;
- announcements of significant acquisitions, strategic partnerships, joint ventures or capital commitments by us, our strategic collaboration partner or our competitors;
- disputes or other developments relating to proprietary rights, including patents, litigation matters and our ability to obtain patent protection for our technologies;
- additions or departures of key scientific or management personnel;
- significant lawsuits, including patent or stockholder litigation;
- changes in the market valuations of similar companies;
- sales of our common stock by us or our stockholders in the future; and
- trading volume of our common stock.

In addition, companies trading in the stock market in general, and The Nasdaq Global Market in particular, have experienced extreme price and volume fluctuations that have often been unrelated or disproportionate to the operating performance of these companies. Broad market and industry factors may negatively affect the market price of our common stock, regardless of our actual operating performance.

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.

Our executive officers, directors, five percent stockholders and their affiliates beneficially own approximately 62.6% of our voting stock and, upon closing of this offering, that same group will beneficially own approximately 48.8% of our outstanding voting stock. Therefore, even after this offering, these stockholders will have the ability to influence us through their ownership positions. These stockholders may be able to determine all matters requiring stockholder approval. For example, these stockholders, acting together, may be able to control elections of directors, amendments of our organizational documents, or approval of any merger, sale of assets, or other major corporate transaction. This may prevent or discourage unsolicited acquisition proposals or offers for our common stock that you may believe are in your best interest as one of our stockholders.

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

We are an "emerging growth company," as defined in the Jumpstart Our Business Startups Act of 2012, or the JOBS Act. For as long as we continue to be an emerging growth company, we may take advantage of exemptions from various reporting requirements that are applicable to other public companies that are not emerging growth companies, including not being required to comply with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act of 2002, or the Sarbanes-Oxley Act, reduced disclosure obligations regarding executive compensation in this prospectus and our periodic reports and proxy statements and exemptions from the requirements of holding a nonbinding advisory vote on executive compensation and stockholder approval of any golden parachute payments not previously approved. We could be an emerging growth company for up to five years, although circumstances could cause us to lose that status earlier, including if the market value of our common stock held by non-affiliates exceeds $700.0 million as of any June 30 before that time or if we have total annual gross revenue of $1.0 billion or more during any fiscal year before that time, in which cases we would no longer be an emerging growth company as of the following December 31 or, if we issue more than $1.0 billion in non-convertible debt during any three-year period before that time, we would cease to be an emerging growth company immediately. Even after we no longer qualify as an emerging growth company, we may still qualify as a "smaller reporting company" which would allow us to take advantage of many of the same exemptions from disclosure requirements, including not being required to comply with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act and reduced disclosure obligations regarding executive compensation in this prospectus and our periodic reports and proxy statements. We cannot predict if investors will find our common stock less attractive because we may rely on these exemptions. If some investors find our common stock less attractive as a result, there may be a less active trading market for our common stock and our stock price may be more volatile.

Under the JOBS Act, emerging growth companies can also delay adopting new or revised accounting standards until such time as those standards apply to private companies. We have irrevocably elected not to avail ourselves of this exemption from new or revised accounting standards and, therefore, will be subject to the same new or revised accounting standards as other public companies that are not emerging growth companies.

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

Investors purchasing shares of common stock in this offering will pay a price per share that substantially exceeds the pro forma book value per share of our tangible assets after subtracting our liabilities. As a result, investors purchasing shares of common stock in this offering will incur immediate dilution of $9.24 per share, based on an assumed initial public offering price of $15.00 per share, the midpoint of the price range set forth on the cover of this prospectus, and our pro forma net tangible book value as of March 31, 2013. Further, based on these assumptions, investors purchasing shares of common stock in this offering will contribute approximately 34.1% of the total amount invested by stockholders since our inception, but will own only approximately 22.9% of the shares of common stock outstanding. For information on how the foregoing amounts were calculated, see "Dilution."

This dilution is due to the substantially lower price paid by our investors who purchased shares prior to this offering as compared to the price offered to the public in this offering, and the exercise of stock options granted to our employees. In addition, as of March 31, 2013, options to purchase 3,652,786 shares of our common stock at a weighted average exercise price of $3.46 per share were outstanding. The exercise of any of these options would result in additional dilution. As a result of the dilution to investors purchasing shares in this offering, investors may receive significantly less than the purchase price paid in this offering, if anything, in the event of our liquidation.

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 after the lock-up and other legal restrictions on resale discussed in this prospectus lapse, the market price of our common stock could decline. Based upon the number of shares of common stock, on an as-converted basis, outstanding as of May 31, 2013, upon the closing of this offering, we will have outstanding a total of 21,869,488 shares of common stock, assuming no exercise of the underwriters' option to purchase additional shares. Of these shares, as of the date of this prospectus, approximately 5.2 million shares of our common stock, plus any shares sold upon exercise of the underwriters' option to purchase additional shares, will be freely tradable, without restriction, in the public market immediately following this offering, assuming that current stockholders do not purchase shares in this offering. J.P. Morgan Securities LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated, however, may, in their sole discretion, permit our officers, directors and other stockholders who are subject to these lock-up agreements to sell shares prior to the expiration of the lock-up agreements.

The lock-up agreements pertaining to this offering will expire 180 days from the date of this prospectus (subject to extension upon the occurrence of specified events). After the lock-up agreements expire, based upon the number of shares of common stock, on an as-converted basis, outstanding as of May 31, 2013, up to an additional 16.7 million shares of common stock will be eligible for sale in the public market, 14.6 million of which shares are held by directors, executive officers and other affiliates and will be subject to Rule 144 under the Securities Act of 1933, as amended, or the Securities Act.

In addition, as of May 31, 2013, 4,638,240 shares of common stock that are either subject to outstanding options, reserved for future issuance under our equity incentive plans or subject to outstanding warrants will become eligible for sale in the public market to the extent permitted by the provisions of various vesting schedules, the lock-up agreements and Rule 144 and Rule 701 under the Securities Act. If these additional shares of common stock are sold, or if it is perceived that they will be sold, in the public market, the market price of our common stock could decline.

After this offering, the holders of approximately 16.3 million shares of our common stock will be entitled to rights with respect to the registration of their shares under the Securities Act, subject to the lock-up agreements described above. 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 market price of our common stock.

Future sales and issuances of our common stock or rights to purchase common stock, including pursuant to our equity incentive plans, could result in additional dilution of the percentage ownership of our stockholders and could cause our stock price to fall.

Additional capital will be needed in the future to continue our planned operations. To the extent we raise additional capital by issuing equity securities, our stockholders may experience substantial dilution. We may sell common stock, convertible securities or other equity securities in one or more transactions at prices and in a manner we determine from time to time. If we sell common stock, convertible securities or other equity securities in more than one transaction, investors may be materially diluted by subsequent sales. These sales may also result in material dilution to our existing stockholders, and new investors could gain rights superior to our existing stockholders.

Pursuant to our 2013 Stock Option and Incentive Plan, or the 2013 Plan, our management is authorized to grant stock options and other equity-based awards to our employees, directors and consultants. The number of shares available for future grant under the 2013 Plan will automatically increase each year by up to 4% of all shares of our capital stock outstanding as of December 31 of the prior calendar year, subject to the ability of our board of directors to take action to reduce the size of the increase in any given year. Currently, we plan to register the increased number of shares available for issuance under the 2013 Plan each year. If our board of directors elects to increase the number of shares available for future grant by the maximum amount each year, our stockholders may experience additional dilution, which could cause our stock price to fall.

We could be subject to securities class action litigation.

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

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

Our management will have broad discretion in the application of the net proceeds from this offering, including for any of the purposes described in the section entitled "Use of proceeds,"

and you will not have the opportunity as part of your investment decision to assess whether the net proceeds are being used appropriately. Because of the number and variability of factors that will determine our use of the net proceeds from this offering, their ultimate use may vary substantially from their currently intended use. The failure by our management to apply these funds effectively could harm our business. Pending their use, we may invest the net proceeds from this offering in short-term, investment-grade, interest-bearing securities. These investments may not yield a favorable return to our stockholders.

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

Under Section 382 of the Internal Revenue Code of 1986, as amended, if a corporation undergoes an "ownership change," generally defined as a greater than 50% change (by value) in its equity ownership 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 tax credits) to offset its post-change income may be limited. We believe we may have triggered an "ownership change" limitation. We may also experience ownership changes in the future as a result of subsequent shifts in our stock ownership. As a result, if we earn net taxable income, our ability to use our pre-change net operating loss carryforwards to offset U.S. federal taxable income may be subject to limitations, which could potentially result in increased future tax liability to us. In addition, at the state level, there may be periods during which the use of NOLs is suspended or otherwise limited, which could accelerate or permanently increase state taxes owed.

We do not intend to pay dividends on our common stock so any returns will be limited to the value of our stock.

We have never declared or paid any cash dividends on our common stock. We currently anticipate that we will retain future earnings for the development, operation and expansion of our business and do not anticipate declaring or paying any cash dividends for the foreseeable future. Any return to stockholders will therefore be limited to the appreciation of their stock.

Provisions in our amended and restated certificate of incorporation and by-laws, as well as provisions of Delaware law, could make it more difficult for a third party to acquire us or increase the cost of acquiring us, even if doing so would benefit our stockholders or remove our current management.

Our amended and restated certificate of incorporation, amended and restated by-laws and Delaware law contain provisions that may have the effect of delaying or preventing a change in control of us or changes in our management. Our amended and restated certificate of incorporation and by-laws, which will become effective upon the closing of this offering, include provisions that:

- authorize "blank check" preferred stock, which could be issued by our board of directors without stockholder approval and may contain voting, liquidation, dividend and other rights superior to our common stock;
- create a classified board of directors whose members serve staggered three-year terms;
- specify that special meetings of our stockholders can be called only by our board of directors, the chairperson of our board of directors, our chief executive officer or our president;
- prohibit stockholder action by written consent;

- establish an advance notice procedure for stockholder approvals to be brought before an annual meeting of our stockholders, including proposed nominations of persons for election to our board of directors;
- provide that our directors may be removed only for cause;
- provide that vacancies on our board of directors may be filled only by a majority of directors then in office, even though less than a quorum;
- specify that no stockholder is permitted to cumulate votes at any election of directors;
- expressly authorize our board of directors to modify, alter or repeal our amended and restated by-laws; and
- require supermajority votes of the holders of our common stock to amend specified provisions of our amended and restated certificate of incorporation and amended and restated by-laws.

These provisions, alone or together, could delay or prevent hostile takeovers and changes in control or changes in our management.

In addition, because we are incorporated in Delaware, we are governed by the provisions of Section 203 of the Delaware General Corporation Law, which limits the ability of stockholders owning in excess of 15% of our outstanding voting stock to merge or combine with us.

Any provision of our amended and restated certificate of incorporation or amended and restated by-laws or Delaware law that has the effect of delaying or deterring a change in control could limit the opportunity for our stockholders to receive a premium for their shares of our common stock, and could also affect the price that some investors are willing to pay for our common stock.

Provisions in our collaboration agreement with Celgene Corporation may prevent or delay a change in control.

Our collaboration agreement with Celgene Corporation provides that, effective upon completion of this offering, during the initial three-year term of the collaboration and, if extended, during the first extension term of the collaboration which is two years, in the event that we engage in a change in control transaction, including for such purposes a merger or consolidation of bluebird bio or the sale of all or substantially all of our assets, or if another person or entity or group of persons or entities acquires at least 50% of our voting capital stock, then Celgene has the right, but not the obligation, to terminate the collaboration agreement and obtain perpetual, non-terminable, worldwide, exclusive, fully paid-up licenses to all, but not less than all, of the product candidates previously identified under the collaboration agreement. We refer to this right to acquire such licenses as the call option.

Under the call option, the product candidates to which Celgene would have the right to acquire fully paid-up licenses include any product candidate previously licensed out of the collaboration during the term of the collaboration, any product candidate for which we have exercised our right to co-develop and co-promote the product candidate within the United States, any product candidate for which Celgene previously declined its option to obtain a license and any product candidate for which at least *in vivo* efficacy studies have been initiated or authorized by the joint steering committee for the collaboration. The purchase price for such

fully paid-up licenses would be determined pursuant to a binding arbitration process and would be paid on or about the consummation of the change of control transaction with our acquiror. The call option will lapse at the end of the three-year term of the collaboration, unless extended, in which case it will lapse at the end of the first extension term, which is two years, even if the collaboration is extended further.

In addition, during the initial three-year term of the collaboration, but not during any extension of the collaboration agreement, in the event that we engage in a change in control transaction described above and Celgene exercises the call option described above, then, in addition to the right to acquire the fully paid-up licenses described above, Celgene would also have the right to obtain a perpetual, non-terminable, worldwide, exclusive license to our intellectual property to develop one or more CAR T cell products targeting one or more oncology associated target antigens identified by Celgene following the third anniversary of the collaboration agreement. There is no limit to the number of oncology associated target antigens Celgene may select under this license. Upon commercialization of any such product candidate so licensed by Celgene, Celgene would be obligated to pay us a specified milestone payment upon regulatory approval and a percentage of net sales as a royalty. We refer to this license agreement to develop one or more CAR T cell products targeting one or more oncology associated target antigens as the target antigen license. The right to acquire a target antigen license will lapse after the initial three-year term of the collaboration, even if the collaboration is extended.

The call option and the right to acquire a target antigen license may have the effect of delaying or preventing a change in control transaction involving us, or may reduce the number of companies interested in acquiring us. If Celgene were to exercise the call option, it would gain exclusive development and marketing rights to the product candidates developed under the collaboration agreement, including any product for which we previously exercised our co-development and co-promotion rights. Were this to happen, our successor would not receive a royalty on net sales of any of the products out-licensed in connection with the call option, nor would it realize any value it may otherwise ascribe to our right to co-develop and co-promote within the United States any products developed during the collaboration. Moreover, if such event were to occur during the first three years of the collaboration, Celgene would also effectively have the exclusive right to develop and market an unlimited number of additional CAR T cell products using our gene therapy platform, whether or not these products were first identified or developed during the course of the collaboration, which product candidates would target a list of oncology associated target antigens that would not be known at the time we close our change in control transaction. This license could potentially give Celgene rights to our gene therapy platform for CAR T cell product candidates in the event we are acquired prior to the third anniversary of the collaboration.

These provisions could have the effect of delaying or preventing a change in control transaction involving bluebird bio, or could reduce the number of companies interested in acquiring us, in particular during the first three years of the collaboration. This risk may become particularly acute in the event either of our lead product candidates, Lenti-D or LentiGlobin, suffer material setbacks or delays in their clinical advancement, as a result of which the long-term strategic value potential acquirors may ascribe to us could increasingly be attributable to the potential long-term value of any CAR T cell products we develop under the collaboration.

Cautionary note regarding forward-looking statements

This prospectus contains forward-looking statements that involve risks and uncertainties. All statements other than statements of historical facts contained in this prospectus are forward-looking statements. In some cases, you can identify forward-looking statements by words such as “anticipate,” “believe,” “contemplate,” “continue,” “could,” “estimate,” “expect,” “intend,” “may,” “plan,” “potential,” “predict,” “project,” “seek,” “should,” “target,” “will,” “would,” or the negative of these words or other comparable terminology. These forward-looking statements include, but are not limited to, statements about:

- the initiation, timing, progress and results of our preclinical and clinical studies, and our research and development programs;
- our ability to advance product candidates into, and successfully complete, clinical studies;
- our ability to advance our viral vector manufacturing and transduction capabilities;
- the timing or likelihood of regulatory filings and approvals;
- the commercialization of our product candidates, if approved;
- the pricing and reimbursement of our product candidates, if approved;
- the implementation of our business model, strategic plans for our business, product candidates and technology;
- the scope of protection we are able to establish and maintain for intellectual property rights covering our product candidates and technology;
- estimates of our expenses, future revenues, capital requirements and our needs for additional financing;
- the potential benefits of strategic collaboration agreements and our ability to enter into strategic arrangements;
- our ability to maintain and establish collaborations or obtain additional grant funding;
- our financial performance;
- developments relating to our competitors and our industry; and
- other risks and uncertainties, including those listed under the caption “Risk factors.”

Any forward-looking statements in this prospectus reflect our current views with respect 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 “Risk factors” and elsewhere in this prospectus. 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 prospectus also contains estimates, projections and other information concerning our industry, our business, and the markets for certain diseases, including data regarding the estimated size of those markets, and the incidence and prevalence of certain medical conditions. Information that is based on estimates, forecasts, projections, market research or similar methodologies is inherently subject to uncertainties and actual events or circumstances may differ materially from events and circumstances reflected in this information. Unless otherwise expressly stated, we obtained this industry, business, market and other data from reports, research surveys, studies and similar data prepared by market research firms and other third parties, industry, medical and general publications, government data and similar sources.

Use of proceeds

We estimate that the net proceeds from the sale of 5,000,000 shares of common stock in this offering will be approximately $66.8 million at an assumed initial public offering price of $15.00 per share, the midpoint of the price range set forth on the cover of this prospectus, after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us. If the underwriters exercise their option to purchase additional shares in full, we estimate that the net proceeds will be approximately $77.2 million after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us. Each $1.00 increase or decrease in the assumed initial public offering price of $15.00 per share would increase or decrease our net proceeds by $4.7 million, assuming the number of shares offered by us, as set forth on the cover of this prospectus, remains the same and after deducting the underwriting discounts and commissions and estimated offering expenses payable by us.

We are undertaking this offering in order to access the public capital markets and to increase our liquidity. We intend to use the net proceeds of this offering as follows:

- Approximately $11.8 million to fund direct research and development expenses for our ALD-102 Study, a Phase II/III clinical study of Lenti-D to evaluate its safety and efficacy in subjects with childhood cerebral adrenoleukodystrophy;
- Approximately $12.7 million to fund direct research and development expenses for our HGB-204 Study, a Phase I/II clinical study in the United States of LentiGlobin to evaluate its safety and efficacy in subjects with ß-thalassemia major;
- Approximately $2.5 million to fund direct research and development expenses for our HGB-205 Study, a Phase I/II clinical study in Europe of LentiGlobin to evaluate its safety and efficacy in subjects with ß-thalassemia major and sickle cell disease; and
- The remainder for general and administrative expenses (including personnel-related costs), potential future development programs, early-stage research and development, capital expenditures and working capital and other general corporate purposes.

Our expected use of net proceeds from this offering represents our current intentions based upon our present plans and business condition. As of the date of this prospectus, we cannot predict with certainty all of the particular uses for the net proceeds to be received upon the completion of this offering or the amounts that we will actually spend on the uses set forth above. We may also use a portion of the net proceeds to in-license, acquire or invest in complementary gene therapy businesses, technologies, products or assets. Due to the many variables inherent to the development of gene therapy products at this time, such as the timing of patient enrollment and evolving regulatory requirements, we cannot currently predict the stage of development we expect the net proceeds of this offering to achieve for our clinical studies and product candidates.

The amount and timing of our actual expenditures will depend upon numerous factors, including the results of our research and development efforts, the timing and success of preclinical studies, our ongoing clinical studies or clinical studies we may commence in the future and the timing of regulatory submissions. As a result, our management will have broad discretion over the use of the net proceeds from this offering.

Pending the use of the proceeds from this offering, we intend to invest the net proceeds in short-term, interest-bearing, investment-grade securities, certificates of deposit or government securities.

Dividend policy

We have never declared or paid cash dividends on our common stock. We currently intend to retain all available funds and any future earnings, if any, to fund the development and expansion of our business and we do not anticipate paying any cash dividends in the foreseeable future. Any future determination to pay dividends will be made at the discretion of our board of directors.

Capitalization

The following table sets forth our cash, cash equivalents and capitalization as of March 31, 2013:

- on an actual basis;
- on a pro forma basis to reflect conversion of all outstanding shares of our preferred stock into an aggregate of 16,388,510 shares of common stock and the reclassification of our outstanding warrants to purchase shares of preferred stock to common stock, in each case upon the closing of this offering; and
- on a pro forma as adjusted basis to additionally reflect the issuance and sale by us of shares of our common stock in this offering, after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us, at an assumed initial public offering price of $15.00 per share, the midpoint of the price range set forth on the cover of this prospectus.

You should read this information together with our audited financial statements and related notes appearing elsewhere in this prospectus and the information set forth under the heading “Selected consolidated financial data” and “Management’s discussion and analysis of financial condition and results of operations.”

	As of March 31, 2013		
(in thousands, except per share data)	**Actual**	**Pro forma**	**Pro forma as adjusted**
		(unaudited)	
Cash and cash equivalents	$ 131,836	$ 131,836	$ 198,586
Preferred stock warrant liability	256	—	—
Series A-2 convertible preferred stock, $0.01 par value: 22,304 shares authorized; 22,304 shares issued and outstanding at March 31, 2013, and no shares issued and outstanding pro forma and pro forma as adjusted	7,137	—	—
Series B convertible preferred stock, $0.01 par value: 115,779 shares authorized; 115,204 shares issued and outstanding at March 31, 2013, and no shares issued and outstanding pro forma and pro forma as adjusted	40,321	—	—
Series C convertible preferred stock, $0.01 par value: 39,943 shares authorized; 39,943 shares issued and outstanding at March 31, 2013, and no shares issued and outstanding pro forma and pro forma as adjusted	12,382	—	—
Series D convertible preferred stock, $0.01 par value: 120,409 shares authorized; 120,409 shares issued and outstanding at March 31, 2013, and no shares issued and outstanding pro forma and pro forma as adjusted	60,000	—	—
Stockholders’ deficit:			
Series A-1 convertible preferred stock, $0.01 par value: 18,817 shares authorized; 12,981 shares issued and outstanding at March 31, 2013, and no shares issued and outstanding pro forma and pro forma as adjusted	2,337	—	—
Preferred Stock, $0.01 par value; 5,000 shares authorized and no shares issued and outstanding at March 31, 2013, pro forma and pro forma as adjusted	—	—	—
Common stock, $0.01 par value; 21,511 shares authorized, actual and pro forma; 348 shares issued and outstanding at March 31, 2013, and 16,737 shares issued and outstanding pro forma(1); 125,000 shares authorized and 21,737 shares issued and outstanding, pro forma as adjusted	3	167	217
Additional paid-in capital	15,963	138,232	204,932
Accumulated deficit	(79,898)	(79,898)	(79,898)
Total stockholders’ (deficit) equity	(61,595)	58,501	125,251
Total capitalization	$ 58,501	$ 58,501	$ 125,251

(1) Excludes 132 shares of unvested restricted common stock.

The actual, pro forma and pro forma as adjusted outstanding shares information in the table above excludes the following:

- 3,652,786 shares of common stock issuable upon the exercise of outstanding stock options having a weighted-average exercise price of $3.46 per share;
- 440,346 shares of common stock issuable upon the exercise of outstanding warrants having a weighted-average exercise price of $9.24 per share;
- 546,030 shares of common stock reserved for issuance pursuant to future equity awards under our 2010 Stock Option and Grant Plan; and
- 955,000 shares of common stock reserved for issuance (including the above-referenced shares reserved for issuance under our 2010 Stock Option and Grant Plan) pursuant to future equity awards under our 2013 Stock Option and Incentive Plan.

Dilution

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

As of March 31, 2013, we had pro forma net tangible book value of $58.5 million, or $3.50 per share of common stock, taking into account the expected conversion of our outstanding preferred stock into common stock and reclassification of our outstanding warrants to purchase our Series B preferred stock into common stock, upon the closing of this offering. Without giving effect to the conversion of our outstanding preferred stock into common stock, we had a historical net tangible book value of $(61.6) million, or $(177.00) per share of common stock, as of March 31, 2013. Historical net tangible book value per share is equal to our total tangible assets, less total liabilities and preferred stock, divided by the number of outstanding shares of our common stock (excluding 132,130 shares of unvested restricted stock subject to repurchase by us). After giving effect to (1) the conversion of all of our preferred stock into 16,388,510 shares of common stock upon the closing of this offering and (2) the sale of 5,000,000 shares of common stock in this offering, after deducting estimated underwriting discounts and commissions and estimated offering expenses payable by us, at an assumed initial public offering price of $15.00 per share, the midpoint of the price range set forth on the cover of this prospectus, our pro forma as adjusted net tangible book value as of March 31, 2013 would have been approximately $125.3 million, or approximately $5.76 per share of common stock. This represents an immediate increase in pro forma as adjusted net tangible book value of $2.26 per share to our existing stockholders and an immediate dilution of $9.24 per share to investors participating in this offering. The following table illustrates this per share dilution:

Assumed initial public offering price per share		$15.00
Historical net tangible book value per share as of March 31, 2013	$(177.00)	
Increase attributable to the conversion of outstanding preferred stock and reclassification of preferred stock warrants	180.50	
Pro forma net tangible book value per share as of March 31, 2013	3.50	
Increase in net tangible book value per share attributable to new investors	2.26	
Pro forma net tangible book value per share after this offering		5.76
Dilution per share to new investors		$ 9.24

Each $1.00 increase (decrease) in the assumed initial public offering price of $15.00 per share would increase (decrease) our pro forma as adjusted net tangible book value by approximately $4.7 million, the pro forma as adjusted net tangible book value per share by approximately $0.21 per share and the dilution to investors purchasing shares in this offering by approximately $0.22 per share, assuming the number of shares offered by us, as set forth on the cover of this prospectus, remains the same and after deducting the underwriting discounts and commissions and estimated offering expenses payable by us.

The following table summarizes, on a pro forma as adjusted basis as of March 31, 2013, the differences between the number of shares of common stock purchased from us, the total consideration and the average price per share paid by existing stockholders (giving effect to the conversion of all of our preferred stock into 16,388,510 shares of common stock prior to the

completion of this offering) and by investors participating in this offering, after deducting estimated underwriting discounts and commissions and estimated offering expenses, at an assumed initial public offering price of $15.00 per share, the midpoint of the price range set forth on the cover of this prospectus.

	Shares purchased		Total consideration		Average price per share
	Number	Percent	Amount	Percent	
Existing stockholders	16,868,566	77.1%	$144,875,241	65.9%	$ 8.59
New investors	5,000,000	22.9%	75,000,000	34.1%	$ 15.00
Total	21,868,566	100.0%	$219,875,241	100.0%	$ 10.05

The number of shares of common stock to be outstanding after this offering is based on the number of shares outstanding as of March 31, 2013 and excludes the following:

- 3,652,786 shares of common stock issuable upon the exercise of outstanding stock options having a weighted-average exercise price of $3.46 per share;
- 440,346 shares of common stock issuable upon the exercise of outstanding warrants having a weighted-average exercise price of $9.24 per share;
- 546,030 shares of common stock reserved for issuance pursuant to future equity awards under our 2010 Stock Option and Grant Plan; and
- 955,000 shares of common stock reserved for issuance (including the above-referenced shares reserved for issuance under our 2010 Stock Option and Grant Plan) pursuant to future equity awards under our 2013 Stock Option and Incentive Plan.

If the underwriters exercise their option to purchase additional shares in full, pro forma as adjusted net tangible book value as of March 31, 2013 will increase to $135.7 million, or $6.04 per share, representing an increase to existing stockholders of $2.54 per share, and there will be an immediate dilution of $8.96 per share to new investors.

Furthermore, we may choose to raise additional capital through the sale of equity or convertible debt securities due to market conditions or strategic considerations even if we believe we have sufficient funds for our current or future operating plans. New investors will experience further dilution if any of our outstanding options or warrants are exercised, new options are issued and exercised under our equity incentive plans or we issue additional shares of common stock, other equity securities or convertible debt securities in the future.

Selected consolidated financial data

The selected consolidated statements of operations data and the consolidated balance sheet data are derived from our audited consolidated financial statements appearing elsewhere in this prospectus. The selected consolidated financial data as of March 31, 2013 and for the three months ended March 31, 2013 and 2012 have been derived from our unaudited consolidated financial statements included elsewhere in this prospectus. In our opinion, these unaudited financial statements have been prepared on a basis consistent with our audited consolidated financial statements and contain all adjustments, consisting only of normal and recurring adjustments, necessary for a fair presentation of such consolidated financial data. You should read this data together with our audited consolidated financial statements and related notes appearing elsewhere in this prospectus and the information under the caption "Management's discussion and analysis of financial condition and results of operations." Our historical results are not necessarily indicative of our future results, and our operating results for the three-month period ended March 31, 2013 are not necessarily indicative of the results that may be expected for the fiscal year ending December 31, 2013 or any other interim periods or any future year or period.

	Year ended December 31,		Three months ended March 31,	
(in thousands, except per share data)	**2011**	**2012**	**2012**	**2013**
			(unaudited)	
Consolidated statements of operations data:				
Revenue:				
Collaboration revenue	$ —	$ —	$ —	$ 1,042
Research and license fees	640	340	85	85
Grant revenue	242	—	—	—
	882	340	85	1,127
Expenses:				
Research and development	11,409	17,210	3,858	5,284
General and administrative	4,615	6,846	1,363	2,324
Total expenses	16,024	24,056	5,221	7,608
Loss from operations	(15,142)	(23,716)	(5,136)	(6,481)
Other income (expense), net	(456)	46	68	(63)
Net loss	$ (15,598)	$ (23,670)	$ (5,068)	$ (6,544)
Net loss per share applicable to common stockholders—basic and diluted(1)	$ (171.59)	$ (13.79)	$ (28.49)	$ (19.94)
Weighted-average number of common shares used in net loss per share applicable to common stockholders—basic and diluted	120	262	223	328
Pro forma net loss per share applicable to common stockholders—basic and diluted (unaudited)(1)		$ (1.81)		$ (0.39)
Pro forma weighted-average number of common shares used in net loss per share applicable to common stockholders —basic and diluted (unaudited)		13,112		16,717

(in thousands)	As of March 31, 2013		
	Actual	Pro Forma(2)	Pro Forma Adjusted (3)(4)
		(unaudited)	
Consolidated balance sheet data:			
Cash and cash equivalents	$131,836	$ 131,836	$ 198,586
Working capital	105,390	105,390	172,140
Total assets	137,459	137,459	204,209
Preferred stock	122,177	—	—
Common stock and additional paid-in capital	15,966	138,399	205,149
Total stockholders' (deficit) equity	(61,595)	58,501	125,251

(1) See Notes 2 and 15 within the notes to our consolidated financial statements appearing elsewhere in this prospectus for a description of the method used to calculate basic and diluted net loss per common share and pro forma basic and diluted net loss per common share.

(2) Pro forma to reflect the conversion of all outstanding shares of our preferred stock into shares of common stock, and the reclassification of our outstanding warrants to purchase our Series B preferred stock to our common stock, upon the closing of this offering.

(3) Pro forma as adjusted to further reflect the sale of shares of our common stock offered in this offering, assuming an initial public offering price of $15.00 per share, the midpoint of the price range set forth on the cover of this prospectus, after deducting underwriting discounts and commissions and estimated offering expenses payable by us.

(4) A $1.00 increase (decrease) in the assumed initial public offering price of $15.00 per share, the midpoint of the price range set forth on the cover of this prospectus, would increase (decrease) the pro forma as adjusted amount of each of cash and cash equivalents and total stockholders' (deficit) equity by approximately $4.7 million, assuming that the number of shares offered by us, as set forth on the cover of this prospectus, remains the same and after deducting underwriting discounts and commissions and estimated offering expenses payable by us. A 1,000,000 share increase in the number of shares offered by us together with a concomitant $1.00 increase in the assumed initial public offering price of $15.00 per share, the midpoint of the price range set forth on the cover of this prospectus, would increase each of cash and cash equivalents and total stockholders' (deficit) equity by approximately $19.5 million after deducting underwriting discounts and commissions and any estimated offering expenses payable by us. Conversely, a 1,000,000 share decrease in the number of shares offered by us together with a concomitant $1.00 decrease in the assumed initial public offering price of $15.00 per share, the midpoint of the price range set forth on the cover of this prospectus, would decrease each of cash and cash equivalents and total stockholders' (deficit) equity by approximately $17.7 million after deducting underwriting discounts and commissions and any estimated offering expenses payable by us.

Management's discussion and analysis of financial condition and results of operations

You should read the following discussion and analysis of our financial condition and results of operations together with our consolidated financial statements and related notes appearing in this prospectus. Some of the information contained in this discussion and analysis or set forth elsewhere in this prospectus, including information with respect to our plans and strategy for our business and related financing, includes forward-looking statements that involve risks and uncertainties. As a result of many factors, including those factors set forth in the "Risk factors" section of this prospectus, our actual results could differ materially from the results described in or implied by the forward-looking statements contained in the following discussion and analysis.

Overview

We are a clinical-stage biotechnology company focused on transforming the lives of patients with severe genetic and orphan diseases using gene therapy. We believe that gene therapy has the potential to change the way these patients are treated by correcting the underlying genetic defect that is the *cause* of their disease, rather than offering solutions that only address their *symptoms*. We and our scientific collaborators have generated what we believe is human proof-of-concept data for our gene therapy platform in two underserved diseases, each of which has been granted orphan drug status by U.S. and European regulatory authorities. We expect to initiate in late 2013 a Phase II/III clinical study of our most advanced product candidate, Lenti-D, to evaluate its safety and efficacy in subjects with childhood cerebral adrenoleukodystrophy, or CCALD, a rare, hereditary neurological disorder affecting young boys that is often fatal. We also expect to initiate in mid-2013 a Phase I/II clinical study in the United States and have initiated a Phase I/II clinical study in Europe of our next most advanced product candidate, LentiGlobin, to evaluate its safety and efficacy in subjects with ß-thalassemia major and, in the European clinical study, sickle cell disease, or SCD, which are rare, hereditary blood disorders that often lead to severe anemia and shortened lifespans. In addition, in March 2013, we announced a global strategic collaboration with Celgene Corporation to discover, develop and commercialize novel, disease-altering gene therapies in oncology.

Since our inception in 1992, we have devoted substantially all of our resources to our development efforts relating to our product candidates, including activities to manufacture product in compliance with good manufacturing practices, or GMP, preparing to conduct clinical studies of our product candidates, providing general and administrative support for these operations and protecting our intellectual property. We do not have any products approved for sale and have not generated any revenue from product sales. We have funded our operations primarily through the private placement of preferred stock, common stock, convertible notes and warrants to purchase common stock. In addition, in October 2012, we were awarded a $9.3 million grant from the California Institute for Regenerative Medicine, or CIRM, to fund our U.S. ß-thalassemia program. This grant will be issued in quarterly installments and is expected to be utilized over a four-year period starting in the second half of 2013.

In March 2013, we entered into a strategic collaboration with Celgene Corporation, or Celgene, to discover, develop and commercialize novel, disease-altering gene therapies in oncology. This collaboration has an initial term of three years, and Celgene has made a $75 million up-front, non-refundable cash payment to us as consideration for entering into the

collaboration. During the three months ended March 31, 2013, we recognized $1.0 million of revenue associated with our collaboration with Celgene related to the research and development services performed. As of March 31, 2013, there is $74.0 million of deferred revenue related to our collaboration with Celgene that is classified as current or long-term in the accompanying balance sheet based on the contractual term of the arrangement.

We have never been profitable and have incurred net losses in each year since inception. Our net losses were $15.6 million and $23.7 million for the years ended December 31, 2011 and 2012, and $5.1 million and $6.5 million for the three months ended March 31, 2012 and 2013, respectively. Substantially all our net losses resulted from costs incurred in connection with our research and development programs and from general and administrative costs associated with our operations.

We expect to continue to incur significant expenses and increasing operating losses for at least the next several years. We expect our expenses will increase substantially in connection with our ongoing activities, as we:

- conduct clinical studies for our Lenti-D and LentiGlobin product candidates;
- continue our research and development efforts;
- increase research and development related activities for the discovery and development of oncology product candidates in connection with our recently-announced strategic collaboration with Celgene;
- manufacture clinical study materials and develop large-scale manufacturing capabilities;
- seek regulatory approval for our product candidates;
- add personnel to support our product development and commercialization efforts; and
- operate as a public company.

We do not expect to generate revenue from product sales unless and until we successfully complete development and obtain regulatory approval for one or more of our product candidates, which we expect will take a number of years and is subject to significant uncertainty. We have no manufacturing facilities and all of our manufacturing activities are contracted out to third parties. Additionally, we currently utilize third-party contract research organizations, or CROs, to carry out our clinical development activities and we do not yet have a sales organization. If we obtain regulatory approval for any of our product candidates, we expect to incur significant commercialization expenses related to product sales, marketing, manufacturing, and distribution. Accordingly, we will seek to fund our operations through public or private equity or debt financings or other sources. However, we may be unable to raise additional funds or enter into such other arrangements when needed on favorable terms or at all. Our failure to raise capital or enter into such other arrangements as and when needed would have a negative impact on our financial condition and our ability to develop our products.

Financial operations overview

Revenue

To date, we have not generated any revenues from the sales of products. Our revenues have been derived from collaboration arrangements, research fees, license fees, and grant revenues.

Collaboration revenue is generated exclusively from our collaboration arrangement with Celgene. The terms of this arrangement contain multiple deliverables, which include at inception: (i) discovery, research and development services, (ii) participation on the joint steering committee and (iii) participation on the patent committee. We recognize arrangement consideration allocated to each unit of accounting when all of the revenue recognition criteria in Financial Accounting Standards Board, or FASB, Accounting Standards Codification, or ASC, Topic 605, *Revenue Recognition*, or ASC 605, are satisfied for that particular unit of accounting. Revenue from the Celgene arrangement associated with discovery, research and development services, joint steering committee services and patent committee services is recognized ratably over the associated period of performance.

Research and license fee revenue is primarily generated through license and research and development agreements with strategic partners and nonprofit organizations for the development and commercialization of our product candidates. There are no performance, cancellation, termination, or refund provisions in any of our arrangements that contain material financial consequences to us.

Nonrefundable license fees are recognized as revenue upon delivery provided there are no undelivered elements in the arrangement. Research fees are recognized as revenue over the period we perform the associated services or on a straight-line basis if the pattern of performance cannot be estimated.

Grant revenue is primarily generated through research and development grant programs offered by federal, state, and local governments. Revenue is recognized when there is reasonable assurance that the grant will be received and we have complied with the terms of the grant.

Our ability to generate product revenue and become profitable depends upon our ability to successfully commercialize products. We expect to incur losses for the foreseeable future, and we expect these losses to increase as we continue our development of, and seek regulatory approvals for, our product candidates and begin to commercialize any approved products. Because of the numerous risks and uncertainties associated with product development, we are unable to predict the timing or amount of increased expenses or when or if we will be able to achieve or maintain profitability. Even if we are able to generate revenues from the sale of our products, we may not become profitable. If we fail to become profitable or are unable to sustain profitability on a continuing basis, then we may be unable to continue our operations at planned levels and be forced to reduce our operations.

Research and development expenses

Research and development expenses consist primarily of costs incurred for the development of our product candidates, which include:

- employee-related expenses, including salaries, benefits, travel and stock-based compensation expense;
- expenses incurred under agreements with CROs and investigative sites that will conduct our clinical studies;
- the cost of acquiring, developing, and manufacturing clinical study materials;
- facilities, depreciation, and other expenses, which include direct and allocated expenses for rent and maintenance of facilities, insurance, and other supplies; and
- costs associated with preclinical activities and regulatory operations.

Research and development costs are expensed as incurred. Costs for certain development activities are recognized based on an evaluation of the progress to completion of specific tasks using information and data provided to us by our vendors and our clinical sites.

We cannot determine with certainty the duration and completion costs of the current or future clinical studies of our product candidates or if, when, or to what extent we will generate revenues from the commercialization and sale of any of our product candidates that obtain regulatory approval. We may never succeed in achieving regulatory approval for any of our product candidates. The duration, costs, and timing of clinical studies and development of our product candidates will depend on a variety of factors, including:

- the scope, rate of progress, and expense of our ongoing as well as any additional clinical studies and other research and development activities;
- future clinical study results;
- uncertainties in clinical study enrollment rate;
- significant and changing government regulation; and
- the timing and receipt of any regulatory approvals.

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

From inception through March 31, 2013, we have incurred $69.8 million in research and development expenses. We plan to increase our research and development expenses for the foreseeable future as we continue the development of our Lenti-D and LentiGlobin product candidates and conduct research and development activities under our recently-announced strategic collaboration with Celgene. Our current planned research and development activities include the following:

- We plan to initiate during late 2013 a Phase II/III clinical study to examine the feasibility, safety and efficacy of our Lenti-D product candidate.
- We have initiated a Phase I/II clinical study in France to study the feasibility, safety and efficacy of our LentiGlobin product candidate in subjects with ß-thalassemia major and SCD.
- We plan to initiate during mid-2013 a Phase I/II clinical study in the United States to study the feasibility, safety and efficacy of our LentiGlobin product candidate in subjects with ß-thalassemia major.
- We will continue to manufacture clinical study materials in support of our clinical studies.

Our direct research and development expenses consist principally of external costs, such as startup fees paid to investigators, consultants, central laboratories and CROs in connection with our clinical studies, and costs related to acquiring and manufacturing clinical study materials. We

do not allocate personnel-related costs, costs associated with our general platform improvements, depreciation or other indirect costs to specific programs, as they are deployed across multiple projects under development and, as such, are separately classified as personnel and other expenses in the table below:

(in thousands)	Year ended December 31, 2011	Year ended December 31, 2012	Three months ended March 31, 2012	Three months ended March 31, 2013
			(unaudited)	
Lenti-D	$ 2,900	$ 3,966	$ 1,100	$ 1,076
LentiGlobin	1,416	5,259	551	1,362
Total direct research and development expenses	4,316	9,225	1,651	2,438
Employee and contractor-related expenses	5,090	6,150	1,686	2,055
Platform-related lab expenses	717	727	265	348
Facility expenses	619	709	187	295
Other expenses	667	399	69	148
Personnel and other expenses	7,093	7,985	2,207	2,846
Total research and development expenses	**$ 11,409**	**$ 17,210**	**$ 3,858**	**$ 5,284**

General and administrative expenses

General and administrative expenses consist primarily of salaries and related costs for personnel, including stock-based compensation and travel expenses for our employees in executive, operational, finance and human resource functions. Other general and administrative expenses include facility-related costs and professional fees for directors, accounting and legal services and expenses associated with obtaining and maintaining patents.

We anticipate that our general and administrative expenses will increase in the future as we increase our headcount to support our continued research and development and potential commercialization of our product candidates. We also anticipate increased expenses related to audit, legal, regulatory, and tax-related services associated with maintaining compliance with exchange listing and Securities and Exchange Commission requirements, director and officer insurance premiums, and investor relations costs associated with being a public company. Additionally, if and when we believe a regulatory approval of the first product candidate appears likely, we anticipate an increase in payroll and related expenses as a result of our preparation for commercial operations, especially as it relates to the sales and marketing of our product candidates.

Other income (expense), net

Other income and expense consists primarily of interest income earned on cash and cash equivalents and the re-measurement gain or loss associated with the change in the fair value of the preferred stock warrant liability.

We use the Black-Scholes option pricing model to estimate the fair value of the warrants. We base the estimates in the Black-Scholes option pricing model, in part, on subjective assumptions, including stock price volatility, risk-free interest rate, dividend yield, and the fair value of the

preferred stock underlying the warrants. The re-measurement gain or loss associated with the change in the fair value of the preferred stock warrant liability each reporting period is recognized as a component of other income (expense), net.

Critical accounting policies and significant judgments and estimates

Our management's discussion and analysis of our financial condition and results of operations are based on our financial statements, which have been prepared in accordance with U.S. generally accepted accounting principles. The preparation of these financial statements requires us to make estimates and judgments that affect the reported amounts of assets, liabilities, and expenses and the disclosure of contingent assets and liabilities in our financial statements. On an ongoing basis, we evaluate our estimates and judgments, including those related to accrued expenses and stock-based compensation. We base our estimates on historical experience, known trends and events, and various other factors that are believed to be reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates under different assumptions or conditions.

While our significant accounting policies are described in more detail in the notes to our financial statements appearing elsewhere in this prospectus, we believe the following accounting policies to be most critical to the judgments and estimates used in the preparation of our financial statements.

Revenue recognition

We have primarily generated revenue through collaboration arrangements, research arrangements and license arrangements with strategic partners and nonprofit organizations for the development and commercialization of product candidates. Additionally, we have generated revenue from research and development grant programs.

We recognize revenue in accordance with ASC 605. Accordingly, revenue is recognized for each unit of accounting when all of the following criteria are met:

- Persuasive evidence of an arrangement exists
- Delivery has occurred or services have been rendered
- The seller's price to the buyer is fixed or determinable
- Collectability is reasonably assured

Amounts received prior to satisfying the revenue recognition criteria are recorded as deferred revenue in our consolidated balance sheets. Amounts expected to be recognized as revenue within the 12 months following the balance sheet date are classified as deferred revenue, current portion. Amounts not expected to be recognized as revenue within the 12 months following the balance sheet date are classified as deferred revenue, net of current portion.

Collaboration revenue

As of March 31, 2013, our collaboration revenue was generated exclusively from our collaboration arrangement with Celgene. The terms of this arrangement contains multiple deliverables, which include at inception: (i) discovery, research and development services, (ii) participation on the joint steering committee and (iii) participation on the patent committee. The

collaboration arrangement also provides Celgene with the option to obtain a license to any product candidates resulting from the collaboration. Moreover, Celgene has the option to extend the term of the collaboration arrangement, first for a period of two years and then for an additional period of one year. Additionally, we have the sole right to manufacture or have manufactured supplies of vectors and associated payloads manufactured for incorporation into the associated product candidate in the event a product candidate is licensed. Non-refundable payments to us under this arrangement may include: (i) up-front research fees, (ii) product candidate license fees, (iii) extension term research fees, (iv) payments for the manufacture and supply of vectors and payloads, (v) payments based on the achievement of certain milestones and (vi) royalties on product sales. Additionally, we may elect to share in the costs incurred from the development, commercialization and manufacture of product candidates licensed by our collaborators and earn our share of the net profits or bear our share of the net losses generated from the sale of product candidates licensed by our collaborators.

We analyze multiple-element arrangements based on the guidance in FASB ASC Topic 605-25, *Revenue Recognition-Multiple-Element Arrangements*, or ASC 605-25. Pursuant to the guidance in ASC 605-25, we evaluate multiple-element arrangements to determine (1) the deliverables included in the arrangement and (2) whether the individual deliverables represent separate units of accounting or whether they must be accounted for as a combined unit of accounting. This evaluation involves subjective determinations and requires us to make judgments about the individual deliverables and whether such deliverables are separable from the other aspects of the contractual relationship. Deliverables are considered separate units of accounting provided that: (i) the delivered item(s) has value to the customer on a standalone basis and (ii) if the arrangement includes a general right of return relative to the delivered item(s), delivery or performance of the undelivered item(s) is considered probable and substantially in our control. In assessing whether an item has standalone value, we consider factors such as the research, manufacturing and commercialization capabilities of the collaboration partner and the availability of the associated expertise in the general marketplace. In addition, we consider whether the collaboration partner can use the other deliverable(s) for their intended purpose without the receipt of the remaining element(s), whether the value of the deliverable is dependent on the undelivered item(s) and whether there are other vendors that can provide the undelivered element(s). The collaboration arrangement does not contain a general right of return relative to the delivered item(s).

Arrangement consideration that is fixed or determinable is allocated among the separate units of accounting using the relative selling price method. Then, the applicable revenue recognition criteria in ASC 605 are applied to each of the separate units of accounting in determining the appropriate period and pattern of recognition. We determine the selling price of a unit of accounting following the hierarchy of evidence prescribed by ASC 605-25. Accordingly, we determine the estimated selling price for units of accounting within each arrangement using vendor-specific objective evidence, or VSOE, of selling price, if available, third-party evidence, or TPE, of selling price if VSOE is not available, or best estimate of selling price, or BESP, if neither VSOE nor TPE is available. We typically use BESP to estimate the selling price, since we generally do not have VSOE or TPE of selling price for our units of accounting. Determining the BESP for a unit of accounting requires significant judgment. In developing the BESP for a unit of accounting, we consider applicable market conditions and relevant entity-specific factors, including factors that were contemplated in negotiating the agreement with the customer and estimated costs. We validate the BESP for units of accounting by evaluating

whether changes in the key assumptions used to determine the BESP will have a significant effect on the allocation of arrangement consideration between multiple units of accounting.

Options are considered substantive if, at the inception of the arrangement, we are at risk as to whether the collaboration partner will choose to exercise the option. Factors that we consider in evaluating whether an option is substantive include the overall objective of the arrangement, the benefit the collaborator might obtain from the arrangement without exercising the option, the cost to exercise the option and the likelihood that the option will be exercised. For arrangements under which an option is considered substantive, we do not consider the item underlying the option to be a deliverable at the inception of the arrangement and the associated option fees are not included in allocable arrangement consideration, assuming the option is not priced at a significant and incremental discount. Conversely, for arrangements under which an option is not considered substantive or if an option is priced at a significant and incremental discount, we would consider the item underlying the option to be a deliverable at the inception of the arrangement and a corresponding amount would be included in allocable arrangement consideration. All of the options included in our collaboration arrangement have been determined to be substantive, and none of the options are priced at a significant and incremental discount.

We recognize arrangement consideration allocated to each unit of accounting when all of the revenue recognition criteria in ASC 605 are satisfied for that particular unit of accounting. We will recognize as revenue arrangement consideration attributed to licenses that have standalone value from the other deliverables to be provided in an arrangement upon delivery. We will recognize as revenue arrangement consideration attributed to licenses that do not have standalone value from the other deliverables to be provided in an arrangement over our estimated performance period as the arrangement would be accounted for as a single unit of accounting.

We recognize revenue from the Celgene arrangement associated with discovery, research and development services, joint steering committee services and patent committee services ratably over the associated period of performance. If there is no discernible pattern of performance and/or objectively measurable performance measures do not exist, then we recognize revenue under the arrangement on a straight-line basis over the period we are expect to complete our performance obligations. Conversely, if the pattern of performance in which the service is provided to the customer can be determined and objectively measurable performance measures exist, then we recognize revenue under the arrangement using the proportional performance method. Revenue recognized is limited to the lesser of the cumulative amount of payments received or the cumulative amount of revenue earned, as determined using the straight-line method or proportional performance method, as applicable, as of the period ending date.

At the inception of an arrangement that includes milestone payments, we evaluate whether each milestone is substantive and at risk to both parties on the basis of the contingent nature of the milestone. This evaluation includes an assessment of whether: (i) the consideration is commensurate with either our performance to achieve the milestone or the enhancement of the value of the delivered item(s) as a result of a specific outcome resulting from our performance to achieve the milestone, (ii) the consideration relates solely to past performance and (iii) the consideration is reasonable relative to all of the deliverables and payment terms within the arrangement. We evaluate factors such as the scientific, clinical, regulatory, commercial and other risks that must be overcome to achieve the respective milestone and the level of effort and

investment required to achieve the respective milestone in making this assessment. There is considerable judgment involved in determining whether a milestone satisfies all of the criteria required to conclude that a milestone is substantive. We have concluded that all of the clinical and regulatory milestones pursuant to its collaboration arrangement are substantive. Accordingly, in accordance with FASB ASC Topic 605-28, *Revenue Recognition-Milestone Method*, revenue from clinical and regulatory milestone payments will be recognized in its entirety upon successful accomplishment of the milestone, assuming all other revenue recognition criteria are met. Milestones that are not considered substantive would be recognized as revenue over the remaining period of performance, assuming all other revenue recognition criteria are met. Revenue from commercial milestone payments will be accounted for as royalties and recorded as revenue upon achievement of the milestone, assuming all other revenue recognition criteria are met.

We will recognize royalty revenue in the period of sale of the related product(s), based on the underlying contract terms, provided that the reported sales are reliably measurable and we have no remaining performance obligations, assuming all other revenue recognition criteria are met.

Accrued research and development expenses

As part of the process of preparing our financial statements, we are required to estimate our accrued expenses. This process involves reviewing open contracts and purchase orders, communicating with our personnel to identify services that have been performed on our behalf and estimating the level of service performed and the associated cost incurred for the service when we have not yet been invoiced or otherwise notified of the actual cost. The majority of our service providers invoice us monthly in arrears for services performed or when contractual milestones are met. We make estimates of our accrued expenses as of each balance sheet date in our financial statements based on facts and circumstances known to us at that time. We periodically confirm the accuracy of our estimates with the service providers and make adjustments if necessary. Examples of estimated accrued research and development expenses include fees paid to:

- CROs in connection with clinical studies;
- investigative sites in connection with clinical studies;
- vendors in connection with preclinical development activities; and
- vendors related to product manufacturing, development and distribution of clinical supplies.

We base our expenses related to clinical studies on our estimates of the services received and efforts expended pursuant to contracts with multiple CROs that conduct and manage clinical studies on our behalf. The financial terms of these agreements are subject to negotiation, vary from contract to contract and may result in uneven payment flows. There may be instances in which payments made to our vendors will exceed the level of services provided and result in a prepayment of the clinical expense. Payments under some of these contracts depend on factors such as the successful enrollment of subjects and the completion of clinical study milestones. In accruing service fees, we estimate the time period over which services will be performed and the level of effort to be expended in each period. If the actual timing of the performance of services or the level of effort varies from our estimate, we adjust the accrual or prepaid accordingly.

Although we do not expect our estimates to be materially different from amounts actually incurred, if our estimates of the status and timing of services performed differs from the actual status and timing of services performed we may report amounts that are too high or too low in any particular period. To date, there has been no material differences from our estimates to the amount actually incurred.

Stock-based compensation

Stock-based awards

We issue stock-based awards to employees and non-employees, generally in the form of stock options and restricted stock. We account for our stock-based awards in accordance with FASB ASC Topic 718, *Compensation—Stock Compensation*, or ASC 718. ASC 718 requires all stock-based payments to employees, including grants of employee stock options and modifications to existing stock options, to be recognized in the consolidated statements of operations and comprehensive loss based on their fair values. We account for stock-based awards to non-employees in accordance with FASB ASC Topic 505-50, *Equity-Based Payments to Non-Employees*, which requires the fair value of the award to be remeasured at fair value as the award vests. We recognize the compensation cost of stock-based awards to employees on a straight-line basis over the vesting period of the award and using an accelerated attribution model for awards to non-employees. Described below is the methodology we have utilized in measuring stock-based compensation expense. Following the consummation of this offering, stock option and restricted stock values will be determined based on the quoted market price of our common stock.

We estimate the fair value of our stock-based awards to employees and non-employees using the Black-Scholes option pricing model, which requires the input of highly subjective assumptions, including (a) the expected volatility of our stock, (b) the expected term of the award, (c) the risk-free interest rate, and (d) expected dividends. Due to the lack of a public market for the trading of our common stock and a lack of company specific historical and implied volatility data, we have based our estimate of expected volatility on the historical volatility of a group of similar companies that are publicly traded. For these analyses, we have selected companies with comparable characteristics to ours including enterprise value, risk profiles, position within the industry, and with historical share price information sufficient to meet the expected life of the stock-based awards. We compute the historical volatility data using the daily closing prices for the selected companies' shares during the equivalent period of the calculated expected term of our stock-based awards. We will continue to apply this process until a sufficient amount of historical information regarding the volatility of our own stock price becomes available. We have estimated the expected life of our employee stock options using the "simplified" method, whereby, the expected life equals the average of the vesting term and the original contractual term of the option. The risk-free interest rates for periods within the expected life of the option are based on the U.S. Treasury yield curve in effect during the period the options were granted.

We are also required to estimate forfeitures at the time of grant, and revise those estimates in subsequent periods if actual forfeitures differ from its estimates. We use historical data to estimate pre-vesting option forfeitures and record stock-based compensation expense only for those awards that are expected to vest. To the extent that actual forfeitures differ from our estimates, the difference is recorded as a cumulative adjustment in the period the estimates were revised. Stock-based compensation expense recognized in the financial statements is based on awards that are ultimately expected to vest.

We have computed the fair value of employee stock options at date of grant using the following weighted-average assumptions:

	Year ended December 31,		Three months ended March 31,	
	2011	2012	2012	2013
			(unaudited)	
Expected volatility	83.0%	79.6%	78.8%	82.0%
Expected term (in years)	6.1	6.1	6.1	6.1
Risk-free interest rate	1.7%	1.0%	1.1%	1.0%
Expected dividend yield	0.0%	0.0%	0.0%	0.0%

The following table presents the grant dates, number of underlying shares and related exercise prices or purchase prices of stock options granted and restricted stock awards, or RSAs, issued between January 1, 2011 and March 31, 2013, along with the corresponding exercise price for each option grant and the fair value per share utilized to calculate stock-based compensation expense:

Date of grant	Type of award	Number of shares	Exercise price (options) or purchase price (restricted stock) per share	Common stock fair value per share on grant date
7/13/2011	Option	623,087	$ 2.09	$ 2.09
7/13/2011	Restricted stock award	14,390	2.09	2.09
10/25/2011	Option	312,121	2.09	2.09
1/8/2012	Option	189,344	2.09	2.09
2/10/2012	Option	65,172	2.09	2.09
4/13/2012	Option	157,239	2.09	2.09
6/4/2012	Option	213,257	2.09	2.09
10/9/2012	Option	160,483	2.66	2.66
1/16/2013	Option	1,399,963	5.50	5.50
2/4/2013	Option	68,012	5.50	5.50

Stock-based compensation totaled approximately $0.8 million for the year ended December 31, 2012 and $0.7 million for the three months ended March 31, 2013. As of March 31, 2013, we had $6.5 million of total unrecognized compensation expense, net of related forfeiture estimates, which is expected to be recognized over a weighted-average remaining vesting period of approximately 3.6 years. We expect the impact of our stock-based compensation expense for stock options and restricted stock granted to employees and non-employees to grow in future periods due to the potential increases in the value of our common stock and headcount.

Fair value of stock options

We have historically granted stock options at exercise prices not less than the fair value of our common stock. As there has been no public market for our common stock to date, the estimated fair value of our common stock has been determined contemporaneously by our board of directors based on valuation estimates provided by management and prepared in accordance with the framework of the American Institute of Certified Public Accountants' Technical Practice Aid, *Valuation of Privately-Held-Company Equity Securities Issued as Compensation*, or AICPA Practice Aid, as well as independent third-party valuations. Our contemporaneous valuations of

our common stock as of April 21, 2011, April 15, 2012, July 23, 2012, December 31, 2012 and March 31, 2013 were based on a number of objective and subjective factors, including external market conditions affecting the biotechnology industry sector and the prices at which we sold shares of preferred stock, the superior rights and preferences of securities senior to our common stock at the time of each grant and the likelihood of achieving a liquidity event such as an initial public offering.

April 21, 2011 valuation

For the contemporaneous valuation at April 21, 2011, we used the back-solve method of the option-pricing method, or OPM, which derives the implied equity value for one type of equity security from a contemporaneous transaction involving another type of equity security. We applied the OPM back-solve method to solve for the equity value and corresponding value of common stock based on the price of $7.12287 per share of common stock issuable upon the conversion of Series C preferred stock sold in April 2011, which financing was led by an unrelated investor that had not previously invested in our Company. Given the proximity to the Series C preferred stock financing, we believe the per share issuance price of the Series C preferred stock provides an indication of the fair value of our equity as of April 21, 2011.

The OPM treats common stock and preferred stock as call options on the total equity value of a company, with exercise prices based on the value thresholds at which the allocation among the various holders of a company's securities changes. Under this method, the common stock has value only if the funds available for distribution to stockholders exceed the value of the liquidation preference at the time of a liquidity event, such as a strategic sale, merger or initial public offering, or IPO, assuming the enterprise has funds available to make a liquidation preference meaningful and collectible by the holders of preferred stock. The common stock is modeled as a call option on the underlying equity value at a predetermined exercise price. In the model, the exercise price is based on a comparison with the total equity value rather than, as in the case of a regular call option, a comparison with a per share stock price. Thus, common stock is considered to be a call option with a claim on the enterprise at an exercise price equal to the remaining value immediately after the preferred stock is liquidated. The option-pricing method uses the Black-Scholes option pricing model to price the call options. This model defines the securities' fair values as functions of the current fair value of a company and uses assumptions such as the anticipated timing of a potential liquidity event and the estimated volatility of the equity securities.

We estimated the time to liquidity as 3.3 years based on then-current plans and estimates of our board of directors and management regarding a liquidity event. The risk free rate was estimated as the interpolated 3.3 year yield on government bonds.

We applied a discount for lack of marketability to the value indicated for our common stock. A discount is appropriate because our common stock is unregistered, and the holder of a minority interest in the common stock may not influence the timing of a liquidity event for our Company. Our estimate of the appropriate discount for lack of marketability took into consideration put option methodologies consistent with the AICPA Practice Aid. A put option model indicated a discount of 47%. We selected a smaller discount after taking into account empirical studies of restricted stock issued by publicly-traded companies.

The following table summarizes the significant assumptions used to determine the fair value of our common stock of $2.09 as of April 21, 2011:

April 21, 2011 valuation	
Key assumptions	
Liquidity date	8/8/2014
Annual volatility	75%
Risk-free interest rate	1.3%
Discount for lack of marketability (DLOM)	35%
Estimated per share present value of marketable common stock (before DLOM)	$ 3.22

April 15, 2012 valuation

For the contemporaneous valuation at April 15, 2012, we used the guideline public company, or GPC, method under the market approach to value our equity. We identified two categories of GPCs. The first category consists of GPCs which are comparable to our Company in certain respects, such as a focus on gene therapy, dependence on a relatively limited number of compounds and exposure to risks associated with clinical studies. Similar to our Company, the majority of the GPCs have more than one product in various stages of development. The companies in this category are AVI BioPharma, CytRx Corporation, Oxford BioMedica, Sangamo Biosciences, and Synageva BioPharma. We considered the average enterprise values of these companies as one indication of the value of our equity. The second category consists of GPCs in the drug development industry which have completed IPOs within the year preceding the April 15, 2012 appraisal date. These companies differ in therapy focus but are similar to our Company in that they depend on a relatively limited number of compounds and are subject to risks associated with clinical studies. As an indicator of value, we considered the increase in value, or step-up, from the most-recent preferred round to the IPO price for each of these GPCs. We considered the median step-up as one indication of value for our equity. The values indicated by these two categories of GPCs were similar, and we assumed an average of the two values.

For the valuation at April 15, 2012, we used the OPM to allocate equity value among our preferred and common securities. Significant assumptions for the OPM included volatility, the risk-free rate, and the time to liquidity. We calculated annual rates of volatility based on weekly historical trading data for a group of guideline public companies. The estimated time to liquidity was based on a 45% probability of liquidity in 2.72 years, a 45% probability of liquidity in 3.72 years and a 10% probability of liquidity in 1.46 years. The anticipated timing and probability of a liquidity event was based on then-current plans and estimates of our board of directors and management. The weighted-average time to liquidity was 3.04 years. We used the yield on three-year U.S. Treasuries as a risk-free rate.

We applied a discount for lack of marketability to the value indicated for our common stock. A discount is appropriate because our common stock is unregistered, and the holder of a minority interest in the common stock may not influence the timing of a liquidity event for our Company. Our estimate of the appropriate discount for lack of marketability took into consideration put option methodologies consistent with the AICPA Practice Aid. Put option models indicated discounts of 30 to 68%. We selected a smaller discount after taking into account empirical studies of restricted stock issued by publicly-traded companies. The following table summarizes the significant assumptions used to determine the fair value of our common stock of $2.09 as of April 15, 2012:

April 15, 2012 valuation	
Key assumptions	
Liquidity date	7/5/2015
Annual volatility	72%
Risk-free interest rate	0.4%
Discount for lack of marketability (DLOM)	25%
Estimated per share present value of marketable common stock (before DLOM)	$ 2.79

July 23, 2012 valuation

For the contemporaneous valuation at July 23, 2012, we used a hybrid of the probability-weighted expected return method, or PWERM, and the OPM, which we refer to as the hybrid method. Under the PWERM, share value is derived from the probability-weighted present value of expected future investment returns, considering possible outcomes available to us, as well as the economic and control rights of each share class. Our July 23, 2012 valuation considers two possible outcomes: an IPO and a later, unspecified liquidity event. The hybrid method is a PWERM where the values in one of the scenarios is calculated using an OPM. The hybrid method considers one IPO scenario and one OPM scenario. For the OPM scenario, the type of liquidity event, or outcome is undefined. In order to estimate the investment return for the IPO scenario, we considered the increase in value, or step-up, from the most-recent preferred round to the IPO price for a group of drug development companies which completed IPOs in the year preceding the appraisal date. We calculated the step-up as an annual rate of return. We applied this rate of return to our Series D preferred price to estimate its future value in the event of an IPO. For the IPO scenario, we assumed a future equity value equal to the product of the future value of Series D preferred stock times the number of common equivalent shares outstanding. The future equity value at the expected IPO date was allocated to each class of preferred stock and the common stock assuming conversion of all preferred classes to common. We estimated the time to an IPO date as 2.44 years based on our board of directors' assessment of our prospects, our investors' motivations and market conditions. We then discounted the values of each class of equity in the IPO scenarios at an appropriate risk-adjusted rate. We assumed risk-adjusted rates of 25% for the preferred shares and 30% for the common shares. We selected these risk-adjusted rates based on studies of the rates of return expected by venture capital investors, as presented in the AICPA Practice Aid.

In the OPM scenario, we applied the OPM back-solve method to solve for the equity value and corresponding value of common stock based on the price of $9.45126 per share of common stock issuable upon the conversion of Series D preferred stock sold in July 2012. Given the proximity to the Series D preferred stock financing, and the fact that the Series D preferred stock financing included and was led by unrelated investors, we believe the per share issuance price of the Series D

preferred stock provides an indication of the fair value of our equity as of July 23, 2012. The values indicated for the preferred and common shares by the IPO scenario and the OPM scenario were probability weighted to calculate the weighted value as of the July 23, 2012 valuation date.

For the July 23, 2012 valuation, we estimated the fair value of our common stock by assigning an 85% weighting to the estimated fair value using the OPM back-solve method and a 15% weighting to the estimated fair value under the IPO scenario. We believe that the 85% weighting on the OPM back-solve method is appropriate due to the proximity of the issuance of our Series D preferred stock in July 2012 to the valuation date and the fact that the issuance included and was led by unrelated investors. The 15% weighting for the IPO scenario was deemed appropriate because at the time of the valuation, we believed that there was the possibility of following a successful Series D financing with an IPO.

Significant assumptions for the OPM include volatility, the risk-free rate, and the time to liquidity. We calculated annual rates of volatility based on weekly historical trading data for a group of guideline public companies. For the OPM scenario, the estimated time to liquidity was 3 years. The anticipated timing of a liquidity event was management's estimate in the event our planned IPO does not occur. We used the yield on three-year U.S. Treasuries as a risk-free rate.

We applied a discount for lack of marketability to the value indicated for our common stock. We lowered our estimate of the discount for lack of marketability to 20% based on our perception of our improved prospects for an IPO.

The following table summarizes the significant assumptions used in the hybrid method to determine the fair value of our common stock of $2.66 as of July 23, 2012:

July 23, 2012 valuation	IPO	OPM
Key assumptions		
Probability weighting	15%	85%
Liquidity date	1/1/2015	7/23/2015
Weighted-average cost of capital	25%	NA
Annual volatility	NA	70%
Risk-free interest rate	NA	0.3%
Discount for lack of marketability (DLOM)	20%	20%
Estimated per share present value of marketable common stock (before DLOM and probability weighting)	$ 5.88	$ 2.85

The estimated per share fair value of our common stock calculated in our valuation as of July 23, 2012 of $2.66 per share increased from the April 15, 2012 valuation of $2.09 per share primarily due to the following factors:

- our improved financial position resulting from the issuance of 120.4 million shares in July 2012 of our Series D preferred stock for an aggregate purchase price of $60.0 million;
- regulatory feedback from the FDA on the design of our Phase II/III Lenti-D study;
- regulatory feedback from the FDA on the nonclinical, manufacturing and clinical design of our Phase I/II LentiGlobin study;

- filing of our clinical trial application, or CTA, in France for our Phase I/II LentiGlobin study; and
- receipt of orphan drug designation for our Lenti-D program in the United States and European Union.

December 31, 2012 valuation

For the contemporaneous valuation at December 31, 2012, we used the hybrid method with one IPO scenario and one OPM scenario. As an indicator of value for the IPO scenario, we considered the increase in value, or step-up, from the most recent preferred round to the IPO price for a group of drug development companies which completed IPOs in the year preceding the appraisal date. We calculated the step-up as an annual rate of return. We applied this rate of return to our Series D preferred price to estimate its future value in the event of an IPO. For the IPO scenario, we assumed a future equity value equal to the product of the future value of Series D preferred stock times the number of common equivalent shares outstanding. The future equity value at the expected IPO date was allocated to each class of preferred stock and the common stock assuming conversion of all preferred classes to common. We estimated the time to an IPO date as one year based on our board of directors' assessment of our prospects, our investors' motivations and market conditions. We then discounted the values of each class of equity in the IPO scenarios at an appropriate risk-adjusted rate. We assumed risk-adjusted rates of 25% for the preferred shares and 30% for the common shares. We selected these risk-adjusted rates based on studies of the rates of return expected by venture capital investors, as presented in the AICPA Practice Aid. In the OPM scenario, we assumed an equity value equal to the present value of our equity in a future IPO.

For the December 31, 2012 valuation, we estimated the fair value of our common stock by assigning a 60% weighting to the estimated fair value using the OPM and a 40% weighting to the estimated fair value under the IPO scenario. We deemed the 40% weighting of our IPO scenario appropriate because of our progress since July 2012 in preparing for a potential IPO, which included advancements of our negotiations with a potential partner, completion of GMP-grade vector lots, qualification of a transduction manufacturing facility, advancement of our IND and CTA applications and engagement in initial discussions with underwriters.

Significant assumptions for the OPM include volatility, the risk-free rate, and the time to liquidity. We calculated annual rates of volatility based on weekly historical trading data for a group of guideline public companies. For the OPM scenario, the estimated time to liquidity was 2.56 years. The anticipated timing of a liquidity event was management's estimate in the event our planned IPO does not occur. We used the yield on three-year U.S. Treasuries as a risk-free rate.

We applied a discount for lack of marketability to the value indicated for our common stock. We lowered our estimate of the discount for lack of marketability to 10% based on our perception of our Company's improved prospects for an IPO.

The following table summarizes the significant assumptions used in the hybrid method to determine the fair value of our common stock of $5.50 as of December 31, 2012:

December 31, 2012 valuation	IPO	OPM
Key assumptions		
Probability weighting	40%	60%
Liquidity date	12/31/2013	7/23/2015
Weighted-average cost of capital	25%	NA
Annual volatility	NA	71%
Risk-free interest rate	NA	0.4%
Discount for lack of marketability (DLOM)	10%	10%
Estimated per share present value of marketable common stock (before DLOM and probability weighting)	$ 9.10	$ 4.17

The estimated per share fair value of our common stock calculated in our valuation as of December 31, 2012 of $5.50 per share increased significantly from the July 23, 2012 valuation of $2.66 per share. This is primarily due to the following factors:

- potential partnership with a leading pharmaceutical company that would extend our platform into oncology indications;
- increased probability of taking our Company public;
- successful manufacturing of two GMP-grade vector lots for our Lenti-D and LentiGlobin programs;
- successful completion of our LentiGlobin transduction manufacturing qualification at a centralized CRO;
- CTA approval of our ß-thalassemia and SCD study in France;
- filing of an IND for our ß-thalassemia program in the United States; and
- award of a $9.3 million grant from CIRM to fund our U.S. LentiGlobin study.

March 31, 2013 valuation

For the contemporaneous valuation at March 31, 2013, we used the hybrid method with one IPO scenario and one OPM scenario. As an indicator of value for the IPO scenario, we considered the increase in value, or step-up, from the most recent preferred round to the IPO price for a group of drug development companies which completed IPOs in the five quarters preceding the appraisal date. We calculated the step-up as an annual rate of return. We applied this rate of return to our Series D preferred price to estimate its future value in the event of an IPO. For the IPO scenario, we assumed a future equity value equal to the product of the future value of Series D preferred stock times the number of common equivalent shares outstanding. The future equity value at the expected IPO date was allocated to each class of preferred stock and the common stock assuming conversion of all preferred classes to common. We estimated the time to an IPO date as 0.42 years based on our board of directors' assessment of our prospects, our investors' motivations and market conditions. We then discounted the values of each class of equity in the IPO scenarios at an appropriate risk-adjusted rate. We assumed risk-adjusted rates of 25% for the

preferred shares and 30% for the common shares. We selected these risk-adjusted rates based on studies of the rates of return expected by venture capital investors, as presented in the AICPA Practice Aid. In the OPM scenario, we assumed an equity value equal to the present value of our equity in a future IPO.

For the March 31, 2013 valuation, we estimated the value of our common stock by assigning a 30% weighting to the estimated value using the OPM and a 70% weighting to the estimated fair value under the IPO scenario. We deemed the 70% weighting of our IPO scenario appropriate because of our progress since December 2012 in preparing for a potential IPO which included entering into a strategic collaboration with Celgene, further advancement of our IND applications, including effectiveness of the IND for our LentiGlobin program, and the filing of our initial registration statement.

Significant assumptions for the OPM include volatility, the risk-free rate, and the time to liquidity. We calculated annual rates of volatility based on weekly historical trading data for a group of guideline public companies. For the OPM scenario, the estimated time to liquidity was 2.31 years. The anticipated timing of a liquidity event was management's estimate in the event our planned IPO does not occur. We used the yield on two-year U.S. Treasuries as a risk-free rate.

We applied a discount for lack of marketability to the value indicated for our common stock. We estimated the discount for lack of marketability to be 10% based on our perception of our prospects for an IPO.

The following table summarizes the significant assumptions used in the hybrid method to determine the fair value of our common stock of $8.16 as of March 31, 2013:

March 31, 2013 valuation	IPO	OPM
Key assumptions		
Probability weighting	70%	30%
Liquidity date	8/31/2013	7/23/2015
Weighted-average cost of capital	25%	NA
Annual volatility	NA	72%
Risk-free interest rate	NA	0.3%
Discount for lack of marketability (DLOM)	10%	10%
Estimated per share present value of marketable common stock (before DLOM and probability weighting)	$ 10.62	$ 5.12

The estimated per share fair value of our common stock calculated in our valuation as of March 31, 2013 of $8.16 per share increased from the December 31, 2012 valuation of $5.50 per share. This is primarily due to the following factors:

- effectiveness of the IND for our LentiGlobin program in the United States;
- filing of an IND for our Lenti-D program in the United States;
- initial submission of our confidential draft registration statement on Form S-1 that increases the likelihood of a near-term liquidity event; and
- entering into a strategic collaboration with Celgene in March 2013 to discover, develop and commercialize novel, disease-altering gene therapies in oncology.

Initial public offering price

In consultation with the underwriters for this offering, we determined the estimated price range for this offering, as set forth on the cover page of this prospectus. The midpoint of the price range is $15.00 per share. In comparison, our estimate of the fair value of our common stock was $8.16 per share as of March 31, 2013. We note that, as is typical in IPOs, the estimated price range for this offering was not derived using a formal determination of fair value, but was determined by negotiation between us and the underwriters. Among the factors that were considered in setting this range were the following:

- an analysis of the typical valuation ranges seen in recent IPOs for companies in our industry;
- the general condition of the securities markets and the recent market prices of, and the demand for, publicly traded common stock of generally comparable companies;
- an assumption that there would be a receptive public trading market for pre-commercial biotechnology companies such as us; and
- an assumption that there would be sufficient demand for our common stock to support an offering of the size contemplated by this prospectus.

The midpoint of the estimated price range for this offering reflects a significant increase over the estimated valuation as of March 31, 2013 of $8.16 per share. Investors should be aware of this difference and recognize that the price range for this offering is in excess of our prior valuations. Further, investors are cautioned not to place undue reliance on the valuation methodologies discussed above as an indicator of future stock prices. We believe the difference may be due to the following factors:

- The contemporaneous valuation prepared as of March 31, 2013 contained multiple liquidity scenarios, including an initial public offering with an anticipated completion date of August 31, 2013 to which we assigned a probability weighting of 70%. However, the consideration of different scenarios accounts for some but not all of the difference between the initial public offering price and the valuation as of March 31, 2013.
- Our receipt in late April of notice that the IND for our Lenti-D program in the United States is now active.
- Improved capital market conditions for companies in our industry, as evidenced by a recent increase in the number of public offerings by such companies and in the initial public offering valuations of such companies compared to the valuations in their most recent pre-IPO equity financing.
- The initial offering price range necessarily assumes that this offering has occurred, a public market for our common stock has been created and that our preferred stock has converted into common stock in connection with this offering and, therefore, excludes the marketability or illiquidity discounts associated with the timing or likelihood of an initial public offering, the superior rights and preferences of our preferred stock and the alternative scenarios considered in the contemporaneous valuations over the past two years. Our March 31, 2013 valuation included an illiquidity discount of 10%.
- In the public markets we believe there are investors who may apply more qualitative and subjective valuation criteria to certain of our clinical assets than the valuation methods

applied in our valuations, although there can be no assurance that this will in fact be the case. As described above, as a private company we used a more quantitative methodology to determine the fair value of our common stock and this methodology differs from the methodology used to determine the estimated price range for this offering. The estimated price range for this offering was not derived using a formal determination of fair value, but rather was determined by negotiation between us and the underwriters. In particular, the estimate of fair value of our common stock as of March 31, 2013 was not a factor in setting the estimated price range for this offering.

- The price that investors are willing to pay in this offering, for which the price range is intended to serve as an estimate, may take into account other things that have not been expressly considered in our prior valuations, are not objectively determinable and that valuation models are not able to quantify.

Investors should be cautioned that the midpoint of the price range set forth on the cover of this prospectus does not necessarily represent the fair value of our common stock, but rather reflects an estimate of the offer price determined in consultation with the underwriters.

There are significant judgments and estimates inherent in the determination of these valuations. These judgments and estimates include assumptions regarding our future performance, including the successful enrollment and completion of our clinical studies as well as the determination of the appropriate valuation methods. If we had made different assumptions, our stock-based compensation expense could have been different. The foregoing valuation methodologies are not the only methodologies available and they will not be used to value our common stock once this offering is complete. We cannot make assurances as to any particular valuation for our common stock. Accordingly, investors are cautioned not to place undue reliance on the foregoing valuation methodologies as an indicator of future stock prices.

Convertible preferred stock warrants

As of March 31, 2013, we had warrants outstanding to purchase shares of Series A-1 and Series B preferred stock. Freestanding warrants that are related to the purchase of redeemable preferred stock are classified as liabilities and recorded at fair value regardless of the timing of the redemption feature or the redemption price or the likelihood of redemption. The warrants are subject to re-measurement at each balance sheet date and any change in fair value is recognized as a component of other income (expense), net. We measure the fair value of our warrant liability using a Black-Scholes option pricing model. Any modifications to the warrant liability are recorded in earnings during the period of the modification. The significant assumptions used in estimating the fair value of our warrant liability include the exercise price, volatility of the stock underlying the warrant, risk-free interest rate, estimated fair value of the preferred stock underlying the warrant, and the estimated life of the warrant.

As a result of the revision of the terms of our Series A-1 preferred stock upon the Series D financing, the redemption feature in the Series A-1 preferred stock is no longer present. Due to this change, we re-evaluated whether the warrants to purchase Series A-1 preferred stock represented a liability. Because the Series A-1 preferred stock does not contain any redemption feature or preference in liquidation, we concluded that the warrant should be classified as permanent equity. On the date of reclassification, we performed a final valuation of the Series A-1 warrants, with the change in value recorded to other income (expense), net. The fair value of the warrants was then reclassified to additional paid in capital.

Pursuant to the terms of these warrants, upon the conversion of the class of preferred stock underlying the warrant, the warrants automatically become exercisable for shares of our common stock based upon the conversion ratio of the underlying class of preferred stock. The consummation of this offering will result in the conversion of all classes of our preferred stock into common stock. Upon such conversion of the underlying classes of preferred stock, the remaining warrants to purchase Series B preferred stock will be classified as a component of equity and no longer be subject to re-measurement.

Emerging growth company status

The Jumpstart our Business Startups Act of 2012, or the JOBS Act, permits an "emerging growth company" such as us to take advantage of an extended transition period to comply with new or revised accounting standards applicable to public companies. We are choosing to "opt out" of this provision and, as a result, we will comply with new or revised accounting standards as required when they are adopted. This decision to opt out of the extended transition period under the JOBS Act is irrevocable.

Recently adopted accounting pronouncements

In February 2013, the FASB issued guidance to provide information about the amounts reclassified out of accumulated other comprehensive income, or AOCI, by component. An entity is required to present, either on the face of the financial statements or in the notes, significant amounts reclassified out of AOCI by the respective line items of net income, but only if the amount reclassified is required to be reclassified in its entirety in the same reporting period. For amounts that are not required to be reclassified in their entirety to net income, an entity is required to cross-reference to other disclosures that provide additional details about those amounts. On January 1, 2013, we adopted this standard, which had no impact on our financial position or results of operations.

In June 2011, the FASB issued an amendment to the accounting guidance for presentation of comprehensive income. Under the amended guidance, a company may present the total of comprehensive income, the components of net income, and the components of other comprehensive income either in a single continuous statement of comprehensive income or in two separate but consecutive statements. In either case, a company is required to present each component of net income along with total net income, each component of other comprehensive income along with a total for other comprehensive income, and a total amount for comprehensive income. The amendment is effective for fiscal years ending, and interim periods within those years, beginning after December 15, 2011, and is applied retrospectively. We adopted this amendment in the accompanying financial statements by presenting comprehensive income in one consecutive statement along with net loss.

In May 2011, the FASB issued amended guidance on fair value measurements. This newly issued accounting standard clarifies the application of certain existing fair value measurement guidance and expands the disclosures for fair value measurements that are estimated using significant unobservable (Level 3) inputs. This accounting standard was effective on a prospective basis for annual and interim reporting periods beginning on or after December 15, 2011. The adoption of this standard has not had a material impact on our financial position or results of operations.

Results of operations

Comparison of the three months ended March 31, 2012 and 2013 (unaudited)

Three months ended March 31, (in thousands)	2012	2013	Increase (Decrease)
	(unaudited)		
Revenue:			
Collaboration revenue	$ —	$ 1,042	$ 1,042
Research and license fees	85	85	—
Total revenue	85	1,127	1,042
Expenses:			
Research and development	3,858	5,284	1,426
General and administrative	1,363	2,324	961
Total expenses	5,221	7,608	2,387
Loss from operations	(5,136)	(6,481)	(1,345)
Other income (expense), net	68	(63)	(131)
Net loss	$ (5,068)	$ (6,544)	$ (1,476)

Revenue. Revenue was $1.1 million for the three months ended March 31, 2013, compared to $0.1 million for the three months ended March 31, 2012. The increase of $1.0 million from $0.1 million is due to the Celgene collaboration. In the three months ended March 31, 2013, we recorded $1.0 million in recognition of amounts allocated to research and development services from the Celgene collaboration, which was entered into in March 2013 and is expected to be recognized on a straight-line basis through March 2016, and $0.1 million of research fees.

Research and development expenses. Research and development expenses were $5.3 million for the three months ended March 31, 2013, compared to $3.9 million for the three months ended March 31, 2012. The increase was primarily due to a $0.4 million increase in employee- and contractor-related expenses to support increased development activities associated with three clinical studies planned to commence in 2013 and an $0.8 million increase in clinical start-up activities related to our LentiGlobin program.

General and administrative expenses. General and administrative expenses were $2.3 million for the three months ended March 31, 2013, compared to $1.4 million for the three months ended March 31, 2012. The increase in spending is primarily due to $0.6 million of employee- and contractor-related expenses to support corporate operational activities, including $0.3 million of consultant costs incurred in connection with preparing for this offering.

Other income (expense), net. Other income (expense), net was $(0.1) million for the three months ended March 31, 2013, compared to $0.1 million for the three months ended March 31, 2012. The decrease was primarily due to the re-measurement of the redeemable convertible preferred stock warrants and foreign currency losses.

Comparison of the years ended December 31, 2011 and 2012

Year ended December 31, (in thousands)	2011	2012	Increase (Decrease)
Revenue	$ 882	$ 340	$ (542)
Expenses:			
Research and development	11,409	17,210	5,801
General and administrative	4,615	6,846	2,231
Total expenses	16,024	24,056	8,032
Loss from operations	(15,142)	(23,716)	(8,574)
Other income (expense), net	(456)	46	502
Net loss	$ (15,598)	$ (23,670)	$ (8,072)

Revenue. We recorded $0.3 million research fee revenue for the year ended December 31, 2012. For the year ended December 31, 2011, we recorded $0.9 million in revenue consisting of $0.3 million research fees, $0.3 million license fees and $0.2 million grant revenue (a tax incentive from the Commonwealth of Massachusetts).

Research and development expenses. Research and development expenses were $17.2 million for the year ended December 31, 2012, compared to $11.4 million for the year ended December 31, 2011, an increase of $5.8 million. The increase was primarily due to:

- $2.8 million increase for clinical supply manufacturing and drug product process development activities in preparation for the ALD-102, HGB-204 and HGB-205 clinical studies planned for 2013;
- $1.1 million increase to employee and contractor-related expenses to support the increased development activities in 2012 in anticipation of the three clinical studies planned for 2013;
- $0.8 million increase in lab supplies, assay transfer and validation activities to support clinical supply and process development activities;
- $0.7 million increase in consulting fees to support regulatory filing and other clinical start-up activities; and
- $0.3 million increase in license and milestone fees paid to third parties.

General and administrative expenses. General and administrative expenses were $6.8 million for the year ended December 31, 2012, compared to $4.6 million for the year ended December 31, 2011. The increase of $2.2 million was due primarily to an increase of $1.4 million in professional fees, $0.6 million in employee and contractor-related expenses to support corporate operational and business development activities and $0.5 million in office and facility expenses, which was partially offset by a decrease in market study-related expenses.

Other income (expense), net. Other income (expense), net, was $0.05 million for the year ended December 31, 2012, compared to $(0.5) million for the year ended December 31, 2011, an increase of approximately $0.5 million. The increase was primarily due to revaluation of the redeemable convertible preferred stock warrants of $0.4 million and $0.1 million of currency losses.

Liquidity and capital resources

We have incurred losses and cumulative negative cash flows from operations since our inception in April 1992, and as of March 31, 2013, we had an accumulated deficit of $79.9 million. We anticipate that we will continue to incur losses for at least the next several years. We expect that our research and development and general and administrative expenses will continue to increase and, as a result, we will need additional capital to fund our operations, which we may raise through a combination of equity offerings, debt financings, other third-party funding, marketing and distribution arrangements and other collaborations, strategic alliances and licensing arrangements.

We have funded our operations principally from the sale of common stock, preferred stock, convertible notes and warrants to purchase common stock. In addition, in October 2012, we were awarded a $9.3 million grant from CIRM to fund our U.S. LentiGlobin study. This grant will be issued in quarterly installments and is expected to be utilized over a four-year period starting in the second half of 2013. In March 2013, we entered into a strategic collaboration with Celgene to discover, develop and commercialize novel, disease-altering gene therapies in oncology. This collaboration has an initial term of three years, and Celgene has made a $75 million up-front, non-refundable cash payment to us as consideration for entering into the collaboration. As of March 31, 2013, we had cash and cash equivalents of approximately $131.8 million. Cash in excess of immediate requirements is invested in accordance with our investment policy, primarily with a view to liquidity and capital preservation. Currently, our funds are held in money market mutual funds consisting of U.S. government-backed securities.

Cash flows

The following table sets forth the primary sources and uses of cash for each of the periods set forth below:

(in thousands)	Year ended December 31, 2011	Year ended December 31, 2012	Three months ended March 31, 2012	Three months ended March 31, 2013
			(unaudited)	
Net cash provided by (used in):				
Operating activities	$ (12,217)	$ (21,044)	$ (6,200)	$ 66,018
Investing activities	(3,964)	2,599	3,175	(812)
Financing activities	32,435	59,852	—	(381)
Net (decrease) increase in cash and cash equivalents	$ 16,254	$ 41,407	$ (3,025)	$ 64,825

Operating activities. The significant increase in cash provided by operating activities for the three months ended March 31, 2013, compared to the three months ended March 31, 2012, is primarily due to the up-front payment related to the Celgene collaboration agreement. The significant increase in cash used in operating activities for the year ended December 31, 2012, compared to the year ended December 31, 2011, is primarily due to an increase in research and development expenses as we continue the development of our Lenti-D and LentiGlobin product candidates, which includes an increase in personnel related costs, process development and manufacturing activities. In addition, general and administrative expenses increased due to an increase in administrative personnel as well as professional and facility-related spending, offset by an increase in accrued expenses. The use of cash in all periods resulted primarily from our net losses adjusted for non-cash charges and favorable changes in components of working capital.

The net cash provided by operating activities was $66.0 million for the three months ended March 31, 2013, and consisted primarily of a net loss of $6.5 million adjusted for non-cash items including stock-based compensation expense of $0.7 million and depreciation of $0.1 million and a net increase in operating assets and liabilities of $71.7 million. The significant items in the change in operating assets and liabilities include an increase in deferred revenue of $73.9 million due to the up-front payment related to the Celgene collaboration partially offset by an increase in prepaid expenses and other current assets of $1.1 million and a decrease in accounts payable of $0.6 million and a decrease in accrued expenses and deferred rent of $0.5 million.

The net cash used in operating activities was $6.2 million for the three months ended March 31, 2012, and consisted primarily of a net loss of $5.1 million adjusted for non-cash items including stock-based compensation expense of $0.2 million and depreciation of $0.1 million and a net decrease in operating assets and liabilities of $1.3 million. The significant items in the change in operating assets and liabilities include decreases in accounts payable of $1.1 million and deferred revenue of $0.1 million and an increase in prepaid expenses and other current assets of $0.5 million slightly offset by an increase in accrued expenses and other liabilities of $0.4 million.

The net cash used in operating activities was $21.0 million for the year ended December 31, 2012, and consisted primarily of a net loss of $23.7 million adjusted for non-cash items including stock-based compensation expense of $0.8 million and depreciation of $0.3 million and a net increase in operating assets and liabilities of $1.5 million. The significant items in the change in operating assets and liabilities include an increase in accounts payable of $0.4 million and accrued expenses and other liabilities of $1.4 million and a decrease in prepaid expenses and current assets of $0.1 million, offset by a decrease in deferred revenue of $0.3 million.

The net cash used in operating activities was $12.2 million for the year ended December 31, 2011, and consisted primarily of a net loss of $15.6 million adjusted for non-cash items including stock-based compensation expense of $0.8 million, re-measurement of warrants of $0.4 million, and depreciation of $0.2 million and a net increase in operating assets and liabilities of $1.9 million. The significant items in the change in operating assets and liabilities include increases in accounts payable of $0.9 million, accrued expenses and other liabilities of $0.4 million, and deferred revenues of $1.0 million, slightly offset by a decrease in prepaid expenses and other current assets of $0.3 million.

Investing activities. Net cash provided by (used in) investing activities consisted of purchases of fixed assets, purchases of marketable securities, and proceeds from the sale of marketable securities. Net cash used in investing activities for the three months ended March 31, 2013 was $0.8 million and consisted primarily of purchases of property and equipment. Net cash provided by investing activities for the three months ended March 31, 2012 was $3.2 million and consisted of proceeds from the sale of marketable securities of $3.5 million slightly offset by purchases of property and equipment of $0.3 million. Net cash provided by investing activities for the year ended December 31, 2012 was $2.6 million and consisted primarily of proceeds from the sale of marketable securities of $3.5 million slightly offset by purchases of property and equipment of $0.9 million. Net cash used in investing activities for the year ended December 31, 2011, was $4.0 million and was comprised primarily of purchases of marketable securities of $5.3 million, slightly offset by proceeds from the sale of marketable securities of $1.8 million and the purchases of property and equipment of $0.4 million.

Financing activities. Net cash used in financing activities for the three months ended March 31, 2013 was $0.4 million and consisted primarily of accumulated issuance costs related to our planned initial public offering. Net cash provided by financing activities for the year ended

December 31, 2012 is the result of the sale of 120.4 million shares of our Series D preferred stock for net proceeds of $59.8 million. Net cash provided by financing activities for the year ended December 31, 2011 is the result of the issuance and sale of 39.9 million shares of our Series C preferred stock for net proceeds of $14.9 million, and the issuance and sale of 53.6 million shares of the second tranche of our Series B preferred stock for net proceeds of $17.5 million for aggregate net proceeds of $32.4 million.

Operating capital requirements

To date, we have not generated any revenue from product sales. We do not know when, or if, we will generate any revenue from product sales. We do not expect to generate significant revenue from product sales unless and until we obtain regulatory approval of and commercialize one of our current or future product candidates. We anticipate that we will continue to generate losses for the foreseeable future, and we expect the losses to increase as we continue the development of, and seek regulatory approvals for, our product candidates, and begin to commercialize any approved products. We are subject to all of the risks incident in the development of new gene therapy products, and we may encounter unforeseen expenses, difficulties, complications, delays and other unknown factors that may adversely affect our business. Upon the closing of this offering, 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.

We believe that the net proceeds from this offering and our existing cash and cash equivalents will be sufficient to fund our projected operating requirements through at least the end of 2015. However, we may require additional capital for the further development of our existing product candidates and may also need to raise additional funds sooner to pursue other development activities related to additional product candidates.

Until we can generate a sufficient amount of revenue from our products, if ever, we expect to finance future cash needs through public or private equity or debt offerings. 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 product candidates. If we raise additional funds through the issuance of additional debt or equity securities, it could result in dilution to our existing stockholders, increased fixed payment obligations and these securities may have rights senior to those of our common stock. 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. Any of these events could significantly harm our business, financial condition and prospects.

Our forecast of the period of time through which our financial resources will be adequate to support our operations is a forward-looking statement and involves risks and uncertainties, and actual results could vary as a result of a number of factors. We have based this estimate on assumptions that may prove to be wrong, and we could utilize our available capital resources sooner than we currently expect. Our future funding requirements, both near and long-term, will depend on many factors, including, but not limited to:

- the initiation, progress, timing, costs and results of clinical studies for our products, including our Phase II/III Lenti-D study and our Phase I/II LentiGlobin studies;

- the outcome, timing and cost of regulatory approvals by the FDA and comparable foreign regulatory authorities, including the potential for the FDA or comparable foreign regulatory authorities to require that we perform more studies than those that we currently expect;
- the ability of our product candidates to progress through clinical development successfully;
- the cost of filing, prosecuting, defending and enforcing any patent claims and other intellectual property rights;
- our need to expand our research and development activities;
- our need and ability to hire additional personnel;
- our need to implement additional infrastructure and internal systems;
- the effect of competing technological and market developments; and
- the cost of establishing sales, marketing and distribution capabilities for any products for which we may receive regulatory approval.

If we cannot expand our operations or otherwise capitalize on our business opportunities because we lack sufficient capital, our business, financial condition and results of operations could be materially adversely affected.

Contractual obligations and commitments

The following table summarizes our contractual obligations at December 31, 2012.

(in thousands)	Total	Less than 1 Year	1 to 3 Years	3 to 5 Years	More than 5 Years
Operating lease obligations(1)	$1,885	$ 831	$ 841	$ 213	$ —

(1) We lease office space at 840 Memorial Drive in Cambridge, Massachusetts under a noncancelable operating lease that expires on March 31, 2015.

We also have obligations to make future payments to third parties that become due and payable on the achievement of certain development, regulatory and commercial milestones (such as the start of a clinical trial, filing of an NDA, approval by the FDA or product launch). We have not included these commitments on our balance sheet or in the table above because the achievement and timing of these milestones is not fixed and determinable. These commitments include:

- Under a license agreement with Inserm-Transfert pursuant to which we license certain patents for use in human adrenoleukodystrophy therapy, we will be required to make payments based upon development, regulatory and commercial milestones for any products covered by the in-licensed intellectual property. The maximum aggregate payments we may be obligated to pay for each of these milestone categories per product is €0.3, €0.2 and €1.6 million, respectively. We will also be required to pay a royalty on net sales of products covered by the in-licensed intellectual property in the low single digits. The royalty is subject to reduction for any third-party payments required to be made, with a minimum floor in the low single digits.
- Under a license agreement with Institut Pasteur pursuant to which we license certain patents for use in *ex vivo* gene therapy, we will be required to make payments per product covered by the in-licensed intellectual property upon the achievement of development and

regulatory milestones, depending on the indication and the method of treatment. The maximum aggregate payments we may be obligated to pay for each of these milestone categories per product is €1.5 and €2.0 million, respectively. We will also be required to pay a royalty on net sales of products covered by the in-licensed intellectual property in the low single digits, which varies slightly depending on the indication of the product. We have the right to sublicense our rights under this agreement, and we will be required to pay a percentage of such license income varying from the low single digits to mid-double digits depending on the nature of the sublicense. Starting in 2016, we will be required to make an annual maintenance payment, which is creditable against royalty payments on a year-by-year basis.

- Under a license agreement with the Board of Trustees of the Leland Stanford Junior University, or Stanford, pursuant to which we license the HEK293T cell line for use in gene therapy products, we are required to pay a royalty on net sales of products covered by the in-licensed intellectual property in the low single digits that varies with net sales. The royalty is reduced for each third-party license that requires payments by us with respect to a licensed product, provided that the royalty to Stanford is not less than a specified percentage that is less than one percent. We are required to pay Stanford an annual maintenance fee based on net sales of licensed products, which is creditable against our royalty payments.
- Under a license agreement with the Massachusetts Institute of Technology, or MIT, pursuant to which we license various patents, we will be required to make a payment of $0.1 million based upon a regulatory filing milestone. We will also be required to pay a royalty on net sales of products covered by the in-licensed intellectual property by us or our sublicensees. The royalty is in the low single digits and is reduced for royalties payable to third parties, provided that the royalty to MIT is not less than a specified percentage that is less than one percent. We have the right to sublicense our rights under this agreement, and we will be required to pay a percentage of such license income varying from the mid-single digits to low double digits. We are required to pay MIT an annual maintenance fee based on net sales of licensed products, which is creditable against our royalty payments.
- Under a license agreement with Research Development Foundation pursuant to which we license patents that involve lentiviral vectors, we will be required to make payments of $1.0 million based upon a regulatory milestone for each product covered by the in-licensed intellectual property. We will also be required to pay a royalty on net sales of products covered by the in-licensed intellectual property in the low single digits, which is reduced by half if during the ten year following first marketing approval the last valid claim within the licensed patent that covers the licensed product expires or ends.

We enter into contracts in the normal course of business with CROs for preclinical research studies, research supplies and other services and products for operating purposes. These contracts generally provide for termination on notice, and therefore are cancelable contracts and not included in the table of contractual obligations and commitments.

On June 3, 2013, we entered into a new nine-year building lease for approximately 43,600 square feet of space in Cambridge, Massachusetts, commencing on the earlier of the substantial completion of our build-out work or January 1, 2014. The lease has monthly lease payments of $0.2 million for the first 12 months with annual rent escalations thereafter and provides a rent abatement of $0.2 million per month for the first six months. The total operating lease obligation of the noncancellable term of this agreement is $24.2 million. In addition, the lease

provides a contribution from the landlord towards the initial build-out of the space of up to $6.5 million. We have the option to extend this lease by an additional five years. In accordance with the lease, we entered into a cash-collateralized irrevocable standby letter of credit in the amount of $1.3 million, naming the landlord as beneficiary. Our current building lease in Cambridge, Massachusetts, expires on March 31, 2015. We plan to relocate to the new space prior to its expiration.

Off-balance sheet arrangements

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

Quantitative and qualitative disclosures about market risks

We are exposed to market risk related to changes in interest rates. As of March 31, 2012 and 2013, we had cash and cash equivalents of $22.6 million and $131.8 million, respectively, primarily money market mutual funds consisting of U.S. government-backed securities. Our primary exposure to market risk is interest rate sensitivity, which is affected by changes in the general level of U.S. interest rates, particularly because our investments are in short-term securities. Our available for sale securities are subject to interest rate risk and will fall in value if market interest rates increase. Due to the short-term duration of our investment portfolio and the low risk profile of our investments, an immediate 100 basis point change in interest rates would not have a material effect on the fair market value of our portfolio.

Business

Overview

We are a clinical-stage biotechnology company focused on transforming the lives of patients with severe genetic and orphan diseases using gene therapy. Many diseases have a genetic aspect whereby a mutated gene linked to a disease is passed down from generation to generation and causes the disease. Gene therapy seeks to introduce a functional copy of the defective gene into a patient's own cells, a process called gene transfer. We believe that gene therapy has the potential to change the way these patients are treated by correcting the underlying genetic defect that is the *cause* of their disease, rather than offering solutions that only address their *symptoms*. Accordingly, we believe gene therapy has the potential to provide transformative disease modifying effects with life-long clinical benefits based on a single therapeutic administration.

Each person's hereditary genetic material, or genome, is encoded by deoxyribonucleic acid, or DNA, in sequences of genetic code called genes. Genes, in turn, through a process called gene expression, produce proteins that perform a vast array of functions within all living organisms. A mutation, or alteration, in the gene or in sequences that control the expression of that gene can cause proteins to be produced aberrantly in the cell – for example, too little or too much protein can be produced in the cell – which can cause disease. Through gene transfer, a functional copy of the mutated gene is delivered to the patient's cells, thereby correcting the underlying genetic defect that causes aberrant gene expression.

In the gene transfer process, a functional gene is delivered and incorporated into a patient's cells through a delivery system called a vector, which are most commonly based on naturally-occurring viruses that have been modified to take advantage of the virus' natural ability to introduce genes into cells. However, unlike naturally-occurring viruses, which replicate following infection of a target cell and have the capacity to infect new cells, viral vectors are modified to be non-replicating by deleting that portion of the viral genome responsible for replication. Gene transfer using a viral vector is called transduction and the resulting gene-modified cells are described as transduced cells. Transduction can be accomplished either via *ex vivo* or *in vivo* delivery. In the *ex vivo* approach, cells are gene-modified outside of the patient's body and the modified cells are transplanted back into the patient. In the *in vivo* approach, vectors are introduced directly into the patient's body to deliver the desired gene to the target cell.

A growing body of gene therapy-based clinical data, the establishment of regulatory guidelines to govern the development and approval of gene therapy products and increased investment from the biopharmaceutical industry suggest that the time is now for gene therapy to emerge as an important new therapeutic modality for patients with significant unmet medical need. We believe we are particularly well-positioned to drive the continued advancement of gene therapy technology for the treatment of severe genetic and orphan diseases. We have assembled extensive expertise in viral vector design, manufacturing and gene transfer, a broad intellectual property estate, an experienced management team and a world-class group of scientific advisors and key opinion leaders. We refer to our viral vector and gene transfer technology and know-how as our gene therapy platform.

We and our scientific collaborators have generated what we believe is human proof-of-concept data for our gene therapy platform in two underserved diseases, each of which has been granted orphan drug status by U.S. and European regulatory authorities. We expect to initiate in late 2013 a Phase II/III clinical study of our most advanced product candidate, Lenti-D, to evaluate

its safety and efficacy in subjects with childhood cerebral adrenoleukodystrophy, or CCALD, a rare, hereditary neurological disorder affecting young boys that is often fatal. We also expect to initiate in the second or third quarter of 2013, or mid-2013, a Phase I/II clinical study in the United States and have initiated a Phase I/II clinical study in Europe of our next most advanced product candidate, LentiGlobin, to evaluate its safety and efficacy in subjects with ß-thalassemia major and, in the European clinical study, sickle cell disease, or SCD, which are rare, hereditary blood disorders that often lead to severe anemia and shortened lifespans. We refer to the initiation of a clinical study as the time by which we have received all regulatory approvals necessary to commence a clinical study in accordance with a defined clinical protocol, we are under agreement with at least one clinical site to conduct the clinical study and we have begun to screen patients for enrollment in the clinical study. In addition, in March 2013, we announced a global strategic collaboration with Celgene Corporation to discover, develop and commercialize novel, disease-altering gene therapies in oncology.

Our gene therapy platform is based on viral vectors that utilize a modified, non-replicating version of the Human Immunodeficiency Virus Type 1, or HIV-1 virus, that has been stripped of all of the components required for it to self-replicate and infect additional cells. The HIV-1 virus is part of the lentivirus family of viruses, as a result of which we refer to our vectors as lentiviral vectors. Our lentiviral vectors are used to introduce a functional copy of a gene to the patient's own isolated blood stem cells, called hematopoietic stem cells, or HSCs, which reside in a patient's bone marrow and are capable of differentiating into a wide range of cell types. HSCs are dividing cells, thus our approach allows for sustained expression of the modified gene as we are able to take advantage of a lifetime of replication of the gene-modified HSCs. Additionally, we have developed a proprietary cell-based vector manufacturing process that is both reproducible and scalable. We believe our innovations in viral vector design and related manufacturing processes are important steps towards advancing the field of gene therapy and in realizing its full potential on a commercial scale, a concept we refer to as the industrialization of gene therapy.

Utilizing our industrialized gene therapy platform, we are developing product candidates comprising the patient's own gene-modified HSCs. Clinical proof-of-concept already exists for allogeneic hematopoietic stem cell transplant, or HSCT, an approach of treating a patient with HSCs contributed by a donor other than the patient that contain the properly functioning copy of the gene whose mutation has caused the underlying disease. However, this approach has significant limitations, including difficulties in finding appropriate genetically-matched donors and the risk of transplant-related rejection and mortality, and is therefore typically only offered on a limited basis. Our approach is intended to address the significant limitations of allogeneic HSCT while utilizing existing stem cell transplant infrastructure and processes. Also, because our approach has the potential to drive sustained expression of the functional protein encoded by the gene insert to provide a potentially single-administration, transformative therapy, we believe the value proposition offered by our product candidates for patients, families, providers and payors would be significant.

Although our initial focus is in CCALD, ß-thalassemia and SCD, we believe our gene therapy platform has broad therapeutic potential in a variety of indications. We believe that our vectors can be used to introduce virtually any gene and have the potential to be manufactured on a commercial scale reproducibly and reliably, as each new vector is produced using substantially the same process. We also take advantage of lentivirus' ability to transduce HSCs more efficiently than other vectors, such as those derived from another virus used in gene therapy approaches, called adeno-associated virus, or AAV, which gives us the potential to address diseases in a variety of cell lineages that are derived from HSCs, such as microglia (useful for CCALD), red blood cells (useful for ß-thalassemia and SCD), T cells (useful for cancer and immunology) and others.

The potential of gene therapy to address severe genetic and orphan diseases

Gene therapy—the time is now

Gene therapy has been an evolving field for the last 20 years that has been characterized by great hope and potential. Gene therapy is an approach to treating disease through the introduction of a desired gene or gene sequence into a patient's own cells to modulate or enhance the activity of such cells. Each person's hereditary genetic material is encoded by deoxyribonucleic acid, or DNA, in sequences of genetic code called genes. Collectively, our gene expression patterns influence cell functionality by controlling protein production, either directly or through other indirect regulatory mechanisms. A mutation, or alteration, in the gene or in sequences that control the expression of that gene can cause proteins to be produced aberrantly in the cell, which can cause disease.

Gene therapy represents a unique opportunity to change the way patients with severe genetic and orphan diseases are treated by addressing the underlying *cause* of their disease, rather than offering solutions that focus only on their *symptoms*. By correcting the underlying genetic defect, we believe gene therapy can provide transformative disease modifying effects—potentially with life-long clinical benefits based on a single therapeutic administration.

Our belief in the potential of gene therapy to become a viable therapeutic modality is supported by several recent developments, including the following:

- **Growing body of promising clinical results** . Over the last several years, a number of clinical studies of gene therapies have shown promising efficacy and safety results in conditions such as retinal disease, adrenoleukodystrophy, or ALD, ß-thalassemia, chronic lymphoid leukemia, hemophilia and Parkinson's disease.
- **Significant design, manufacturing and process improvements** . In recent years, we and others have designed new viral vectors with improved safety profiles over earlier generation vectors. Improvements in viral vector manufacturing techniques have also enabled the production of more potent and efficient viral vectors on a commercially viable scale.
- **Growing support from regulators for gene therapy** . Although the U.S. Food and Drug Administration, or the FDA, has not yet approved any human gene therapy product for sale, it has provided guidance for the development of gene therapy products. For example, the FDA has established the Office of Cellular, Tissue and Gene Therapies, or OCTGT, within its Center for Biologics Evaluation and Research, or CBER, to consolidate the review of gene therapy and related products, and the Cellular, Tissue and Gene Therapies Advisory Committee, or CTGTAC, to advise CBER on its reviews. In addition, the FDA has issued a growing body of clinical guidelines, chemical, manufacturing and control, or CMC, guidelines and other guidelines, all of which are intended to facilitate industry's development of gene therapy products.
- **First regulatory approval of a gene therapy product in the Western world** . In 2012, the European Medicines Agency, or EMA, approved a gene therapy product called Glybera, which is the first gene therapy product approved by regulatory authorities anywhere in the Western world.
- **Growing investment from the pharmaceutical and biotechnology industries** . Companies such as GlaxoSmithKline plc, Sanofi/Genzyme Corporation and BioMarin Pharmaceutical Inc. are currently advancing programs in gene therapy, and in 2012 Novartis AG

announced a broad collaboration with the University of Pennsylvania to develop gene therapy products. In addition, Sanofi/Genzyme and Shire plc have made equity investments of $8.0 million in the aggregate in our Company, and we have partnered with Celgene Corporation in the field of oncology.

- **Increased interest in genetic screening**. The growing market for both clinical and direct-to-consumer genetic testing and screening, including newborn screening initiatives for known hereditary diseases, points to increasing interest from patients and clinicians in therapeutic approaches that target specific genetic defects to treat disease.

Encouraged by these developments, we believe we are particularly well-positioned to drive the continued advancement of gene therapy technology in treating severe genetic and orphan diseases. We have assembled a leading position in the fields of gene therapy and severe genetic and orphan diseases, including extensive expertise in viral vector design, manufacturing and transduction, a broad intellectual property estate, an experienced management team and a world-class group of scientific advisors and key opinion leaders. Leveraging these capabilities, we have developed new, proprietary lentiviral vectors designed to more safely deliver our product candidates to patients, as well as improved transduction techniques to more efficiently effect gene transfer. We refer to our viral vector and transduction technology and know-how as our gene therapy platform. Our initial focus is on our two lead clinical programs in CCALD and ß-thalassemia major. However, we believe our gene therapy platform has broad applicability in a variety of severe genetic and orphan diseases beyond these initial indications, which we intend to explore selectively, either alone or through partnerships, such as our recently-announced collaboration with Celgene in the field of oncology.

Our gene therapy platform and process

Our gene therapy platform and product candidates are being developed based on a simple notion: *to genetically modify a patient's own cells to fundamentally correct or address the genetic basis underlying a disease* . Although the notion of gene transfer to a patient's own cells is simple, the processes of developing viral vectors capable of delivering the genetic material and inserting gene sequences safely into a patient's target cells is highly technical and demands significant expertise, experience and know-how. Leveraging our extensive expertise in viral vector design and manufacturing and transduction, we have developed a gene therapy platform that we believe is broadly applicable in a variety of indications of significant unmet medical need.

The historical challenges for gene therapy relate to the three factors on which the success of a gene therapy product is primarily based —potency, efficiency and safety. The potency of a particular gene therapy product is measured by its effectiveness, which is based on successfully introducing the gene of interest into the target cells at a high enough frequency to achieve expression of the desired protein at a level sufficient to exert a therapeutic benefit. The efficiency of a gene therapy product is measured by the amount of product that is required to create the desired effect, the period of time it takes for the therapy to go into effect, and also the period of time over which the therapy is effective for a given dosage. Safety is evaluated based on the nature and severity of any side effects, complications, conditions or diseases that may result from introducing foreign materials into a person's body and cells. Until recently, there has been a lack of manufacturing and transduction infrastructure that would enable the delivery of these therapies in a reliable and reproducible manner and at a commercially viable scale.

However, over the last several years, we have focused on and made significant investments in developing improved, “next generation,” viral vectors and manufacturing processes and procedures to address each of these issues.

These improvements include the following:

- We have developed proprietary viral vectors with improved potency, efficiency and safety over those vectors used historically, which in some cases raised serious safety concerns.
- We have developed proprietary vector manufacturing processes and techniques that produce a more purified and concentrated end product, as evidenced by the approximately 25 to 30-fold reduction in non-infectious viral particles as compared to viral vectors used in previous clinical studies (both ours and of others).
- We are investing in the development of mid- to large-scale manufacturing systems designed to be both reproducible and sustainable, with a view towards supporting our product candidates, if approved, at commercial scale.

We refer to these improvements as the “industrialization” of gene therapy manufacturing and production. We believe these improvements and our continuing investment in our manufacturing platform will enable us to develop best-in-class, next generation gene therapy products for severe genetic and orphan diseases.

Our proprietary lentiviral vectors

The success of a gene therapy platform is highly dependent on the type of delivery system used. Our platform is based upon an *ex vivo* viral delivery system whereby a certain type of virus delivers the DNA that it is carrying into a cell and inserts this DNA into the cell’s existing DNA. We have developed significant expertise in designing a particular type of vector delivery system employing a lentivirus for use in gene therapy and have also developed and in-licensed relevant intellectual property, including know-how, related to lentiviral vectors. Our lentiviral construct design includes only the minimal viral components of the HIV-1 virus required to enable the vector to undergo one round of replication within the cell during manufacturing and subsequently to enter the target cells and deliver the gene that it is carrying.

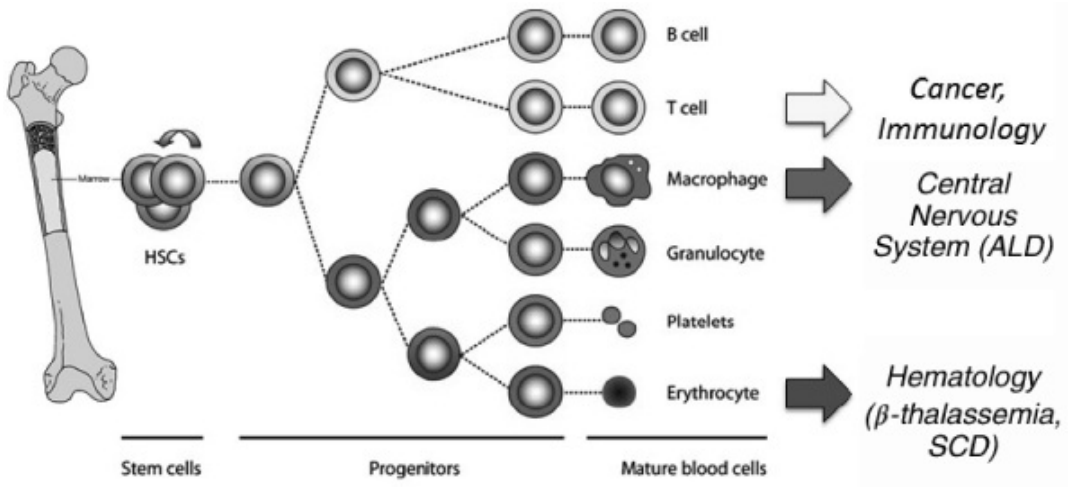
We believe that our lentiviral vectors are particularly well-suited for treating a number of diseases and have certain advantages over other viral vectors used in developing gene therapy products, including:

- **Sustained expression**—Unlike other viral vectors based on other viruses, such as AAV, lentiviral vectors are capable of integrating the functional gene they carry into the DNA of the target cell’s chromosome. As such, they are well-suited to introduce a sustained therapeutic effect in dividing cells because the gene sequence introduced by the lentiviral vector will be replicated during cell division along with the rest of the cell’s chromosomal DNA. Therefore, subsequent dividing cells resulting from the originally transduced cell will also carry the newly inserted gene sequence. The power of lentiviral vectors is sustained expression: a single insertion of a functional gene into a dividing cell can have a multiplying effect on multiple downstream cells. Other vector platforms that take advantage of different viruses introduce genes into cells but they don’t integrate into a cell’s DNA and thus require many viral events to transform a cell.

- **Safety**—In clinical studies of gene therapy product candidates conducted by other entities, earlier generations of integrating viral vectors based on a mouse gamma-retrovirus were shown to preferentially integrate into certain regulatory regions of genes (such as the promoter regions) and in some instances inappropriately activate the cell to divide uncontrollably, leading to cancer through a process called insertional oncogenesis. These genetic alterations have led to several well-publicized adverse events, including several reported cases of leukemia, and highlighted the need to develop new gene therapy vectors with improved safety profiles. Next generation, lentiviral vectors, unlike gamma retroviruses, have a distinct pattern of integrating into regions that provide instructions for making proteins rather than preferentially integrating into regions that can lead to cell proliferation and cancer. We believe this difference in integration patterns is a critical factor in improving the safety profile of the vector, and distinguishes them from earlier generations of integrating viral vectors. This integration pattern difference has been published in several studies, showing that lentiviral vectors have demonstrated an improved safety profile over gamma-retrovirus vectors, with no known clinical events of insertional oncogenesis or cancer.
- **Carrying capacity**—Unlike AAV, the lentivirus is able to carry large therapeutic gene sequences (up to 8,000 base pairs) into a host cell. This may limit the utility of AAV in some diseases where the required gene sequences will be too large to fit into an AAV construct. In this regard, lentiviral vectors offer more flexibility.

Our focus on Hematopoietic Stem Cells (HSCs)

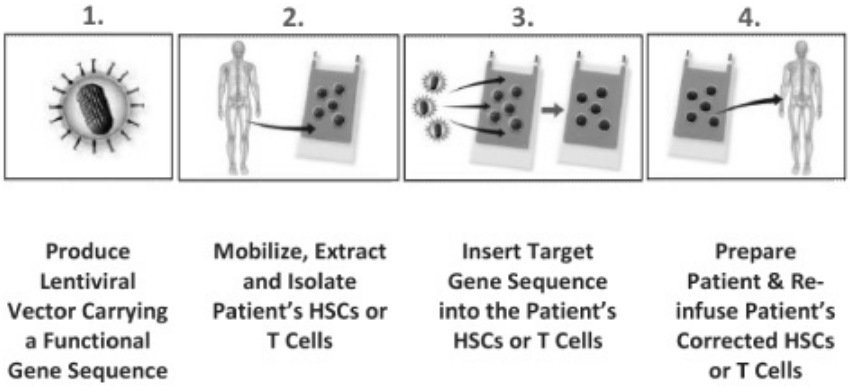
Our gene therapy platform takes advantage of lentiviral vectors' ability to stably integrate into the target cell's chromosome by focusing on diseases we can treat through genetic modification of hematopoietic stem cells, or HSCs, which when reintroduced back into the patient, differentiate into numerous other cell lineages, as depicted below. We believe our initial clinical indications —CCALD, ß-thalassemia major and SCD—can all be treated by introducing a specific functional gene into HSCs taken from the patient to correct the gene defect responsible for the disease.



HSCs are dividing stem cells that are permanently found in a patient's bone marrow and are an ongoing replacement source of mature cell types as they die off. HSCs produce progeny cells, called progenitors, that differentiate into all of the cellular elements that compose the blood, including microglia (useful for CCALD), red blood cells (useful for ß-thalassemia and SCD), T cells (useful for cancer and immunology) and others. As such, all progenitors derived from a single gene therapy-modified HSC will carry the same corrective genetic modification, which we believe gives our approach the potential to deliver life-long clinical benefits based on a single therapeutic administration. We believe there are numerous diseases associated with genetic abnormalities in cell types derived from HSCs that we can target using our gene therapy platform.

Our therapeutic approach

The delivery of a gene therapy product requires several steps, as illustrated in the figure below. Importantly, our approach seeks to leverage cell transplant procedures and infrastructure already widely used in the clinic for allogeneic HSCT.



1. We produce our lentiviral vector by co-transfecting a packaging cell line with multiple plasmids that separately encode the various components of the virus as well as the

functional gene sequence the viral vector will carry. The use of multiple plasmids is an important safety step designed to further prevent the resulting lentiviral vectors from being able to replicate and cause infection on their own.

2. A sample of the patient's own HSCs is extracted and isolated through a standard process known as apheresis, where HSCs are first mobilized into the blood stream from the bone marrow using a routinely-used pharmaceutical agent and then collected from the patient's blood. In some cases, HSCs are extracted directly from the patient's bone marrow.

3. The lentiviral vector is mixed with the patient's isolated HSCs *ex vivo*. This leads to the insertion of the functional gene into the HSCs' existing DNA, thus creating a pool of the patient's own, or autologous, gene-modified cells. The cells are then washed to remove any remnants of the viral vector or culture media. These gene-modified HSCs are the therapeutic drug product that is delivered back into the patient.

4. Prior to administering our drug product, the patient undergoes a standard myeloablation procedure (also used in allogeneic HCST) to remove all endogenous bone marrow cells. The modified HSCs are then re-infused back into the patient (approximately one to two months after initial extraction of the patient's HSCs) and begin re-populating a portion of the bone marrow as permanently modified HSCs in a process known as engraftment. The engrafted HSCs will go on to give rise to progenitor cell types with the corrected gene sequences. Following successful engraftment, we anticipate that clinical benefits for Lenti-D in CCALD, indicated by prevention of major functional disabilities, stabilization of NFS and Loes score and resolution of gadolinium enhancement, will begin to become evident within 24 months of transplant, and that clinical benefits for LentiGlobin in ß-thalassemia and SCD, indicated by reduction or elimination of blood transfusion requirements, number of in-patient hospitalization days (post-transplant discharge) and, for SCD, several additional endpoints, will begin to become evident within 12-24 months of transplant.

We believe that our approach has several potential advantages over current treatment options for CCALD, ß-thalassemia and SCD, including the following:

- **Single administration with potential life-long benefit**. Our process allows us to potentially arrest, correct or treat a disease with a single therapeutic administration as many of the corrected cells will live in the patient's body in perpetuity and have the potential to deliver long-term, and possibly life-long, effects.
- **We know exactly what gene to insert**. We are initially pursuing diseases where the genetic abnormality is known and is found in a single gene, known as monogenic diseases. We therefore know what we are correcting and exactly what gene sequence to insert into the patient's cells, thus mitigating against the uncertainty of the disease biology.
- **Allogeneic HSCT provides proof-of-concept for our approach**. We are currently pursuing clinical indications for which allogeneic HSCT is already a proven therapeutic option. Clinical proof-of-concept already exists for the diseases we are targeting via allogeneic HSCT, an approach of treating a patient with HSCs contributed by a donor other than the patient that contain the properly functioning copy of the gene whose mutation has caused the underlying disease.
- **We use the patient's own cells**. By using the patient's own isolated HSCs, we believe our approach will eliminate many of the challenges associated with allogeneic HSCT, such as

the limited availability of optimally matched donors and risks of transplant rejection that often result in serious adverse events, such as graft-versus-host disease. Even where allogeneic HSCT is deemed successful, many patients are required to comply with prolonged immunosuppressive drug regimens that increase the risk of opportunistic infections and other adverse events.

- **We modify our target cells *ex vivo***. By inserting the new functional DNA into the cells *ex vivo*, we reduce the risk of adverse events and remove one of the key biological complexities of any therapeutic—getting a drug directly to the target cells.
- **Administration of our drug product is consistent with existing stem cell transplant practices** . The final step of our process, in which patients are myeloablated and then transfused with the finished drug product, is consistent with widely adopted stem cell transplant clinical practices and infrastructure already in use.
- **Value proposition to patients, families, providers and payors** . Given the potentially dramatic clinical and life-long benefits anticipated from such therapies delivered through potentially a single administration, we believe the value proposition for patients, families, providers and payors would be significant.

Put simply, we believe we have developed next generation vectors with improved potency, efficiency and safety using a reproducible, scalable manufacturing process to address a variety of severe genetic and orphan diseases.

Our strategy

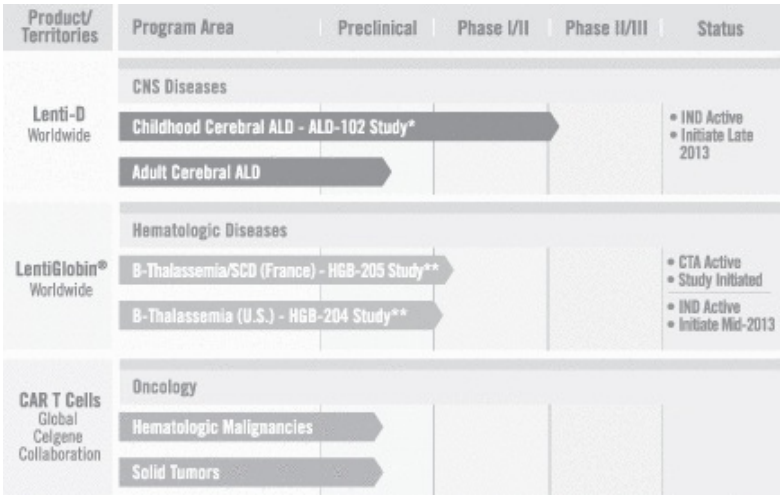
Our objective is to develop and commercialize a next generation of products based on the transformative potential of gene therapy to treat patients with severe genetic and orphan diseases. Central to this effort is a collective determination within our Company to provide these patients with hope for a better life in the face of limited or no long-term safe and effective treatment options. Specifically, our business strategy is based on the following principles:

- **Relentlessly focus on serving our patients** . Our culture is rooted in a shared motivation to bring the transformative potential of gene therapy to patients in need. Our initial focus is on patients suffering from monogenic diseases such as CCALD, ß-thalassemia and SCD, as well as cancer; however, we believe there are many additional indications for which our technology may be applicable.
- **Be the world's biggest gene therapy geeks** . We believe our people and our culture (based on the principles: b colorful, b cooperative, b yourself) will continue to be fundamental to our success. We will continue to build a professional team of employees, advisors and collaborators with deep and industry-leading experience in the discovery, development, manufacturing and commercialization of gene therapy technologies to treat severe genetic and orphan diseases. We believe our expertise in this field—in terms of lentiviral vector design and gene therapy process industrialization—will allow us to continue developing next generation technologies that will overcome some of the challenges that have historically complicated the use of gene therapy on a broader scale and allow for deployment in many underserved severe genetic and orphan disease markets. We will continue our efforts, which over the last several years have resulted in the production of early clinical proof-of-concept results in two diseases, the industrialization of the gene therapy process and the generation of significant intellectual property.

- **Leverage our platform and technical expertise to build a gene therapy product engine for severe genetic and orphan diseases**. We will continue to take advantage of the adaptability of our gene therapy platform in creating viral vectors and gene therapy products to address a broad range of genetically-defined diseases. Unlike other gene modification approaches that may require extensive optimization for each gene target or disease indication, each of our lentiviral vectors is produced using the same modified vector backbone and manufacturing system. This enables us to generate new product candidates relatively quickly by essentially swapping in the new gene of interest and assessing its potency and purity using standardized assays and tests. We believe our specific ability to design and manufacture lentiviral vectors quickly and reproducibly on a commercial scale will differentiate us from other gene therapy technologies and provides a strong competitive advantage in the long term.
- **Develop and commercialize drugs in our core disease areas and partner selectively to expand the scope of our pipeline**. Our core disease areas are severe genetic and orphan diseases, such as CCALD and ß-thalassemia, that we believe to be good candidates for treatment with gene therapy. Given the relatively low prevalence of these diseases and the strong key opinion leader communities and patient advocacy groups around them, we believe we can serve these markets with a small targeted commercial infrastructure. The broad potential of our platform also presents an opportunity for us to selectively form collaborative alliances to expand our capabilities and product offerings into other therapeutic areas and potentially accelerate the development and commercialization of our products. For example, we recently announced a global strategic collaboration with Celgene to discover, develop and commercialize novel, disease-altering gene therapies in oncology.
- **Pursue indications with high unmet medical need and greater probability of clinical, regulatory and commercial success**. Each of our three current core indications are severe diseases with high unmet medical need. We believe there is a strong rationale for treating diseases like these with gene therapy because their underlying genetic abnormality is well-characterized and can be addressed by correcting or inserting a single gene. Given the poor prognosis and current lack of corrective treatment options for these diseases, we believe our gene therapy product candidates may offer a potential single-treatment alternative for these patients and their families. Our gene therapy products, if successful, may offer a potentially superior long-term value proposition for our patients and the healthcare system more broadly, which will allow us to drive premium value while delivering patients life-altering treatments.

Our product candidate pipeline

The following table summarizes key information on our development programs.



* The Phase II/III ALD-102 Study is our first clinical study of our current Lenti-D viral vector and product candidate. See “Business—Our Lenti-D product candidate.”

** The Phase I/II HGB-205 and HGB-204 Studies are our first clinical studies of our current LentiGlobin viral vector and product candidate. See “Business—Our LentiGlobin product candidate.”

Our most advanced product candidate is called Lenti-D, which we are developing to treat patients with ALD. We plan to initiate a Phase II/III clinical study of Lenti-D in the United States in late 2013, which we refer to as the ALD-102 Study, to examine the feasibility, safety and efficacy of Lenti-D in preserving neurological function and stabilizing cerebral demyelination in subjects with CCALD, the most severe form of ALD. We also expect to initiate sites outside the United States, pending approvals from the applicable regulatory authorities. If successful, and pending further discussion with the FDA, the results from the ALD-102 Study could potentially form the basis of a Biologics License Application, or BLA, submission to the FDA and a Marketing Authorization Application, or MAA, to the EMA for this product candidate. However, there can be no assurance that the FDA and the EMA will not require additional studies before the approval of a BLA or MAA, respectively. Initial proof-of-concept data from a clinical study utilizing an approach similar to Lenti-D with an earlier generation lentiviral vector supplied by a third party were published in *Science* (2009).

Our next most advanced product candidate is called LentiGlobin, which we are developing to treat patients with ß-thalassemia and SCD. We are currently conducting a Phase I/II clinical study in France evaluating an earlier generation of our LentiGlobin vector for the treatment of ß-thalassemia major and SCD. Initial proof-of-concept data from this study were published in *Nature* (2010). We have initiated an extension of this study under a revised protocol for LentiGlobin, which we refer to as the HGB-205 Study. We also plan to initiate a second Phase I/II clinical program in the United States for LentiGlobin, which we refer to as the HGB-204 Study, for ß-thalassemia major in mid-2013. We expect to submit an IND with the FDA in 2014 to evaluate LentiGlobin in patients with SCD.

In March 2013, we announced a global strategic collaboration with Celgene Corporation to discover, develop and commercialize novel disease-altering gene therapies in oncology. The collaboration will focus on applying gene therapy technology to genetically modify a patient's own T cells to target and destroy cancer cells. Such modified T cells, called chimeric antigen receptor, or CAR, T cells have been shown to have beneficial effects in human clinical trials for patients with B cell lymphomas. The multi-year research and development collaboration has the potential to lead to the development and commercialization of multiple CAR T cell products. See "—Our strategic alliance with Celgene."

Our Lenti-D opportunity

Adrenoleukodystrophy

Adrenoleukodystrophy is a rare X-linked, inherited, neurological disorder that is often fatal. ALD is caused by mutations in the ABCD1 gene which encodes for a protein called the ALD protein, or ALDP, which plays a critical role in the breakdown and metabolism of very long-chain fatty acids, or VLCFA. Without functional ALDP, VLCFA accumulate in cells including neural cells in which they cause damage to the myelin sheath, a protective and insulating membrane that surrounds nerve cells in the brain. This damage can result in decreased motor coordination and function, visual and hearing disturbances, the loss of cognitive function, dementia, seizures, adrenal dysfunction and other complications, including death. The worldwide incidence rate for ALD is approximately one in 20,000 newborn males.

ALD is divided into various sub-segments with three main phenotypes that impact brain function:

- **CCALD (Childhood cerebral adrenoleukodystrophy)** : The most severe form of ALD is CCALD. CCALD accounts for about 30-40% of patients diagnosed with ALD and presents in young boys. CCALD is characterized by progressive destruction of myelin, leading to severe loss of neurological function and eventual death. In boys affected by CCALD, learning and behavioral problems are often observed in mid-childhood between the ages of 3 and 15 years (median age 7). In the absence of intervention, boys affected by CCALD typically experience rapid degeneration into vegetative state, and ultimately death within a decade of diagnosis.
- **AMN (Adrenomyeloneuropathy)** : AMN which typically develops in adults aged 21 years and older, is the most common neurological form of ALD, accounting for 40-45% of all patients diagnosed with ALD. All patients with AMN present with more slowly progressive symptoms resulting from (non-inflammatory) disruption of the axons (which are a fundamental component of the central nervous system that allows nerve signals to be transmitted) in the spinal cord. Approximately 40% of these patients have or will develop cerebral disease similar to CCALD, with varying degrees of associated inflammation.
- **ACALD (Adult Cerebral ALD)**: ACALD typically develops in males aged 15 years and older. It is also very severe, with progression of neurologic symptoms that parallels the course of CCALD. ACALD accounts for approximately 5% of all patients diagnosed with ALD.

Limitations of current treatment options

There is a clear unmet medical need for patients with the neurologic forms of ALD. Currently, the only effective treatment option for boys with CCALD is allogeneic HSCT. In this procedure, the patient is treated with HSCs containing the properly functioning copy of the gene

contributed by a donor other than the patient. Allogeneic HSCT has also been shown to have potential clinical benefit in other forms of ALD including AMN and ACALD.

Allogeneic HSCT is typically performed early in the course of the disease, ideally using an unaffected matched sibling HSC donor to minimize complications. However, the majority of allogeneic HSCT procedures for CCALD are carried out with non-sibling matched donor cells, partially matched related or unrelated donor cells and umbilical cord blood cells because a matched sibling donor is not available in most cases. The difficulty of finding a suitable sibling-matched donor is one of the primary drawbacks of this approach. Allogeneic HSCT is associated with significant morbidity and mortality, particularly in patients who undergo non-sibling-matched allogeneic HSCT. Complications of allogeneic HSCT include a 10-30% risk of engraftment failure in unrelated Human-Leukocyte-Antigen, or HLA, matched patients, a 12-16% incidence of life-threatening infection, and an approximately 30% risk of graft-versus-host-disease, or GVHD, a common complication in which donor immune cells (white blood cells in the graft) recognize the cells of the recipient (the host) as “foreign” and attack them. As a result of these safety challenges, allogeneic HSCT in CCALD patients whose donor is not a matched sibling result in significant mortality rates. In addition, because of the need for long-term immunosuppression following allogeneic HSCT, there is a prolonged risk of opportunistic infections and other serious side effects associated with immunosuppressive drugs.

Moreover, of the approximately 80 boys who are born with CCALD each year in the United States and European Union, we estimate that between 20% and 50% may have disease so advanced at the time of diagnosis that a beneficial outcome from treatment would be unlikely. This is attributed to rapid disease progression and difficulty with early diagnosis, as the initial presentation of the signs and symptoms of CCALD are frequently misdiagnosed, for example as attention deficit hyperactivity deficit disorder. Newborn screening through a simple and inexpensive blood test is being developed to enable earlier detection of CCALD, but is not yet widely available. Based in part on the fact that several states are currently considering universal newborn screening for ALD, it is our expectation that newborn screening will be widely adopted in the United States within the next five years, and potentially elsewhere, providing for the opportunity to identify more boys for proactive monitoring of disease symptoms and early disease intervention.

Our Lenti-D product candidate

We are developing our Lenti-D product candidate as a potential one-time treatment to halt the progression of CCALD. Our approach involves the *ex vivo* insertion of a functional copy of the ABCD1 gene via an HIV-1 based lentiviral vector into the patient’s own HSCs to correct the aberrant expression of ALDP in patients with CCALD. HSCs derived from the patient’s own body are called autologous HSCs. We refer to autologous HSCs that have been modified to carry the functional copy of the ABCD1 gene as the final Lenti-D drug product, or our Lenti-D product candidate. Upon successful engraftment of our Lenti-D product candidate, we expect that microglia in the brain derived from the transduced HSCs will correct the metabolic abnormalities resulting from excess VLCFA and stabilize the demyelination and cerebral inflammation characteristic of CCALD.

We have had and continue to have extensive dialogue with the FDA, the EMA and other regulatory authorities and advisory bodies concerning the clinical advancement of our Lenti-D product candidate. These interactions include the following:

- our Lenti-D product candidate has been granted orphan drug status by the FDA and the EMA for the treatment of CCALD;

- in 2010, the NIH's Office of Biotechnology Activities' Recombinant DNA Advisory Committee, or the RAC, reviewed our draft protocol and its recommendations were incorporated into the final protocol and informed consent;
- a type B pre-IND meeting with the FDA in 2010, during which meeting the FDA recommended we initiate a retrospective natural history of disease study to inform future clinical studies and provide guidance on the manufacturing, nonclinical and clinical development of our Lenti-D product candidate;
- receipt of Scientific Advice regarding the design of the planned ALD-102 Study from the French agence nationale de sécurité du médicament et des produits de santé, or ANSM, in February 2011, from the EMA in May 2011, and from the United Kingdom Medicines and Healthcare Products Regulatory Agency, or MHRA, in May 2012;
- a type C pre-IND meeting with the FDA in 2012, focused on the design of the planned ALD-102 Study;
- an agreed Pediatric Investigation Plan, or PIP, with the EMA Pediatric Committee, or PDCO, in March 2013; and
- an IND submission for our ALD-102 Study in March 2013, which IND is active as of April 2013.

We expect to initiate the ALD-102 Study in the United States in late 2013. We also expect to initiate sites outside the United States, pending approvals from the applicable regulatory authorities. If successful, and pending further discussion with the regulatory authorities, the results from the ALD-102 Study could potentially form the basis of a BLA submission to the FDA and an MAA to the EMA for this product candidate. However, there can be no assurance that the FDA and the EMA will not require additional studies before the approval of a BLA or MAA, respectively. The FDA has advised us that the ALD-102 Study may not be deemed to be a pivotal study or may not provide sufficient support for a BLA submission. The FDA normally requires two pivotal clinical studies to approve a drug or biologic product, and thus the FDA may require that we conduct additional clinical studies of Lenti-D prior to a BLA submission.

Clinical development of our Lenti-D product candidate

Completed non-interventional retrospective study (the ALD-101 Study)

Due to the rarity of CCALD, and the fact that allogeneic HSCT has historically not been subject to extensive systematic analysis in controlled clinical studies, the amount of clinical data necessary to precisely characterize progression of the disease and the efficacy and safety profile of allogeneic HSCT is largely absent from the current scientific literature. Accordingly, in order to properly design future clinical studies of Lenti-D and interpret the efficacy and safety results thereof, at the recommendation of the FDA, we performed a non-interventional retrospective data collection study to assess the natural course of disease in CCALD patients that were left untreated, which we refer to as the untreated group or cohort, in comparison to the efficacy and safety data obtained from patients that received allogeneic HSCT, which we refer to as the treated cohort. A non-interventional retrospective data collection study involves an examination of historical clinical records from patients with the pertinent condition in order to assess the typical course of the condition and the efficacy and safety of treatment options. In the study, we collected neurologic

and neuropsychological assessments and neuroimaging data for both treated and untreated patients, as available; however, given the retrospective nature of the study, we were not able to collect comprehensive data for all subjects.

For this study, we collected data from four U.S. sites and one French site on a total of 137 subjects, 72 of whom were untreated and 65 of whom were treated with allogeneic HSCT. To our knowledge, the ALD-101 Study is the most comprehensive study ever conducted to characterize clinical outcomes in untreated versus allogeneic HSCT-treated CCALD patient populations. The ALD-101 Study report was completed in March 2013.

Three primary clinical measurements of CCALD disease progression

The findings from the ALD-101 Study suggest that, although there are a wide number of cognitive, behavioral, functional and radiological modalities utilized to assess patients with CCALD, three are utilized most widely and consistently:

- **The Neurological Function Score (NFS)**. The NFS is a 25-point neurological function score that assesses fifteen neurological abnormalities typically caused by ALD. These neurological abnormalities are summarized below:

Symptoms	Score
Loss of communication*	3
No voluntary movement*	3
Cortical blindness*	2
Tube feeding*	2
Wheelchair required*	2
Total incontinence*	2
Swallowing/other CNS dysfunctions	2
Spastic gait (needs assistance)	2
Hearing/auditory processing problems	1
Aphasia/apraxia	1
Visual impairment/fields cut	1
Running difficulties/hyperreflexia	1
Walking difficulties/spasticity/spastic gait (no assistance)	1
Episodes of incontinency	1
Nonfebrile seizures	1
Total	25

* Major Functional Disabilities (MFDs)

Among the 15 functional domains in the NFS scale, we consider six to be of particular clinical importance because when these neurological abnormalities occur, the patient's ability to function independently is severely compromised. These particular deficiencies, which we define as Major Functional Disabilities, or MFDs, are loss of communication, complete loss of voluntary movement, cortical blindness, requirement for tube feeding, wheelchair dependence and total incontinence.

- **The Loes score**. The Loes score is a 34-point scale specifically designed to objectively measure the extent of central nervous system disease burden based on brain magnetic resonance imaging, or MRI, studies. The Loes score measures the extent and location of brain abnormalities such as the presence of white matter changes, degree of demyelination and the presence of focal or global atrophy. A Loes score of one or more

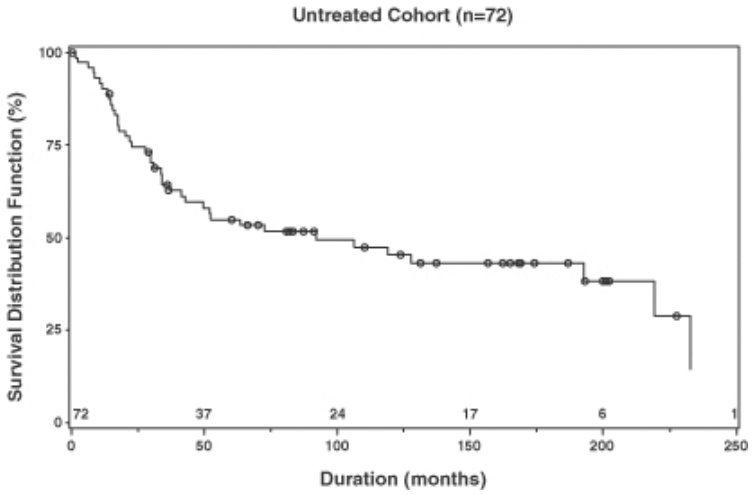
(i.e., the presence of any such abnormalities) indicates significant disease, and patients with a Loes score of 10 or more generally are not considered to be good candidates for transplant therapy due to the advanced stage of the disease.

- **Gadolinium enhancement**. One of the hallmarks of inflammatory disease in ALD patients is the presence of a compromised blood-brain barrier behind the leading edge of demyelinating lesions in the brain. This can be assessed using a contrast agent called gadolinium in brain MRI studies. Evidence of gadolinium enhancement in the brain in a MRI study, referred to by clinicians as a gadolinium positive result, suggests that neuroinflammation is present and the blood-brain barrier has been compromised, which in published studies has been shown to be a predictive biomarker of ALD disease progression.

Summary of findings

Key findings from the ALD-101 Study are summarized below:

- **Untreated, CCALD patients progress to dismal outcomes** . In the untreated cohort, the median overall survival was 92 months (7.7 years) and the estimated probability of survival at five years was 55%. Although informative, survival data must be considered in light of the fact that supportive measures may be used to sustain life after progression to a vegetative state.



- **Baseline disease severity, as assessed by NFS and Loes scores, were good predictors of survival** . In both the untreated and treated cohorts, significantly lower mortality rates were seen in patients with lower baseline NFS and Loes scores than in those with higher scores.

	Mortality Rate*			
	NFS ≤ 1	NFS > 1	Loes ≥ 1 ≤ 9	Loes > 9
Untreated Cohort	42%	85%	46%	76%
Treated Cohort	12%	29%	13%	28%

* Mortality rate determined by the number of deaths that occurred at any time through the observation period post-CCALD diagnosis.

As a consequence of this observation, and consistent with entry criteria that have been used in studies of allogeneic HSCT, the entry criteria for the ALD-102 Study excludes subjects with evidence of advanced disease on NFS and Loes score to prevent enrollment of subjects whose disease would be expected to progress to a poor outcome despite treatment.

- **MFDs occurred in the majority of the untreated cohort who showed evidence of gadolinium enhancement in brain MRI**. Among the 72 patients in the untreated cohort, data were available regarding the presence of MFDs at 24 months post-CCALD diagnosis in 56 of these patients. Among these 56 patients, 29 patients (52%) developed at least one MFD throughout the data collection period. Of the 18 cases in the untreated cohort who were gadolinium positive, 13 (72%) had developed at least one MFD at 24 months from the time of their first gadolinium positive scan. We believe the finding that a large proportion of the untreated cohort with gadolinium enhancement progress to an MFD at 24 months provides an important reference point by which to assess the success of treatment with our Lenti-D product candidate. These observations support the requirement that subjects enrolled in the ALD-102 Study demonstrate gadolinium enhancement at baseline and support a primary endpoint based on the prevention of MFDs.
- **Gadolinium enhancement appears to be an objective, predictive measure of the likelihood of rapid progression** . In the untreated cohort, of the 15 patients with scans that were gadolinium-positive and had repeat NFS assessments during the applicable observation period, most (12 of the15 patients) showed rapid progression of NFS scores, defined as an increase of greater than five points over the applicable observation period, with all 12 showing decline within six to 18 months. This observation supports the requirement that subjects enrolled in the ALD-102 Study demonstrate gadolinium enhancement at baseline. These patients would be expected to develop progressive disease without therapeutic intervention.
- **Allogeneic HSCT was associated with disease stabilization**. Despite the significant risk of morbidity and mortality associated with allogeneic HSCT, successful transplantation was shown to provide clinically meaningful benefit to patients with CCALD, particularly those with early-stage disease. For the majority of patients in the treated cohort (63%), no MFD was present at 24 months post-HSCT. Allogeneic HSCT was also associated with resolution of gadolinium enhancement. Of those patients who would meet eligibility criteria for the ALD-102 study (baseline NFS of zero or one, gadolinium-positive at baseline, baseline Loes between 0.5 and nine, inclusive), three of 20 (15%) patients developed an MFD within 24 months post-allogeneic HSCT.
- **Consistent with published literature, allogeneic HSCT, particularly with unmatched/unrelated donors, was associated with clinically significant morbidity and mortality.**
  - Morbidity: Post-allogeneic HSCT, engraftment failure occurred in 12 of 65 (18%) patients, 10 of whom (83%) were transplanted with unrelated donor cells. Despite prophylaxis, the GVHD rate was 54%, including acute GVHD in 27 (42%) patients and chronic GVHD in 12 (18%) patients. Due to the requirement for myeloablation prior to HSCT, the occurrence of GVHD and the requirement for immunosuppressive therapy post-allogeneic HSCT, allogeneic HSCT is associated with a substantial risk of life-threatening infection. Infections were the most commonly reported serious adverse

event, with at least one serious infection reported in 19 (29%) patients post-allogeneic HSCT. The substantial morbidity associated with allogeneic HSCT for CCALD supports evaluating Lenti-D in the ALD-102 Study as an alternative therapeutic option that is expected to avoid the issues of immune incompatibility seen with allogeneic HSCT.

- Mortality: Post-allogeneic HSCT, the 100-day mortality rate was 8% and the overall one-year mortality rate was 19%. The estimated probability of two and five year survival rates post-allogeneic HSCT were 82% and 74%, respectively. As anticipated from the published literature, analysis of survival by type of donor (matched sibling versus other) showed that the proportion of deaths through the observation period post- allogeneic HSCT was lower in matched-sibling donor cases than in other allogeneic HSCT cases. The majority of allogeneic HSCT patients (46 patients; 71%) were transplanted with unrelated donor cells given the limited availability of HLA-matched sibling donors. As a result of this analysis, we determined to exclude patients with a sibling-matched donor from the ALD-102 Study.

We believe the results from the ALD-101 Study support the proposition that, while the approach of treating a patient with genetically corrected HSCs can stabilize the progression of disease in patients with CCALD, there remains a significant unmet medical need for safer therapies, particularly for patients without the option of a sibling-matched donor. We believe that many of the issues that contribute to the mortality and morbidity associated with allogeneic HSCT could be avoided using a patient's own gene-modified HSCs. Importantly, the results from this study were also used to inform the criteria for patient and endpoint selection for our planned ALD-102 Study, which we describe below.

Previous clinical experience with lentiviral gene therapy for CCALD (the TG04.06.01 Study)

Between September 2006 and September 2010, four boys with a confirmed diagnosis of CCALD were treated in Paris, France, in a Phase I/II study with autologous HSCs transduced *ex vivo* with a lentiviral vector carrying a functional ABCD1 gene before reinfusion. Short-term clinical data and biological experience with the first two treated boys was first reported in *Science* (2009). The study is ongoing although no new subjects are expected to be enrolled beyond the initial four boys.

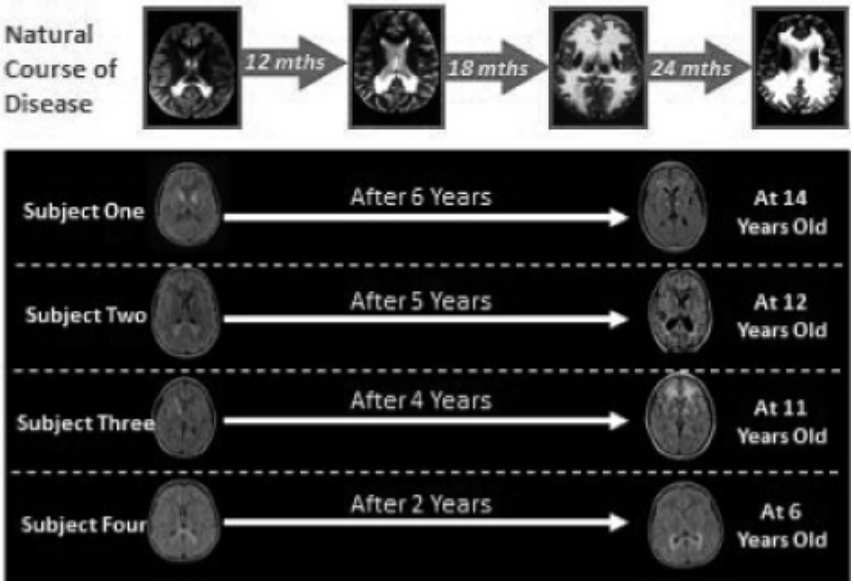
The TG04.06.01 Study is sponsored by the institut national de la santé et de la recherche médicale (French Institute of Health and Medical Research), or Inserm, in Paris, and the lentiviral vector was supplied by a third party company not affiliated with bluebird bio. We are party to a strategic collaboration agreement with Inserm for the development of HSC gene therapies in this patient population, pursuant to which we are collaborating with Patrick Aubourg, the Principal Investigator of the TG04.06.01 Study.

In the TG04.06.01 Study, all four subjects had cerebral demyelinating lesions with Loes scores ranging from two to seven prior to treatment. Gadolinium contrast enhancement indicated that the lesions were active and inflammatory in all four subjects. At the time of enrollment, each subject had a normal neurologic examination with NFS equal to zero.

Below is a summary of the efficacy results for each of the four subjects in the TG04.06.01 Study.

- **Subject One**: Loes score stabilized at month 30 and remained stable through month 75.

- **Subject Two**: Loes score stabilized at month 30 and remained stable through month 64. Gadolinium enhancement was initially positive, resolved, reappeared in the parietal area and then resolved and has remained negative.
- **Subject Three**: Loes score stabilized at month 33 but gadolinium enhancement has persisted. Subject Three had active, progressive disease post-transplant resulting in the development of significant cognitive deficits with the loss of ability for new learning consistent with a frontal lobe syndrome, including the loss of spontaneous speech by month 33 and urinary incontinence. As of 54 months post-transplant, he had no further decline in NFS or Loes scores since his month 33 evaluation.
- **Subject Four**: Loes score stabilized at month 16 and remained stable at 24 months. Gadolinium enhancement disappeared 45 days post-transplant and was still not detectable at month 12.



At the top of the figure is a series of brain MRI images showing an example of progressive white matter disease in an untreated patient with CCALD. The expanding "white" in the images from left to right illustrates increasing demyelination in the brain and represents severe disease. The images below represent the baseline (left) and recent (right) brain MRI images from the four boys treated in the TG04.06.01 Study. In contrast to the extensive progressive white matter disease that might be seen in untreated CCALD, as shown at the top of the figure, the progression of white matter disease following treatment in the TG04.06.01 Study is more limited.

We believe these efficacy results are consistent with outcomes that would be expected following successful allogeneic HSCT. All four boys are alive two years or more after treatment, while the ALD-101 Study would suggest an expected mortality rate of approximately 20% in the same two-year window post-allogeneic HSCT. As assessed by NFS and brain MRI, Subjects One, Two and Four have shown encouraging evidence of disease stabilization. Additionally, gadolinium enhancement resolved in Subjects One, Two and Four, suggesting a reduction of neuroinflammation. These results also contrast with the natural history of disease in untreated patients, which is characterized by continuous and rapid progression of cerebral demyelination in the majority of cases, particularly those with gadolinium enhancement on brain MRI. All four subjects demonstrated some deterioration of neurologic function within the second year after

transplant, which is expected as it is also frequently seen following allogeneic HSCT, given the time it takes for transplant-derived microglial cells to populate the brain. Although neurologic deficits have occurred in these subjects post-treatment, we are encouraged by the fact that neurologic disease has stabilized in all four subjects.

Importantly, there have also been no reported incidents of gene therapy-related safety concerns in the TG04.06.01 Study. The infusion procedure was clinically uneventful for all four subjects, with all achieving successful engraftment within 15 days post-transplant. In addition, none of these subjects experienced adverse events due to immune incompatibility issues typically associated with allogeneic HSCT, such as graft rejection or GVHD.

We believe the efficacy and safety results of the TG04.06.01 Study provide clinical proof-of-concept, as the lentiviral vector used in the study shares many features with our Lenti-D vector. In addition, the results of the TG04.06.01 Study were helpful in informing the design of our future ALD-102 Study. The design of the ALD-102 Study is built upon the observations made in the TG04.06.01 Study, but will enroll a larger number of subjects, is a multi-center, international trial with a different primary endpoint determined by analysis of the ALD-101 Study data and in consultation with experts in the field, and has a predefined criterion for clinical success. Additionally, with improvements we have introduced into the vector manufacturing and transduction processes, we expect to obtain a higher frequency of gene-modified HSCs in subjects treated in the ALD-102 Study compared to what was achieved in the TG04.06.01 Study, which we believe will translate into improved clinical benefit by virtue of the increased expression of normally-functioning ALDP.

Phase II/III clinical study (the ALD-102 Study)

In April 2013, the FDA informed us that the IND we filed in March 2013 with the FDA for a Phase II/III clinical study to examine the feasibility, safety and efficacy of our Lenti-D product candidate is now active. We refer to this study as the ALD-102 Study. The study is designed as a single-dose, open-label, non-randomized, international, multi-center Phase II/III study to test the safety and efficacy of our Lenti-D product candidate in preserving neurological function and stabilizing cerebral demyelination in subjects with CCALD. Subjects will be followed for 24 months post-transplant under this protocol. Per the *FDA Guidance for Industry: Gene Therapy for Clinical Trials – Observing Subjects for Delayed Adverse Events*, we will be monitoring study subjects in a long-term follow up protocol to evaluate safety for up to 15 years, and will also monitor efficacy endpoints to demonstrate a sustained treatment effect.

Our clinical trial recruitment plans involve a multi-faceted approach, including:

- clinical site community outreach programs;
- global patient referral and support programs to bring patients from across the world to existing clinical sites;
- gene therapy patient, family and physician education tools, including general gene therapy and ALD-specific websites and materials;
- ALD patient advocacy engagement and support; and
- continued publication of existing and future scientific and clinical ALD data.

Up to 15 subjects will be enrolled in the study to obtain at least 12 evaluable subjects that have been transplanted with the Lenti-D drug product. In the study, subjects must be age fifteen years or younger with a confirmed diagnosis of active CCALD, including elevated levels of plasma VLCFA, a brain MRI Loes score of 0.5 to nine, inclusive, evidence of gadolinium enhancement and an NFS $\leq$ one. Subjects with a willing matched sibling HSCT donor will be excluded from the study. We expect to initiate the ALD-102 Study in late 2013.

Based on results from our retrospective ALD-101 Study and consultation with leading clinicians in the field of ALD, we have defined the primary efficacy endpoint in the ALD-102 Study as the proportion of subjects who have no MFDs, as measured by NFS, at 24 months (±two months) post-transplant. Secondary efficacy evaluations, in each case measured at 24 months (±two months) post-transplant, capture the key assessments of CCALD disease status, including the change from baseline in NFS and Loes score, resolution of gadolinium enhancement on MRI and determination of MFD-free survival and overall survival. The sample size for this study was not determined by formal statistical methods, but we believe it may be sufficient to demonstrate a robust effect on the binary response endpoint, where a responder is defined as a subject with no MFD at 24 months (±two months) following transplant. Thus, we expect the FDA will make a qualitative assessment of the efficacy and safety data from this study to evaluate whether the results are sufficient to support a BLA.

Safety evaluations will be performed during the study and will include evaluation of the following: success and kinetics of HSC engraftment; incidence of transplant-related mortality through 100 and 180 days post-transplant; detection of vector-derived replication of the HIV-1 virus; and characterization and quantification of events related to the location of insertion of the functional gene in target cells.

If successful, we believe that the results from the ALD-102 Study would form the basis of a BLA and an MAA. However, given the number of subjects and design of the study and the qualitative/subjective assessment of the data, there can be no assurance the FDA will not require one or more additional clinical studies as a precursor to a BLA application. The FDA has advised us that the ALD-102 Study may not be deemed to be a pivotal study or may not provide sufficient support for a BLA submission. The FDA normally requires two pivotal clinical studies to approve a drug or biologic product, and thus the FDA may require that we conduct additional clinical studies of Lenti-D prior to a BLA submission.

Preclinical evaluation of our Lenti-D product candidate

We have completed a single-dose toxicology study of our Lenti-D product candidate in immunodeficient mice following a single intravenous administration. This study investigated the engraftment of normal human HSCs transduced with our Lenti-D vector and the reversibility of any toxicity following a 28 and 91 day post-treatment recovery period. The assessment of toxicity was based on mortality, clinical observations, body and organ weights, and anatomic pathology. In addition, engraftment of the HSCs was analyzed in the bone marrow of all the interim and main sacrifice animals by fluorescence-activated cell sorting and by polymerase chain reaction procedures.

Study results from the single dose toxicology study found no product candidate-related effects in body and organ weight, hematology or clinical chemistry parameters. In addition, histopathological evaluation revealed that there were no product candidate-related microscopic findings. There were no significant group differences (aside from slight individual animal

variation) in cellularity of the bone marrow in treated control and test animals, as determined by light microscopy. Based upon the evaluation criteria used for the study, the Lenti-D drug product appeared to be well tolerated after single intravenous injection.

Additional potential clinical indications for Lenti-D

The ACALD and AMN subsets of the broader ALD patient population represent potential additional opportunities for our Lenti-D product candidate. Allogeneic HSCT has shown some early reported success in ACALD patients, suggesting autologous gene therapy with our Lenti-D product candidate may also be used to address these patients. AMN represents a population of heterogeneous patients with about 40% presenting with cerebral symptoms, however no known allogeneic HSCT studies have been conducted in the AMN population to provide evidence for a gene therapy based approach in the treatment of this disease. The risk-reward balance and safety risks associated with allogeneic HSCT have limited its use in treating ACALD and AMN patients, which may provide an opportunity to expand the use of our Lenti-D gene therapy product in these indications to increase interest in gene therapy for the treatment of other forms of ALD.

Our LentiGlobin opportunity

ß-thalassemia

Overview

ß-thalassemia is a rare hereditary blood disorder caused by a genetic abnormality of the ß-globin gene resulting in defective red blood cells, or RBCs. Genetic mutations cause the absence or reduced production of the beta chains of hemoglobin, or ß-globin, thereby preventing the proper formation of hemoglobin A, which normally accounts for greater than 95% of the hemoglobin in the blood of adults. Hemoglobin is an iron-containing protein in the blood that carries oxygen from the respiratory organs to the rest of the body. Hemoglobin A consists of four chains—two chains each of α-globin and ß-globin. Normally existing at an approximate 1:1 ratio, genetic mutations that impair the production of ß-globin can lead to a relative excess of α-globin, leading to premature death of red blood cells. The clinical implications of the α-globin/ß-globin imbalance are two-fold: first, patients lack sufficient RBCs and hemoglobin to effectively transport oxygen throughout the body and can become severely anemic; and second, the shortened life span and ineffective production of RBCs can lead to other complications such as splenomegaly, marrow expansion, bone deformities, and iron overload in major organs.

The clinical course of ß-thalassemia correlates with the degree of globin chain imbalance. Nearly 200 different mutations have been described in patients with ß-thalassemia. Symptoms of ß-thalassemia can include severe anemia, splenomegaly, marrow expansion, bone deformities and iron overload in major organs. The clinical presentation varies widely, dependent largely upon the number and type of inherited mutation. Mutations can be categorized as those which result in little or no functional ß-globin production ($ß^0$) and those which result in decreased functional ß-globin production ($ß^+$). ß-thalassemia major refers to any mutation pairing that results in the need for chronic transfusions due to severe anemia, and is the clinical finding in patients with $ß^0ß^0$ genotype as well as many with the $ß^0ß^+$ genotype. Affected patients produce as little as one to seven g/dL of hemoglobin (while a normal adult produces 12-18 g/dL of hemoglobin). Hemoglobin E, which is another ß-globin mutation and is usually asymptomatic, can also result in ß-thalassemia major when paired with the $ß^0$ or $ß^+$ mutations.

ß-thalassemia is concentrated in populations of Mediterranean, South and Southeast Asian and Middle Eastern descent. It has been estimated that about 1.5% (80 to 90 million people) of the global population are carriers of ß-thalassemia, with about 60,000 symptomatic individuals born annually, the great majority in the developing world. According to Thalassemia International Federation, about 288,000 patients with ß-thalassemia major are alive and registered as receiving regular treatment around the world, of which it is estimated that about 15,000 live in the United States and Europe. Due to the rarity of this disease in the United States, published research on the prevalence of ß-thalassemia in the United States is limited, although it is estimated that due to changing immigration patterns, 1.8 in 100,000 births in California are affected by ß-thalassemia. This data is derived from a mandatory screening program for hemoglobinopathies in that state.

Limitations of current treatment options

In geographies where treatment is available, patients with ß-thalassemia major receive chronic blood transfusion regimens aimed at maintaining steady state hemoglobin levels of approximately 9-10 g/dL. These regimens consist of infusions with units of pRBC every three to five weeks, the timing of which is based predominantly on monitoring hemoglobin levels. Chronic blood transfusions can be effective at preventing the hallmark symptoms of childhood ß-thalassemia major, however, often lead to a large iron overload, which over time leads to mortality through iron-associated heart and liver toxicity. To prevent iron overload-associated risks, patients must adhere to therapeutic iron chelation regimens to reduce the iron overload. Poor compliance with chelation regimens remains a key challenge; it is estimated that with typical compliance, the overall life expectancy for a patient with transfusion-dependent ß-thalassemia is only 28 years. Even patients who are compliant with transfusion and iron chelation regimens can experience a reduced quality of life due to the burden of therapy and the fluctuating levels of hemoglobin on a month-to-month basis.

The only potentially curative therapy for ß-thalassemia today is allogeneic HSCT. However, because of the significant risk of transplant-related morbidity and mortality, transplants are offered primarily to pediatric patients with a matched sibling donor, which occurs in less than 25% of all cases. Allogeneic HSCT carries a significant risk of morbidity and mortality related to myeloablation (which decreases or eliminates the cells in the bone marrow and blood), immunosuppressive medications, graft failure, GVHD and opportunistic infections. Overall, ß-thalassemia major remains a devastating disease with an unmet medical need.

In many developing countries where ß-thalassemia is more prevalent, such as Thailand, the lack of readily available chronic blood transfusions and optimal iron chelation regimens represents a significant societal challenge. In these countries, children with ß-thalassemia major have a poor prognosis and experience growth retardation, hepatosplenomegaly, or enlargement of the spleen, and skeletal deformities resulting from extra-medullary hematopoiesis. Ultimately, most die in childhood. We believe that safer therapies, such as those represented by our gene therapy approach, could offer a potential solution to the challenges of treating ß-thalassemia patients across the world.

Sickle cell disease

Overview

Sickle cell disease, or SCD, is a hereditary blood disorder resulting from a mutation in the ß-globin gene that causes polymerization of hemoglobin proteins and abnormal red blood cell function. The disease is characterized by anemia, vaso-occlusive pain crisis (a common complication

of SCD in which there is severe pain due to obstructed blood flow in the bones, joints, lungs, liver, spleen, kidney, eye, or central nervous system), infections, stroke, overall poor quality of life and early death in a large subset of patients. Under low-oxygen conditions, which are exacerbated by the red blood cell abnormalities, the mutant hemoglobin aggregates causing the RBCs to take on a sickle shape (sickle cells), which causes them to aggregate and obstruct small blood vessels, thereby restricting blood flow to organs resulting in pain, cell death and organ damage. If oxygen levels are restored, the hemoglobin can disaggregate and the RBCs will return to their normal shape, but over time, the sickling damages the cell membrane and the cells fail to return to the normal shape even in high-oxygen conditions. Additionally, the sickle-shaped RBCs tend to rupture more easily, often resulting in damage to the blood vessels and iron overload that can ultimately lead to organ failure and death.

SCD is concentrated in populations of African, Middle Eastern and South Asian descent. The global incidence of SCD is estimated to be 250,000-300,000 births annually, and the global prevalence of the disease is estimated to be about 20-25 million. In the United States, where SCD is a standard part of mandatory newborn screening, the incidence is more than 1,600 births annually with an estimated prevalence of 100,000 individuals.

Limitations of current treatment options

Where adequate medical care is available, common treatments for patients with SCD include chronic blood transfusions and hydroxyurea. As is the case with ß-thalassemia, chronic transfusions pose a compliance burden and are associated with significant risks that often leads to mortality through iron-associated heart and liver toxicity. Patients must also adhere to daily iron chelation regimens. A significant number of patients with SCD find it difficult to adhere to hydroxyurea treatment regimens due in part to drug-related toxicities.

The only potentially curative therapy currently available for SCD is allogeneic HSCT, however because of the significant risk of transplant-related morbidity and mortality, this option is usually offered primarily to pediatric patients with available sibling-matched donors. It is particularly difficult to find suitable donors for individuals of African descent, and it is estimated that approximately 10% of eligible patients do so. In light of these factors, we believe SCD is a devastating disease with a significant unmet medical need.

Our LentiGlobin product candidate

We are developing our LentiGlobin product candidate as a potential one-time treatment for both ß-thalassemia and SCD. Our approach involves the *ex vivo* insertion of a single codon variant of the normal ß-globin gene via an HIV-1 based lentiviral vector into the patient's own HSCs to enable formation of normally functioning hemoglobin A and normal RBCs in patients with ß-thalassemia or SCD. Importantly, this codon variant, referred to as T87Q, also serves as a distinct biomarker used to quantify expression levels of the functional ß-globin protein in patients with ß-thalassemia and SCD, while also providing strong anti-sickling properties in the context of SCD. We refer to the gene-modified HSCs as the final LentiGlobin drug product, or our LentiGlobin product candidate.

We have had and continue to have a comprehensive dialogue with the FDA, the EMA and other regulatory authorities and advisory bodies concerning the clinical advancement of our LentiGlobin product candidate. These interactions include the following:

- our LentiGlobin product candidate has been granted orphan drug designation by the FDA and the EMA and Fast Track status by the FDA;

- in 2012, the NIH's RAC reviewed our draft protocol and its recommendations were incorporated into the final protocol and informed consent;
- a type B pre-IND meeting with the FDA in 2012 focused on the design of our planned HGB-204 Study and provided guidance on the manufacturing and nonclinical development with a view towards a future IND filing;
- an IND submission for our HGB-204 Study in December 2012, which IND is effective as of January 2013;
- a meeting with ANSM in November 2011 regarding the submission of a Clinical Trial Application, or CTA, with a revised clinical protocol to support the use of our current LentiGlobin vector in our planned HGB-204 Study, and confirming that no additional *in vivo* toxicology data would be required for the CTA submission; and
- submission and approval of the CTA for the HGB-205 Study in 2012.

We have initiated our HGB-205 clinical study, and we expect to initiate our HGB-204 clinical study in mid-2013. We expect to have preliminary, interim data from one or both of these clinical studies in late 2014, although there can be no assurance this will be the case.

Clinical development of our LentiGlobin product candidate

Previous clinical experience with lentiviral gene therapy for ß-thalassemia major (the LG001 Study)

Between September 2006 and November 2011, three subjects with ß-thalassemia major were treated in France by our scientific collaborators in a Phase I/II study with autologous HSCs transduced *ex vivo* with an earlier generation of our LentiGlobin vector, called HPV569. We refer to the HSCs transduced *ex vivo* with the HPV569 vector as the HPV569 drug product. Clinical data and biological experience with one subject in this study (Subject Three) were first reported in *Nature* (2010).

Four subjects were enrolled in the LG001 Study, although only three subjects were actually treated with the HPV569 drug product —Subject One was ineligible due to pre-transplant complications. The other three subjects were successfully transplanted, however Subject Two received a dose of HPV569 drug product with cell counts well below current standards in transplant practice and failed to engraft. All subjects enrolled in the study required significant transfusion support prior to treatment. Below is a summary of the results for the two subjects with successful engraftment:

- **Subject Three**: During the first year post-transplant, Subject Three experienced a decline in both the volume and frequency of transfusion requirements and eventually became transfusion-independent approximately one year post-treatment. Subject Three has remained transfusion-independent ever since (more than four years), even in light of regular blood withdrawals to eliminate iron accumulation in the body. Adverse events considered to be treatment related were all attributable to study procedures or myeloablative conditioning, but not the HPV569 drug product. One notable observation was the detection of partial clonal dominance of a common myeloid progenitor bearing an integrated vector in the third intron of the HMGA2 gene, which resulted in a relatively large proportion of the gene therapy modified cells being derived from a single clone in which the lentiviral vector had inserted into the HMGA2 gene. There was some initial concern that the observed clonal dominance might represent a pre-leukemic event, however there have been no adverse clinical consequences of this event, or any signs of

cancer, in over five years since the observation was made. In fact, the presence of the HMGA2 clone has steadily declined over time to the point that it is no longer the most common clone.

- **Subject Four**: After transplant, Subject Four experienced delayed recovery of platelets and required platelet transfusion thrice weekly until day 100, with the last transfusion on day 122. Therapeutic hemoglobin in reticulocytes was detectable by one month post-transplant. At two- and six-months post-transplant, therapeutic hemoglobin was expressed in 4.0% and 3.1% of reticulocytes, respectively. Subject Four is clinically stable, has fully engrafted and feels well. However, transfusion requirements remain unchanged at approximately monthly intervals with T87Q corrected globin stably expressed at levels substantially below those demonstrated by Subject Three at similar time points. Further follow-up is required to establish the complete trajectory of T87Q globin production and vector copy number. Adverse events considered to be treatment related were all attributable to study procedures or myeloablative conditioning, but not the HPV569 drug product.

We believe that achieving transfusion independence in Subject Three is a direct benefit of treatment with the HPV569 drug product, as we are not aware of any reported cases of spontaneous transfusion independence in patients with ß-thalassemia major. While successful allogeneic HSCT may achieve transfusion independence, the mortality risk of allogeneic HSCT in adults with ß-thalassemia major exceeds 20%, and for that reason it is not a standard therapeutic intervention for adult patients. The approach of using autologous gene-modified HSCs avoids the adverse consequences of immune incompatibility that are responsible for much of the mortality and morbidity associated with allogeneic HSCT.

We believe the efficacy and safety results of the LG001 Study provide clinical proof-of-concept, as the lentiviral vector used in the study shares many features with our current LentiGlobin vector. In addition, the results of the LG001 Study were helpful in informing the design of our HGB-205 and HGB-204 clinical studies. Additionally, with improvements we have introduced into the vector manufacturing and transduction processes, we expect to obtain a higher frequency of gene-therapy modified HSCs in the patients treated in the HGB-205 and HGB-204 clinical studies compared to what was achieved in the LG001 Study, which we believe will translate into improved clinical efficacy and in improved clinical benefit by virtue of increased production of normally functioning hemoglobin.

Phase I/II clinical study for ß-thalassemia major and sickle cell disease (the HGB-205 Study)

At the request of ANSM, in 2012 we submitted a CTA with a revised clinical protocol for the LG001 Study as a result of our decision to use our newer LentiGlobin BB305 vector for our clinical studies going forward. A preclinical evaluation of LentiGlobin BB305 showed that transduction efficiency was higher with the LentiGlobin BB305 vector as compared to the HPV569 vector used in the LG001 Study, resulting in higher expression of the therapeutic ß-globin protein in transduced cells, despite unchanged expression levels per vector copy. The CTA was accepted in 2012, resulting in an active study, now called the HGB-205 study, which we initiated in France in mid-2013. This continuation study is a Phase I/II clinical study to examine the safety and efficacy of our LentiGlobin product candidate in up to seven additional subjects with a diagnosis of ß-thalassemia major or SCD. Study subjects must be between five and 35 years of age with a diagnosis of ß-thalassemia major or SCD. Those with ß-thalassemia must have received at least 100 mL/kg/year of pRBCs per year for the past two years. Those with SCD must have failed to

achieve clinical benefit from treatment with hydroxyurea and have an additional poor prognostic risk factor (e.g., recurrent veno-occlusive crises or acute chest syndromes). All subjects must be eligible for allogeneic HSCT, but without a matched related donor. Subjects with a matched sibling allogeneic HSCT donor will be excluded from the study.

Our clinical trial recruitment plans for the HGB-205 Study involve a multi-faceted approach, including:

- clinical site community outreach programs;
- global patient referral and support programs to bring patients to existing clinical sites;
- clinical site expansion in areas of high epidemiology;
- gene therapy patient, family and physician education tools, including general gene therapy and ß-thalassemia and SCD specific websites and materials;
- ß-thalassemia and SCD patient advocacy engagement; and
- support and continued publication of existing and future ß-thalassemia and SCD scientific and clinical data.

For all subjects, efficacy will be measured by RBC transfusion requirements per month and per year, post-transplant and the number of total in-patient hospitalization days (post-transplant discharge) at six, 12 and 24 months. For SCD patients only, efficacy will be measured by the number of vaso-occlusive crises or acute chest syndrome events at six, 12 and 24 months and evaluation of changes in the nature or frequency of the subject-specific main inclusion criteria.

Safety evaluations to be performed during the study include success and kinetics of HSC engraftment, incidence of transplant-related mortality post-treatment, overall survival, detection of vector-derived replication-competent lentivirus in any subject and characterization of events of insertional mutagenesis leading to clonal dominance or leukemia.

Phase I/II clinical study for ß-thalassemia major (the HGB-204 Study)

In December 2012, we submitted an IND with the FDA for a Phase I/II clinical study to examine the feasibility, safety and efficacy of our LentiGlobin product candidate in patients with ß-thalassemia. We refer to this study as the HGB-204 Study. The study is a single-dose, open-label, non-randomized, multi-site Phase I/II clinical study in the United States to evaluate the safety and efficacy of the LentiGlobin product candidate in increasing hemoglobin production and eliminating or reducing transfusion dependence following treatment. In January 2013, we were cleared to commence the study and we expect to initiate this study in mid-2013. We expect to submit an IND with the FDA in 2014 to evaluate LentiGlobin in patients with SCD.

Our clinical trial recruitment plans for the HGB-204 Study involve a multi-faceted approach, including:

- clinical site community outreach programs;
- global patient referral and support programs to bring patients to existing clinical sites;
- clinical site expansion in areas of high epidemiology;
- gene therapy patient, family and physician education tools, including general gene therapy and ß-thalassemia specific websites and materials;

- ß-thalassemia patient advocacy engagement; and
- support and continued publication of existing and future ß-thalassemia scientific and clinical data.

Up to 15 adults will be enrolled in the study. Study subjects must be between 18 and 35 years of age with a diagnosis of ß-thalassemia major and who receive at least 100 mL/kg/year of pRBCs or greater than or equal to eight transfusions of pRBCs per year in each of the two years preceding enrollment. The subjects must also be eligible for allogeneic HSCT.

Efficacy will be evaluated primarily by the production of ≥2.0 g/dL of hemoglobin A containing $ß^{A-T87Q}$-globin for the six-month period between 18 and 24 months post-transplant. In order to allow for endogenous hemoglobin production following transplant, subjects will be transfused with RBCs only when total hemoglobin decreases below 7.0 g/dL. The rationale for the primary endpoint is that production of ≥2.0 g/dL of hemoglobin A containing $ß^{A-T87Q}$ -globin represents a clinically meaningful increase in endogenous hemoglobin production that would be expected to diminish transfusion requirements, and could result in transfusion independence in ß-thalassemia subjects.

Exploratory efficacy endpoints include RBC transfusion requirements (measured in milliliters per kilogram) per month and per year, post-transplant. Safety evaluations to be performed during the study include success and kinetics of HSC engraftment, incidence of transplant-related mortality post-treatment, overall survival, detection of vector-derived replication-competent lentivirus in any subject and characterization of events of insertional mutagenesis leading to clonal dominance or leukemia. Subjects will be monitored by regular screening. Each subject will remain on study for approximately 26 months from time of consent and then will be enrolled in a long-term follow-up protocol that will assess safety and efficacy beyond 24 months.

Preclinical evaluation of our LentiGlobin product candidate

Several nonclinical studies have been performed to support the use of our LentiGlobin BB305 vector. These studies were conducted in human HSCs isolated from patients with SCD and in *in vivo* mouse transplant models. In these studies, transduction efficiency was shown to be higher with the LentiGlobin BB305 vector as compared to the HPV569 vector, based on higher expression levels of the therapeutic ß-globin protein in cells transduced with this vector despite unchanged protein expression levels per vector copy. *In vivo* pharmacology and safety studies carried out in a mouse model for ß-thalassemia provided no evidence that our lentiviral vectors caused any adverse effects or alteration of bone marrow homeostasis in animals treated with cells transduced with either the HPV569 or BB305 vector. In two independent *in vitro* immortalization, or IVIM, assays, LentiGlobin BB305 vector showed a reduced risk of IVIM and genotoxicity in murine HSCs as compared to positive control vectors known to have significant oncogenic potential. Results of integration site analyses in mice treated with syngeneic bone marrow cells transduced with either LentiGlobin BB305 or HPV569 vectors revealed no signs for clonal outgrowth. The integration site profile of the two vectors was comparable and typical for HIV-1 based lentiviral vectors. Both vectors showed a large overlap of integration sites in identical common integration site regions. Although integration near oncogenes was, in general, increased in the analyzed vector samples compared to the theoretical random integration site data, there was no increase of integration sites near oncogenes in the post-transplant samples isolated from the bone marrow at necropsy compared to pre-transplant samples of transduced bone marrow.

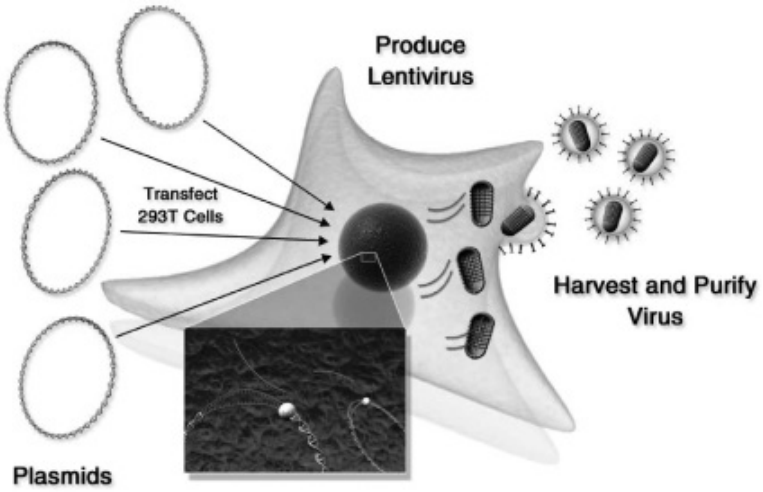
Previous preclinical experience with lentiviral gene therapy for sickle cell disease

In 2001, a preclinical proof-of-concept study, led by our scientific founder Dr. Philippe Leboulch and scientists at Harvard Medical School and the Massachusetts Institute of Technology, corrected sickle cell disease in mice using gene therapy. In the study, mice were bioengineered to contain a human gene that produced defective hemoglobin, causing SCD. HSCs containing the defective gene were removed from the bioengineered mice and gene-modified by the addition of an anti-sickling gene using a lentiviral vector. The modified gene (T87Q) produced ß-globin that gave rise to a modified normal hemoglobin molecule that prevented the sickling process. This gene construct is the same construct we use in our LentiGlobin product candidate. After adding the anti-sickling gene, the corrected marrow was then transplanted into other mice with SCD whose bone marrow had been removed by radiation. Ten months later, blood samples from the transplanted mice showed a high level of expression of the anti-sickling ß-hemoglobin gene. The results from this preclinical proof-of-concept study for SCD were published in *Science* (2001).

Manufacturing

Our gene therapy platform has two main components: lentiviral vector production and the target cell transduction process, which results in our finished drug product.

Our lentiviral manufacturing process



Our lentiviral vectors are assembled using a human cell line called HEK293T. The HEK293T cells are maintained in disposable flasks until sufficient cell mass has been generated to fill approximately 40 ten tray cell factories, or TTCFs, then transferred and allowed to adhere to the bottom of the trays. Adherent cells are transfected with multiple plasmids encoding all the genetic material required to assemble the lentiviral vector carrying such functional gene of interest. The genetic material is delivered on multiple plasmids to reduce the odds of generating a replication-competent virus and improve the overall safety of this step of the procedure. The transfected HEK293T cells then assemble our lentiviral vectors packaged with the functional gene of interest, which bud off into the cell culture media. The media containing the assembled vectors is harvested, purified by a single chromatography step, concentrated and formulated

prior to freezing for storage. These finished lentiviral vectors are what is ultimately used to transduce the HSCs isolated from the patient.

We believe that our lentiviral vectors have broad applicability, since the majority of the viral production system can remain the same, while we change only the therapeutic gene "cassette" depending on the disease. In other words, the vector "backbone" stays the same, while only the therapeutic gene and related sequences are changed. If we were to undertake drug development in an additional indication, we believe we could rapidly move forward using this lentiviral vector backbone and associated assays, simply by switching the therapeutic gene insert and associated control elements.

Although we intend to continue manufacturing our Lenti-D vectors in TTCFs, we are currently in the process of adapting our LentiGlobin vector production technology to a larger, suspension-based bioreactor process with the potential to scale from 100 to upwards of 1,000 liters in a single production run. So far, we have demonstrated successful production of LentiGlobin vectors on a small scale and are currently transferring the new process to a contract manufacturer in compliance with Good Manufacturing Practices, or GMP, to accommodate future demand for our drug candidates, if approved, in their current indications as well as those beyond our initial focus.

Our target cell transduction process—creating the gene-modified cells (our drug product)

The ultimate product of our manufacturing processes is the patient's own gene-modified cells, which we refer to as our drug product. The process for producing our drug product is as follows:

1. **Selection**: We extract HSCs from peripheral blood mononuclear cells obtained from the patient's blood by apheresis (or alternatively, by bone marrow harvest) following mobilization via a colony stimulating factor. The process is carried out using existing hospital infrastructure and standard protocols currently in place for stem cell transplant procedures.
2. **Pre-stimulation**: The isolated HSCs are treated with a mixture of growth factors and additional proprietary processes that help enable an efficient transduction process.
3. **Transduction**: The isolated, purified and pre-treated HSCs are exposed to our lentiviral vectors containing the appropriate functional gene for up to 40 hours to facilitate transduction and insertion of the therapeutic DNA into the chromosomes of the target cells.
4. **Final harvest**: Once transduction is complete, the gene-modified HSCs are washed and re-suspended into cell culture media to remove any residual impurities. A portion of the harvested cells is removed for quality control release testing, which includes ensuring that transduction was successful and the functional gene delivered by the vector is adequately expressed by the target cells.
5. **Formulation and freeze**: The remaining cells are appropriately formulated and cryopreserved.

The final step is to return the gene-modified HSCs to the patient. Just prior to dosing, the drug product is thawed and sampled for cell number and viability to ensure the dose administered meets a pre-defined minimum.

Of note, our proprietary lentiviral vector manufacturing and HSC transduction processes utilize operations and equipment that are common to the biopharmaceutical industry. We rely exclusively on the use of contract manufacturing organizations to manufacture our Lenti-D and LentiGlobin vectors and drug product candidates, and do not own or operate any of our own facilities for these purposes. However, we believe our team of technical personnel has extensive manufacturing, analytical and quality experience as well as strong project management discipline to effectively oversee these contract manufacturing and testing activities, and to compile manufacturing and quality information for our regulatory submissions.

Future applications and opportunities

The investments that we have made to industrialize our gene therapy platform, processes and manufacturing may have application to other severe genetic and orphan diseases. We believe that we have the opportunity to pursue other disease indications that would take advantage of our know-how and other intellectual property, and expertise in three main areas:

- **Other lentiviral *ex vivo* applications:** We believe our current gene therapy platform will enable us to develop and test new vectors based on similar viral vector backbones that carry different gene sequences for other hereditary diseases without the need for significant research work. In this way, we can move products rapidly through preclinical into clinical development. We may consider research and development programs targeting other monogenic, hereditary diseases that involve cells derived from HSCs. These programs may involve hereditary orphan diseases that could be developed and potentially commercialized on our own.

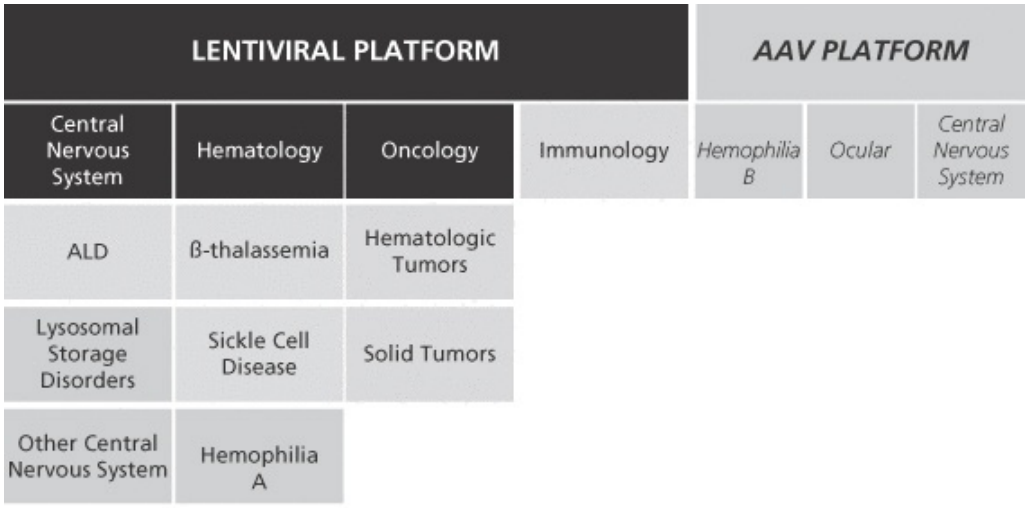
  We also plan to pursue gene therapy programs that target other cell types, such as T cells, that leverage the unique properties of lentiviral vectors. Through our global partnership with Celgene, we are now developing gene therapy products by inserting novel gene sequences into a patient's own T cells using lentiviral vectors for oncology. This represents a direct application of our expertise in gene therapy and our capabilities, know-how and patents associated with lentiviral gene therapy for *ex vivo* applications. As we further develop this program, we will investigate the opportunity to expand the application to T cells and other cell types for new potential indications.

- **Lentiviral *in vivo* applications:** Our expertise in lentiviral vector production and cell transduction also provides an opportunity to develop new lentiviral products for use in the *in vivo* setting. In this case, lentiviral vectors carrying certain gene sequences would be delivered directly to the disease site (e.g., to the brain or eye) or into the bloodstream of the patient and, in each case, the vector would need to find the target cell *in vivo* and deliver the genetic material into those target cells. Although this represents a less controlled environment in which to transduce cells and deliver genetic material, it opens up additional orphan and large market indications where this approach is more appropriate for the disease and targeted cells.

- **Adeno-associated viral (AAV) vector platform targeting other diseases:** Our team has extensive historic experience with AAV research and development programs. There is extensive evidence in the scientific literature supporting the use of these vectors for *in vivo*

applications. The unique properties of AAV vectors may offer advantages in some indications where lentiviral vectors might be less suited. For example, AAV vectors may be better suited for use in products delivered *in vivo* systematically. Our experience and know-how could be useful with an AAV platform in these additional disease settings and we expect to explore cautiously and opportunistically AAV product candidates that could provide a bolt-on platform and capability for us.

The graphic below represents an example of the breadth of potential applications of our gene therapy platform.



Strategic collaborations

Our objective is to develop and commercialize a next generation of products based on the transformative potential of gene therapy to treat patients with severe genetic and orphan diseases. To access the substantial funding and other resources required to develop and commercialize gene therapy products, we have formed, and intend to seek other opportunities to form, strategic alliances with collaborators who can augment our industry leading gene therapy expertise. To date, we have focused on forging a limited number of significant strategic alliances with leading pharmaceutical partners and academic laboratories where both parties contribute expertise to enable the discovery and development of potential gene therapy product candidates.

Our strategic alliance with Celgene

In March 2013, we announced a strategic collaboration with Celgene Corporation to discover, develop and commercialize novel disease-altering gene therapies in oncology. The collaboration will focus on applying gene therapy technology to genetically modify a patient's own T cells, to target and destroy cancer cells. Such modified T cells, which are called chimeric antigen receptor, or CAR, T cells, have been shown to have beneficial effects in human clinical trials for patients with B cell lymphomas. The multi-year research and development collaboration has the potential to lead to the development and commercialization of multiple CAR T cell products.

Under the terms of the collaboration, for any product candidate selected for development under the collaboration, we will be responsible for conducting and funding all research and

development activities performed up through completion of the initial Phase I clinical study, if any, of such product candidate. This collaboration will be governed by a joint steering committee, or JSC, formed by representatives from us and Celgene. The JSC will, among other activities, review the collaboration program, review and evaluate product candidates and approve regulatory plans.

On a product candidate-by-product candidate basis, up through a specified period following completion of an initial Phase I clinical study for such product candidate, we have granted Celgene an option to obtain an exclusive worldwide license to develop and commercialize such product candidate pursuant to a written agreement, the form of which we have already agreed upon. If Celgene elects to exercise this option, it must pay us an option fee, subject to reduction if we elect to co-develop and co-promote that product candidate in the United States. In addition to the option fee, Celgene would also be obligated to pay us additional amounts based upon achievement of specified development and regulatory milestones and a percentage of net sales as a royalty, however, if we elect to co-develop and co-promote in the United States, this royalty only applies to sales outside the United States. The maximum option fee payable to us under these agreements, together with the maximum additional payments payable to us upon achievement of specified clinical, regulatory and commercial milestones, is $225 million, and the royalties payable to us range from the mid-single digits to mid-teens. The royalties payable to us are subject to certain reductions, including for any royalty payments required to be made by Celgene to acquire patent rights, with an aggregate minimum floor. Celgene will assume certain development obligations and must report on their progress in achieving these milestones on a quarterly basis. If we do elect to co-develop and co-promote the product candidate within the United States, we would share equally in all costs relating to developing, commercializing and manufacturing the product candidate within the United States and we would share equally in the United States profits.

Celgene will be solely responsible for all costs and expenses of manufacturing and supplying any optioned product candidates. Subject to customary “back-up” supply rights granted to Celgene, we have the sole right to manufacture or have manufactured supplies of vectors and associated payloads manufactured for incorporation into the optioned product candidate. We would do so under a written agreement, the form of which has not yet been agreed upon, although we have agreed upon certain material terms for such manufacturing and supply agreement. Celgene would reimburse us for our costs to manufacture and supply such vectors and associated payloads, plus a modest mark-up.

If Celgene does not exercise its option with respect to any product candidate prior to expiration of the applicable option period, then we have the right to develop that product candidate outside the scope of the collaboration, subject to a Celgene opt-in right to obtain a license to that product candidate, which right exists through a specified period following completion of a pivotal study for that product candidate.

We received an up-front payment of $75.0 million from Celgene in connection with the collaboration. The collaboration term ends in March 2016, unless extended at Celgene’s option. Celgene may elect to extend the term twice, first for a period of two years and then for an additional period, in each case in consideration of a specified payment to us. Either party may terminate the agreement upon written notice to the other party in the event of the other party’s uncured material breach. Celgene may terminate the agreement for any reason upon prior written notice to us. If the agreement is terminated, rights to product candidates in development at the time of such termination will be allocated to the parties through a mechanism included in the agreement. In addition, if Celgene terminates the agreement for our breach, any then- existing co-development and co-promotion agreement will be automatically terminated and

replaced with a license agreement for such product candidate and any amounts payable by Celgene under any then-existing product license agreements will be reduced.

Baylor College of Medicine

Simultaneous with entering into the collaboration agreement with us, Celgene entered into a strategic collaboration with the Baylor College of Medicine, or Baylor, to discover, develop and commercialize CAR T cell products. We are not a party to this collaboration agreement, although, by virtue of our agreements with Celgene, the joint steering committee under the Baylor-Celgene collaboration agreement will include representatives selected by us, together with representatives selected by each of Celgene and Baylor. Under our collaboration agreement with Celgene, we may develop product candidates covered by the intellectual property rights of Baylor in this field, which intellectual property rights would be in-licensed by Celgene pursuant to its collaboration agreement with Baylor.

Call Option and Target Antigen License

Our agreement with Celgene provides that, effective upon completion of this offering, during the initial three-year term of the collaboration and, if extended, during the first two-year extension term of the collaboration, in the event that we engage in a change in control transaction, including for such purposes a merger or consolidation of bluebird bio or the sale of all or substantially all of our assets, or if another person or entity or group of persons or entities acquires at least 50% of our voting capital stock, then Celgene has the right, but not the obligation, to terminate the collaboration agreement and obtain perpetual, non-terminable, worldwide, exclusive, fully paid-up licenses to all, but not less than all, of the product candidates previously identified under the collaboration agreement. We refer to this right to acquire such licenses as the call option.

Under the call option, the product candidates to which Celgene would have the right to acquire fully paid-up licenses include any product candidate previously licensed out of the collaboration during the term of the collaboration, any product candidate for which we have exercised our right to co-develop and co-promote the product candidate within the United States, any product candidate for which Celgene previously declined its option to obtain a license and any product candidate for which at least *in vivo* efficacy studies have been initiated or authorized by the JSC. The purchase price for such fully paid-up licenses would be determined pursuant to a binding arbitration process and would be paid on or about the consummation of the change in control transaction with our acquiror.

In addition, during the initial three-year term of the collaboration, but not during any extension of the collaboration agreement, in the event that we engage in a change in control transaction described above and Celgene exercises the call option described above, then, in addition to the right to acquire the fully paid-up licenses described above, Celgene would also have the right to obtain a perpetual, non-terminable, worldwide, exclusive license to our intellectual property to develop one or more CAR T cell products targeting one or more oncology associated target antigens identified by Celgene following the third anniversary of the collaboration agreement. There is no limit to the number of oncology associated target antigens Celgene may select under this license. Upon commercialization of any such product candidate so licensed by Celgene, Celgene would be obligated to pay us a specified milestone payment upon regulatory approval and a percentage of net sales as a royalty. We refer to this license agreement to develop one or more CAR T cell products targeting one or more oncology associated target antigens as the target antigen license.

The call option and the right to acquire a target antigen license may have the effect of delaying or preventing a change in control transaction involving us, or may reduce the number of companies interested in acquiring us. See “Risk factors—Provisions in our collaboration agreement with Celgene Corporation may prevent or delay a change in control.”

Intellectual property

We strive to protect and enhance the proprietary technology, inventions, and improvements that are commercially important to the development of our business, including seeking, maintaining, and defending patent rights, whether developed internally or licensed from third parties. We also rely on trade secrets relating to our proprietary technology platform and on know-how, continuing technological innovation and in-licensing opportunities to develop, strengthen and maintain our proprietary position in the field of gene therapy that may be important for the development of our business. We additionally rely on regulatory protection afforded through orphan drug designations, data exclusivity, market exclusivity, and patent term extensions where available.

Our commercial success may depend in part on our ability to obtain and maintain patent and other proprietary protection for commercially important technology, inventions and know-how related to our business; defend and enforce our patents; preserve the confidentiality of our trade secrets; and operate without infringing the valid enforceable patents and proprietary rights of third parties. Our ability to stop third parties from making, using, selling, offering to sell or importing our products may depend on the extent to which we have rights under valid and enforceable patents or trade secrets that cover these activities. With respect to both licensed and company-owned intellectual property, we cannot be sure that patents will be granted with respect to any of our pending patent applications or with respect to any patent applications filed by us in the future, nor can we be sure that any of our existing patents or any patents that may be granted to us in the future will be commercially useful in protecting our commercial products and methods of manufacturing the same.

We have developed or in-licensed numerous patents and patent applications and possess substantial know-how and trade secrets relating to the development and commercialization of gene therapy products. Our proprietary intellectual property, including patent and non-patent intellectual property, is generally directed to, for example, certain genes, methods of transferring genetic material into cells, processes to manufacture our lentivirus-based product candidates and other proprietary technologies and processes related to our lead product development candidates. As of the date of this prospectus, our patent portfolio includes the following:

- approximately 176 patents or patent applications that we own or have exclusively in-licensed from academic institutions and third parties related to lentiviral vectors and vector systems;
- approximately 58 patents or patent applications that we have non-exclusively in-licensed or optioned from academic institutions and third parties related to lentiviral vectors and vector systems;
- approximately 18 patents or patent applications that we own, including eight that are co-owned with MIT, related to vector manufacturing or production;
- approximately seven patents or patent applications that have been non-exclusively in-licensed from academic institutions and third parties related to vector manufacturing or production; and

- approximately 12 patents or patent applications that we own or have exclusively in-licensed from academic institutions and third parties related to therapeutic cellular products.

Our objective is to continue to expand our portfolio of patents and patent applications in order to protect our gene therapy product candidates and lentiviral manufacturing process. Examples of the products and technology areas covered by our intellectual property portfolio are described below. See also "—License agreements."

Childhood Cerebral Adrenoleukodystrophy (CCALD)

The CCALD platform includes three patent portfolios, described below.

- **Pasteur Institute.** The Pasteur patent portfolio contains patent applications directed to FLAP/cPPT elements and lentiviral vectors utilized to produce our Lenti-D product candidate for CCALD. As of March 31, 2013, we had an exclusive license (from Pasteur Institute) to four issued U.S. patents and four pending U.S. applications. Corresponding foreign patents and patent applications include pending applications or issued patents in Australia, Canada, China, Europe, Hong Kong, Israel, and Japan. We expect the issued composition of matter patents to expire from 2019-2023 in the United States, and from 2019-2020 in the rest of the world (excluding possible patent term extensions). Further, we expect composition of matter patents, if issued from the pending patent applications and if the appropriate maintenance, renewal, annuity or other governmental fees are paid, to expire in 2019-2020 (excluding possible patent term extensions). We expect the patents and patent applications in this portfolio other than composition of matter patents, if issued, and if the appropriate maintenance, renewal, annuity, or other governmental fees are paid, to expire in 2019-2020 (worldwide, excluding possible patent term extensions).
- **RDF.** The in-licensed patent portfolio from Research Development Foundation, or RDF, in part, contains patents and patent applications directed to aspects of our lentiviral vectors utilized to produce our Lenti-D product candidate for CCALD. As of March 31, 2013, we had an exclusive license (from RDF) to three issued U.S. patents and one pending U.S. application related to our lentiviral vector platform. Corresponding foreign patents and patent applications related to our lentiviral vector platform include pending applications or issued patents in Canada, Europe, and Israel. We expect the issued composition of matter patents to expire from 2022-2023 (excluding possible patent term extensions). Further, we expect composition of matter patents, if issued from the pending patent applications and if the appropriate maintenance, renewal, annuity or other governmental fees are paid, to expire in 2021-2022 (excluding possible patent term extensions). We expect the patents and patent applications in this portfolio other than composition of matter patents, if issued, and if the appropriate maintenance, renewal, annuity, or other governmental fees are paid, to expire in 2021-2022 (worldwide, excluding possible patent term extensions).
- **bluebird bio**. The bluebird bio patent portfolio contains patent applications directed to compositions of matter for CCALD gene therapy vectors and compositions and methods of using the vectors and compositions in cell-based gene therapy of adrenoleukodystrophy or adrenomyeloneuropathy. As of March 31, 2013, we owned one pending U.S. application and one pending Patent Cooperation Treaty, or PCT, application that is due for national stage entry in December 2013. We expect the composition of matter patent for the CCALD gene therapy vectors, if issued from the pending patent application and if the appropriate

maintenance, renewal, annuity or other governmental fees are paid, to expire in 2032 (worldwide, excluding possible patent term extensions). We expect the other patents and patent applications in this portfolio, if issued, and if the appropriate maintenance, renewal, annuity, or other governmental fees are paid, to expire in 2032 (worldwide, excluding possible patent term extensions).

ß-thalassemia/SCD

The ß-thalassemia/SCD platform includes three patent portfolios, described below.

- **Pasteur Institute.** The in-licensed Pasteur patent portfolio contains the patents and patent applications described above directed towards aspects of our lentiviral vectors utilized to produce our LentiGlobin product candidate for ß-thalassemia and SCD.
- **RDF.** The in-licensed RDF patent portfolio contains the patents and patent applications described above directed towards aspects of our lentiviral vectors utilized to produce our LentiGlobin product candidate for ß-thalassemia and SCD.
- **MIT/bluebird bio.** The co-owned patent portfolio contains patents and patent applications directed to certain specific compositions of matter for lentiviral ß-globin expression vectors. As of March 31, 2013, we co-owned one issued U.S. patent and two pending U.S. applications, as well as corresponding foreign patents issued in Europe and Hong Kong. We expect the issued composition of matter patents to expire in 2023 (excluding possible patent term extensions). Further, we expect composition of matter patents, if issued from the pending patent applications and if the appropriate maintenance, renewal, annuity or other governmental fees are paid, to expire in 2023 (excluding possible patent term extensions). We expect the other patents and patent applications in this portfolio, if issued, and if the appropriate maintenance, renewal, annuity, or other governmental fees are paid, to expire in 2023 (worldwide, excluding possible patent term extensions). We note that we have an exclusive license to MIT's interest in this co-owned intellectual property.

Lentiviral platform (e.g., vectors, manufacturing, and cell therapy products)

The lentiviral platform, which is potentially applicable to the CCALD, ß-thalassemia, SCD and other potential programs, includes three patent portfolios, described below.

- **Pasteur Institute.** The Pasteur patent portfolio contains the patents and patent applications described above.
- **RDF.** The in-licensed RDF patent portfolio contains the patents and patent applications described above.
- **bluebird bio.** One aspect of the bluebird bio patent portfolio contains patents and patent applications directed to certain specific compositions of matter and improved methods for selecting and delivering transduced cells. As of March 31, 2013, we owned one pending PCT application that is due for national stage entry in July 2013. We expect any composition of matter or methods patents, if issued from a corresponding nonprovisional national stage application, and if the appropriate maintenance, renewal, annuity or other governmental fees are paid, to expire in 2031 (worldwide, excluding possible patent term extensions). We expect the other patents and patent applications in this portfolio, if issued, and if the appropriate maintenance, renewal, annuity, or other governmental fees

are paid, to expire in 2031 (worldwide, excluding possible patent term extensions). Another component of the bluebird bio patent portfolio includes the vector manufacturing platform and is potentially applicable to the CCALD, ß-thalassemia, SCD and other programs. This portion of the portfolio contains patents and patent applications directed to compositions of matter for improved packaging cells and cell lines and improved methods for transfection and transduction of therapeutic cells. As of March 31, 2013, we owned two U.S. provisional applications, which have nonprovisional filing bar dates in 2013, and two pending PCT applications, which are due for national stage entry in December 2013 and March 2014. We expect composition of matter and method patents, if issued from a corresponding nonprovisional national stage application, and if the appropriate maintenance, renewal, annuity or other governmental fees are paid, to expire in 2032 (worldwide, excluding possible patent term extensions).

In addition to the above, we have established expertise and development capabilities focused in the areas of preclinical research and development, manufacturing and manufacturing process scale-up, quality control, quality assurance, regulatory affairs and clinical trial design and implementation. We believe that our focus and expertise will help us develop products based on our proprietary intellectual property.

The term of individual patents depends upon the legal term of the patents in the countries in which they are obtained. In most countries in which we file, the patent term is 20 years from the date of filing the non-provisional application. In the United States, a patent's term may be lengthened by patent term adjustment, which compensates a patentee for administrative delays by the U.S. Patent and Trademark Office in granting a patent, or may be shortened if a patent is terminally disclaimed over an earlier-filed patent.

The term of a patent that covers an FDA-approved drug may also be eligible for patent term extension, which permits patent term restoration of a U.S. patent as compensation for the patent term lost during the FDA regulatory review process. The Hatch-Waxman Act permits a patent term extension of up to five years beyond the expiration of the patent. The length of the patent term extension is related to the length of time the drug is under regulatory review. 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 one patent applicable to an approved drug may be extended. Moreover, a patent can only be extended once, and thus, if a single patent is applicable to multiple products, it can only be extended based on one product. Similar provisions are available in Europe and other foreign jurisdictions to extend the term of a patent that covers an approved drug. When possible, depending upon the length of clinical trials and other factors involved in the filing of a new drug application, or NDA, we expect to apply for patent term extensions for patents covering our product candidates and their methods of use.

We may rely, in some circumstances, on trade secrets to protect our technology. However, trade secrets can be difficult to protect. We seek to protect our proprietary technology and processes, in part, by entering into confidentiality agreements with our employees, consultants, scientific advisors and contractors. We also seek to preserve the integrity and confidentiality of our data and trade secrets by maintaining physical security of our premises and physical and electronic security of our information technology systems. While we have confidence in these individuals, organizations and systems, agreements or security measures may be breached, and we may not have adequate remedies for any breach. In addition, our trade secrets may otherwise become known or be independently discovered by competitors. To the extent that our

consultants, contractors or collaborators use intellectual property owned by others in their work for us, disputes may arise as to the rights in related or resulting know-how and inventions.

License agreements

Inserm-Transfert

In May 2009, we entered into an exclusive license with Inserm-Transfert, which is a wholly-owned subsidiary of Institut national de la santé et de la recherche médicale, for use of certain patents and know-how related to the ABCD1 gene and corresponding protein, for use in the field of human ALD therapy. This agreement was amended once in 2012 and again in 2013. Inserm-Transfert is referred to herein as Inserm. The Inserm licensed patent portfolio includes at least three U.S. and foreign patents and patent applications. This portfolio has no pending applications. Inserm retains the right to practice the intellectual property licensed under the agreement for educational, clinical and preclinical studies purposes.

Upon commercialization of our products covered by the in-licensed intellectual property, which we expect would include our Lenti-D product candidate, we will be obligated to pay Inserm a percentage of net sales as a royalty for the longer of the life of any patents covering the product or 10 years from first commercial sale. This royalty is in the low single digits. The royalties payable to Inserm are subject to reduction for any third party payments required to be made, with a minimum floor in the low single digits.

We are required to use all commercially reasonable efforts to develop licensed products and introduce them into the commercial market as soon as practical, consistent with our reasonable business practices and judgment in compliance with an agreed upon development plan. We have assumed certain development, regulatory and commercial milestone obligations and must report on our progress in achieving these milestones on an annual basis.

We may unilaterally terminate the license agreement at any time. Either party may terminate the agreement in the event of the other party's material breach which remains uncured after 60 days of receiving written notice of such breach or in the event the other party become subject of a voluntary or involuntary petition in bankruptcy and such petition is not dismissed with prejudice within 120 days after filing. In addition, Inserm may terminate the license agreement in the event that we cannot prove within 60 days of written notice from Inserm that we have been diligent in developing the licensed products and introducing them into the commercial market.

Absent early termination, the agreement will automatically terminate upon the expiration of all issued patents and filed patent applications within the patent rights covered by the agreement or 10 years from the date of first commercial sale of a licensed product, whichever is later. The license grant ceases in connection with any such termination. The longest lived patent rights licensed to us under the agreement are currently expected to expire in 2016.

Institut Pasteur

In September 2011, we entered into a license with Institut Pasteur for certain patents relating to the use of DNA sequences, lentiviral vectors and recombinant cells in the field of *ex vivo* gene therapy in a range of indications. This agreement was amended twice in 2012. The Institut Pasteur licensed patent portfolio includes at least 23 U.S. and foreign patents and patent

applications. Any patents within this portfolio that have issued or may yet issue would have a statutory expiration date in 2019 and 2020. The license is exclusive for products containing human (HIV-1 and HIV-2) lentiviral vector and non-exclusive for products containing non-human lentiviral vector. Institut Pasteur retains the right, on behalf of itself, its licensees and research partners, to conduct research using the licensed intellectual property.

We have the right to grant sublicenses outright to third parties under the agreement. If we receive any income (cash or non-cash) in connection with such sublicenses we must pay Institut Pasteur a percentage of such income varying from low single digits to lower to mid double digits depending on the nature of the sublicense.

Upon commercialization of our products covered by the in-licensed intellectual property, which we expect would include our Lenti-D and LentiGlobin product candidates, we will be obligated to pay Institut Pasteur a percentage of net sales as a royalty. This royalty varies depending on the indication of the product but in any event is in the low single digits. In addition, starting in 2016 we must make under this agreement an annual maintenance payment which is creditable against royalty payments on a year-by-year basis. If the combined royalties we would be required to pay to Institut Pasteur and third parties is higher than a pre-specified percentage, we may ask Institut Pasteur to re-negotiate our royalty rates under this relationship.

We are required to use all reasonable commercial efforts (as compared to a company of similar size and scope) to develop and commercialize one or more products in the license field and to obtain any necessary governmental approvals in respect of, and market the products in license field, if any. Additionally, we have assumed certain development and regulatory milestone obligations. We must report on our progress towards achieving these milestones on an annual basis.

We may unilaterally terminate the license agreement at any time by sending Institut Pasteur 90 day prior written notice. Either party may terminate the license in the event of the other party's substantial breach which remains uncured after 60 days of receiving written notice of such breach. Institut Pasteur may also terminate the agreement in the event bankruptcy proceedings are opened against us and not dismissed within 60 days.

Absent early termination, the agreement will automatically terminate upon the expiration of the last licensed patents. In the event the agreement is terminated, while the license grant would cease, we would retain the right to manufacture, import, use and sell licensed products for a certain period of time post-termination. In addition, our ownership stake in certain jointly made improvements covered by the licensed patents would survive termination of the agreement. The longest lived patent rights licensed to us under the agreement are currently expected to expire in 2023.

Stanford University

In July 2002, we entered into a non-exclusive license agreement with the Board of Trustees of the Leland Stanford Junior University, referred to herein as Stanford, which we amended and restated in April 2012. Under this agreement, we are granted a license to use the HEK293T cell line for any commercial or non-commercial use for research, non clinical and clinical development purpose and human and animal gene therapy products.

We have the right to grant sublicenses outright to third parties under the agreement. For each such sublicense we grant, we must pay Stanford a fee (unless the sublicense is to a collaborating partner, contract manufacturer or contract research organization).

Upon commercialization of our products covered by the in-licensed intellectual property, which we expect would include our Lenti-D product candidate, we will be obligated to pay Stanford a percentage of net sales as a royalty. This royalty varies with net sales but in any event is in the low single digits and is reduced for each third-party license that requires payments by us with respect to a licensed product, provided that the royalty to Stanford is not less than a specified percentage which is less than one percent. Beginning in April 2013, we will pay Stanford an annual maintenance fee, which will be creditable against our royalty payments.

We may unilaterally terminate the agreement by giving Stanford 30 days' written notice. Stanford may also terminate the license agreement if after 30 days of providing notice we are delinquent on any report or payment, are not using commercially reasonable efforts to develop, manufacture and/or commercialize one or more licensed products, are in material breach of any provision or provide any false report. Termination of this agreement may require us to utilize different cell types for vector manufacturing, which could lead to delays.

Absent early termination, the license will expire in April 2037. We may elect to extend the term for an additional 25 years so long as we have a commercial product on the market at that time and we are in material compliance with the license agreement.

Massachusetts Institute of Technology

In December 1996, we entered into an exclusive license with the Massachusetts Institute of Technology, referred to herein as MIT, for use of certain patents in any field. This license agreement was amended in December 2003, May 2004 and June 2011. The licensed patent portfolio includes at least 26 U.S. and foreign patents and patent applications. Any patents within this portfolio that have issued or may yet issue would have a statutory expiration date in 2023. This license also has been amended to include a case jointly owned by MIT and us wherein we received the exclusive license to MIT's rights in this case. MIT retains the right to practice the intellectual property licensed under the agreement for noncommercial research purposes.

We have the right to grant sublicenses outright to third parties under the agreement. In the event we sublicense the patent rights, we must pay MIT a percentage of all payments we receive from by the sublicensee. This percentage varies from mid-single digits to low double digits.

Upon commercialization of our products covered by the in-licensed intellectual property, which we expect would include our LentiGlobin product candidate, we will be obligated to pay MIT a percentage of net sales by us or our sublicensees as a royalty. This royalty is in the low single digits and is reduced for royalties payable to third parties, provided that the royalty to MIT is not less than a specified percentage that is less than one-percent. In addition, we make under this agreement an annual maintenance payment which may be credited against the royalty payments.

We are required to use diligent efforts to market licensed products and to continue active, diligent development and marketing efforts for licensed products during the term of the agreement. We have assumed certain milestones with respect to raising capital investment and regulatory progress. We must report on our progress on achieving these milestones on an annual basis.

We may unilaterally terminate the license agreement upon six months' notice to MIT. MIT may terminate the agreement if we cease to carry on our business, or in the event of our material breach which remains uncured after 90 days of receiving written notice of such breach (30 days in the case of nonpayment). In the event the agreement is terminated, while the license grant would cease, we would retain a right to complete manufacture of any licensed products in process and sell then-existing inventory. In addition, MIT would grant our sublicensees a direct license following such termination. With respect to jointly owned intellectual property, any termination would allow MIT to grant licenses to any third party to such intellectual property, without our approval, unless a sublicensee was already in place, in which case, MIT would grant our sublicensees a direct license.

Research Development Foundation

In December 2011, we entered into an exclusive license with RDF to use certain patents that involve lentiviral vectors. The RDF licensed patent portfolio includes at least 14 U.S. and foreign patents and patent applications. Any patents within this portfolio that have issued or may yet issue would have an expected statutory expiration date of 2021 or 2022. RDF retains the right, on behalf of itself and other nonprofit academic research institutions, to practice and use the licensed patents for any academic, non-clinical research and educational purposes. We have the right to grant sublicenses outright to third parties under the agreement.

Upon commercialization of our products covered by the in-licensed intellectual property, which we expect would include both our Lenti-D and LentiGlobin product candidates, we are obligated to pay RDF a percentage of net sales as a royalty. This royalty is in the low single digits and is reduced by half if during the following ten years from the first marketing approval the last valid claim within the licensed patent that covers the licensed product expires or ends.

We are required to use commercially reasonable and diligent efforts for a company of our size and resources to develop or commercialize one or more licensed products, including our first licensed product by 2016 and a second licensed product by 2018. These diligence efforts include minimum annual royalty payments to RDF, which are creditable against earned royalties otherwise due to RDF, and payments upon regulatory milestones.

RDF may terminate the agreement in the event of our material breach which remains uncured after 90 days of receiving written notice of such breach (30 days in the case of nonpayment) or in the event we become bankrupt, our business or assets or property are placed in the hands of a receiver, assignee or trustee, we institute or suffer to be instituted any procedure in bankruptcy court for reorganization or rearrangement of our financial affairs, make a general assignment for the benefit of creditors, or if we or an affiliate or a sublicensee institutes any procedure challenging the validity or patentability of any patent or patent application within the licensed patents, the agreement will immediately terminate.

Absent early termination, the agreement will continue until its expiration upon the later of there being no more valid claims within the licensed patents or the expiration of our royalty obligations on licensed products that are subject to an earned royalty, if such earned royalty is based on the minimum 10-year royalty period described above. In the event the agreement is terminated, while the license grant would cease, RDF will grant our sublicensees a direct license. The longest lived patent rights licensed to us under the agreement are in one U.S. patent currently expected to expire in 2025.

Competition

The biotechnology and pharmaceutical industries are characterized by intense and rapidly changing competition to develop new technologies and proprietary products. While we believe that our proprietary asset estate and scientific expertise in the gene therapy field provide us with competitive advantages, we face potential competition from many different sources, including larger and better-funded pharmaceutical companies. Not only must we compete with other companies that are focused on gene therapy products but any products that we may commercialize will have to compete with existing therapies and new therapies that may become available in the future.

There are other organizations working to improve existing therapies or to develop new therapies for our initially selected indications. Depending on how successful these efforts are, it is possible they may increase the barriers to adoption and success for our Lenti-D and LentiGlobin product candidates, if approved. These efforts include the following:

- **CCALD:** The current standard of care for the treatment of CCALD is allogeneic HSCT. We understand that various academic centers around the world are seeking to develop improvements to allogeneic HSCT. In addition, some physicians recommend glyceryl trierucate—better known as Lorenzo's Oil—to patients diagnosed with ALD or AMN. However, Lorenzo's Oil has not been clinically proven to address the cerebral symptoms of ALD, and has not been approved by any major regulatory agency as a prescription drug. There are efforts underway to obtain FDA approval for Lorenzo's Oil as a prescription drug. We are also aware of some early-stage, preclinical efforts in academic centers to investigate the use of anti-oxidants for patients with AMN.
- **ß-thalassemia:** The current standard of care for the treatment of ß-thalassemia in the developed world is chronic blood transfusions to address the patient's anemia. In addition, such patients often receive iron chelation therapy to help manage the iron overload associated with their chronic blood transfusions. We understand that established biopharmaceutical companies, such as Novartis AG and ApoPharma Inc., who provide the leading iron chelation therapy, are seeking to develop improvements to their product profile and accessibility. In addition, some patients with ß-thalassemia receive HCST treatment, particularly if a sufficiently well-matched source of donor cells is identified. We understand that various academic centers around the world are seeking to develop improvements to allogeneic HSCT. A number of different approaches are under investigation to improve treatment options, including iron modulating agents and fetal hemoglobin regulators. There are also several different groups developing gene therapy approaches for ß-thalassemia. Some of these groups use a similar *ex vivo* autologous approach, but make use of different vectors and different cell processing techniques. These include: Memorial Sloan Kettering, which received approval for its IND in 2012, and is actively recruiting for a Phase I/II gene therapy study; GlaxoSmithKline Plc, which has entered into an agreement with the San Raffaele Telethon Institute for Gene Therapy to advance several gene therapy programs, including one for ß-thalassemia, although to our knowledge no clinical studies have been initiated; and Sangamo BioSciences Inc., which has announced plans to investigate the use of zinc finger nuclease-mediated gene-correction techniques in hemoglobinopathies including ß-thalassemia, although to our knowledge no clinical studies have been initiated.

- **Sickle cell disease:** The current standard of care for the treatment of SCD in the developed world is chronic blood transfusions or hydroxyurea (a generic drug). In addition, such patients often receive iron chelation therapy to help manage the iron overload associated with chronic blood transfusions. We are aware of ongoing studies that continue to evaluate the efficacy and safety of hydroxyurea in various populations, and it can be assumed that the data from these studies will influence future utilization of this therapeutic modality. In addition, some patients with SCD receive allogeneic HSCT treatment, particularly if a sufficiently well-matched source of donor cells is identified. We understand that various academic centers around the world are seeking to develop improvements to allogeneic HSCT. There is also considerable interest from academic centers and biopharmaceutical companies to develop new therapies for SCD. A number of different approaches are under investigation, targeting the various aspects of SCD pathophysiology, including: fetal hemoglobin regulators, including HQK-1001 in Phase II studies supported by HemaQuest Pharmaceuticals Inc., and Vorinostat in Phase II studies supported by Merck & Co.; and pan-selectin inhibitors, including GMI-1070 in Phase II studies supported by GlycoMimetics Inc. (in 2011, Pfizer Inc. and GlycoMimetics Inc. entered a global collaboration to advance this compound). There are also several different groups developing gene therapy approaches for SCD. Some of these groups use a similar *ex vivo* autologous approach, but make use of different vectors and different cell processing techniques. These include: UCLA, which has received funding from the California Institute of Regenerative Medicine to pursue a Phase I/II gene therapy study for SCD, although to our knowledge no clinical studies have been initiated and Sangamo BioSciences Inc., which has announced plans to investigate the use of zinc finger nuclease-mediated gene-correction techniques in hemoglobinopathies including SCD, although to our knowledge no clinical studies have been initiated.

Many of our competitors, either alone or with their strategic partners, have substantially greater financial, technical and human resources than we do and significantly greater experience in the discovery and development of product candidates, obtaining FDA and other regulatory approvals of treatments and the commercialization of those treatments. Accordingly, our competitors may be more successful than us in obtaining approval for treatments and achieving widespread market acceptance. Our competitors' treatments may be more effective, or more effectively marketed and sold, than any treatment we may commercialize and may render our treatments obsolete or non-competitive before we can recover the expenses of developing and commercializing any of our treatments.

Mergers and acquisitions in the biotechnology and pharmaceutical industries may result in even more resources being concentrated among a smaller number of our competitors. These competitors also compete with us in recruiting and retaining qualified scientific and management personnel and establishing clinical study sites and patient registration for clinical studies, as well as in acquiring technologies complementary to, or necessary for, our programs. Smaller or early-stage companies may also prove to be significant competitors, particularly through collaborative arrangements with large and established companies.

We anticipate that we will face intense and increasing competition as new drugs enter the market and advanced technologies become available. We expect any treatments that we develop and commercialize to compete on the basis of, among other things, efficacy, safety, convenience of administration and delivery, price, the level of generic competition and the availability of reimbursement from government and other third-party payors.

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. In addition, our ability to compete may be affected in many cases by insurers or other third-party payors seeking to encourage the use of generic products. If our therapeutic product candidates are approved, we expect that they will be priced at a significant premium over competitive generic products.

Government regulation

Biological products, including gene therapy products, are subject to regulation under the Federal Food, Drug, and Cosmetic Act, or FD&C Act, and the Public Health Service Act, or PHS Act, and other federal, state, local and foreign statutes and regulations. Both the FD&C Act and the PHS Act and their corresponding regulations govern, among other things, the testing, manufacturing, safety, efficacy, labeling, packaging, storage, record keeping, distribution, reporting, advertising and other promotional practices involving biological products. FDA approval must be obtained before clinical testing of biological products, and each clinical study protocol for a gene therapy product is reviewed by the FDA and, in some instances, the NIH, through its RAC. FDA approval also must be obtained before marketing of biological products. The process of obtaining regulatory approvals and the subsequent compliance with appropriate federal, state, local and foreign statutes and regulations require the expenditure of substantial time and financial resources and we may not be able to obtain the required regulatory approvals.

Within the FDA, the CBER regulates gene therapy products. The CBER works closely with the NIH and its RAC, which makes recommendations to the NIH on gene therapy issues and engages in a public discussion of scientific, safety, ethical and societal issues related to proposed and ongoing gene therapy protocols. The FDA and the NIH have published guidance documents with respect to the development and submission of gene therapy protocols. The FDA also has published guidance documents related to, among other things, gene therapy products in general, their preclinical assessment, observing subjects involved in gene therapy studies for delayed adverse events, potency testing, and chemistry, manufacturing and control information in gene therapy INDs.

Ethical, social and legal concerns about gene therapy, genetic testing and genetic research could result in additional regulations restricting or prohibiting the processes we may use. Federal and state agencies, congressional committees and foreign governments have expressed interest in further regulating biotechnology. More restrictive regulations or claims that our products are unsafe or pose a hazard could prevent us from commercializing any products. New government requirements may be established that could delay or prevent regulatory approval of our product candidates under development. It is impossible to predict whether legislative changes will be enacted, regulations, policies or guidance changed, or interpretations by agencies or courts changed, or what the impact of such changes, if any, may be.

U.S. biological products development process

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

- completion of nonclinical laboratory tests and animal studies according to good laboratory practices, or GLPs, and applicable requirements for the humane use of laboratory animals or other applicable regulations;
- submission to the FDA of an application for an IND, which must become effective before human clinical studies may begin;
- performance of adequate and well-controlled human clinical studies according to the FDA's regulations commonly referred to as good clinical practices, or GCPs, and any additional requirements for the protection of human research subjects and their health information, to establish the safety and efficacy of the proposed biological product for its intended use;
- submission to the FDA of a Biologics License Application, or BLA, for marketing approval that includes substantive evidence of safety, purity, and potency from results of nonclinical testing and clinical studies;
- satisfactory completion of an FDA inspection of the manufacturing facility or facilities where the biological product is produced to assess compliance with GMP, to assure that the facilities, methods and controls are adequate to preserve the biological product's identity, strength, quality and purity and, if applicable, the FDA's current good tissue practices, or GTPs, for the use of human cellular and tissue products;
- potential FDA audit of the nonclinical and clinical study sites that generated the data in support of the BLA; and
- FDA review and approval, or licensure, of the BLA.

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

Where a gene therapy study is conducted at, or sponsored by, institutions receiving NIH funding for recombinant DNA research, prior to the submission of an IND to the FDA, a protocol and related documentation is submitted to and the study is registered with the NIH Office of Biotechnology Activities, or OBA, pursuant to the NIH Guidelines for Research Involving Recombinant DNA Molecules, or NIH Guidelines. Compliance with the NIH Guidelines is mandatory for investigators at institutions receiving NIH funds for research involving recombinant DNA, however many companies and other institutions not otherwise subject to the NIH Guidelines voluntarily follow them. The NIH is responsible for convening the RAC, a federal advisory committee, that discusses protocols that raise novel or particularly important scientific, safety or ethical considerations at one of its quarterly public meetings. The OBA will notify the FDA of the RAC's decision regarding the necessity for full public review of a gene therapy protocol. RAC proceedings and reports are posted to the OBA web site and may be accessed by the public.

The clinical study sponsor must submit the results of the preclinical tests, together with manufacturing information, analytical data, any available clinical data or literature and a proposed clinical protocol, to the FDA as part of the IND. Some preclinical testing may continue even after the IND is submitted. The IND automatically becomes effective 30 days after receipt by the FDA, unless the FDA places the clinical study on a clinical hold within that 30-day time period. In such a case, the IND sponsor and the FDA must resolve any outstanding concerns before the clinical study can begin. With gene therapy protocols, if the FDA allows the IND to proceed, but the RAC decides that full public review of the protocol is warranted, the FDA will request at the completion of its IND review that sponsors delay initiation of the protocol until after completion of the RAC review process. The FDA may also impose clinical holds on a biological product candidate at any time before or during clinical studies due to safety concerns or non-compliance. If the FDA imposes a clinical hold, studies may not recommence without FDA authorization and then only under terms authorized by the FDA. Accordingly, we cannot be sure that submission of an IND will result in the FDA allowing clinical studies to begin, or that, once begun, issues will not arise that suspend or terminate such studies.

Clinical studies involve the administration of the biological product candidate to healthy volunteers or patients under the supervision of qualified investigators, generally physicians not employed by or under the study sponsor's control. Clinical studies are conducted under protocols detailing, among other things, the objectives of the clinical study, dosing procedures, subject selection and exclusion criteria, and the parameters to be used to monitor subject safety, including stopping rules that assure a clinical study will be stopped if certain adverse events should occur. Each protocol and any amendments to the protocol must be submitted to the FDA as part of the IND. Clinical studies must be conducted and monitored in accordance with the FDA's regulations comprising the GCP requirements, including the requirement that all research subjects provide informed consent. Further, each clinical study must be reviewed and approved by an independent institutional review board, or IRB, at or servicing each institution at which the clinical study will be conducted. An IRB is charged with protecting the welfare and rights of study participants and considers such items as whether the risks to individuals participating in the clinical studies are minimized and are reasonable in relation to anticipated benefits. The IRB also approves the form and content of the informed consent that must be signed by each clinical study subject or his or her legal representative and must monitor the clinical study until completed. Clinical studies also must be reviewed by an institutional biosafety committee, or IBC, a local institutional committee that reviews and oversees basic and clinical research conducted at that institution. The IBC assesses the safety of the research and identifies any potential risk to public health or the environment.

Human clinical studies are typically conducted in three sequential phases that may overlap or be combined:

- *Phase I*. The biological product is initially introduced into healthy human subjects and tested for safety. In the case of some products for severe or life-threatening diseases, especially when the product may be too inherently toxic to ethically administer to healthy volunteers, the initial human testing is often conducted in patients.
- *Phase II*. The biological product is evaluated in a limited patient population to identify possible adverse effects and safety risks, to preliminarily evaluate the efficacy of the product for specific targeted diseases and to determine dosage tolerance, optimal dosage and dosing schedule.

- *Phase III*. Clinical studies are undertaken to further evaluate dosage, clinical efficacy, potency, and safety in an expanded patient population at geographically dispersed clinical study sites. These clinical studies are intended to establish the overall risk/benefit ratio of the product and provide an adequate basis for product labeling.

Post-approval clinical studies, sometimes referred to as Phase IV clinical studies, may be conducted after initial marketing approval. These clinical studies are used to gain additional experience from the treatment of patients in the intended therapeutic indication, particularly for long-term safety follow-up. The FDA recommends that sponsors observe subjects for potential gene therapy-related delayed adverse events for a 15-year period, including a minimum of five years of annual examinations followed by ten years of annual queries, either in person or by questionnaire, of study subjects.

During all phases of clinical development, regulatory agencies require extensive monitoring and auditing of all clinical activities, clinical data, and clinical study investigators. Annual progress reports detailing the results of the clinical studies must be submitted to the FDA. Written IND safety reports must be promptly submitted to the FDA, the NIH and the investigators for serious and unexpected adverse events, any findings from other studies, tests in laboratory animals or in vitro testing that suggest a significant risk for human subjects, or any clinically important increase in the rate of a serious suspected adverse reaction over that listed in the protocol or investigator brochure. The sponsor must submit an IND safety report within 15 calendar days after the sponsor determines that the information qualifies for reporting. The sponsor also must notify the FDA of any unexpected fatal or life-threatening suspected adverse reaction within seven calendar days after the sponsor's initial receipt of the information. Phase I, Phase II and Phase III clinical studies may not be completed successfully within any specified period, if at all. The FDA or the sponsor or its data safety monitoring board may suspend a clinical study at any time on various grounds, including a finding that the research subjects or patients are being exposed to an unacceptable health risk. Similarly, an IRB can suspend or terminate approval of a clinical study at its institution if the clinical study is not being conducted in accordance with the IRB's requirements or if the biological product has been associated with unexpected serious harm to patients.

Human gene therapy products are a new category of therapeutics. Because this is a relatively new and expanding area of novel therapeutic interventions, there can be no assurance as to the length of the study period, the number of patients the FDA will require to be enrolled in the studies in order to establish the safety, efficacy, purity and potency of human gene therapy products, or that the data generated in these studies will be acceptable to the FDA to support marketing approval. The NIH and the FDA have a publicly accessible database, the Genetic Modification Clinical Research Information System which includes information on gene transfer studies and serves as an electronic tool to facilitate the reporting and analysis of adverse events on these studies.

Concurrent with clinical studies, companies usually complete additional animal studies and must also develop additional information about the physical characteristics of the biological product as well as finalize a process for manufacturing the product in commercial quantities in accordance with GMP requirements. To help reduce the risk of the introduction of adventitious agents with use of biological products, the PHS Act emphasizes the importance of manufacturing control for products whose attributes cannot be precisely defined. The manufacturing process must be capable of consistently producing quality batches of the product candidate and, among other things, the sponsor must develop methods for testing the identity, strength, quality,

potency and purity of the final biological product. Additionally, appropriate packaging must be selected and tested and stability studies must be conducted to demonstrate that the biological product candidate does not undergo unacceptable deterioration over its shelf life.

U.S. review and approval processes

After the completion of clinical studies of a biological product, FDA approval of a BLA, must be obtained before commercial marketing of the biological product. The BLA must include results of product development, laboratory and animal studies, human studies, information on the manufacture and composition of the product, proposed labeling and other relevant information. In addition, under the Pediatric Research Equity Act, or PREA, a BLA or supplement to a BLA must contain data to assess the safety and effectiveness of the biological product for the claimed indications in all relevant pediatric subpopulations and to support dosing and administration for each pediatric subpopulation for which the product is safe and effective. The FDA may grant deferrals for submission of data or full or partial waivers. Unless otherwise required by regulation, PREA does not apply to any biological product for an indication for which orphan designation has been granted. The testing and approval processes require substantial time and effort and there can be no assurance that the FDA will accept the BLA for filing and, even if filed, that any approval will be granted on a timely basis, if at all.

Under the Prescription Drug User Fee Act, or PDUFA, as amended, each BLA must be accompanied by a user fee. The FDA adjusts the PDUFA user fees on an annual basis. According to the FDA's fee schedule, effective through September 30, 2013, the user fee for an application requiring clinical data, such as a BLA, is $1,958,800. PDUFA also imposes an annual product fee for biologics ($98,380) and an annual establishment fee ($526,500) on facilities used to manufacture prescription biologics. Fee waivers or reductions are available in certain circumstances, including a waiver of the application fee for the first application filed by a small business. Additionally, no user fees are assessed on BLAs for products designated as orphan drugs, unless the product also includes a non-orphan indication.

Within 60 days following submission of the application, the FDA reviews a BLA submitted to determine if it is substantially complete before the agency accepts it for filing. The FDA may refuse to file any BLA that it deems incomplete or not properly reviewable at the time of submission and may request additional information. In this event, the BLA must be resubmitted with the additional information. The resubmitted application also is subject to review before the FDA accepts it for filing. Once the submission is accepted for filing, the FDA begins an in-depth substantive review of the BLA. The FDA reviews the BLA to determine, among other things, whether the proposed product is safe and potent, or effective, for its intended use, and has an acceptable purity profile, and whether the product is being manufactured in accordance with GMP to assure and preserve the product's identity, safety, strength, quality, potency and purity. The FDA may refer applications for novel biological products or biological products that present difficult questions of safety or efficacy to an advisory committee, typically a panel that includes clinicians and other experts, for review, evaluation and a recommendation as to whether the application should be approved and under what conditions. The FDA is not bound by the recommendations of an advisory committee, but it considers such recommendations carefully when making decisions. During the biological product approval process, the FDA also will determine whether a Risk Evaluation and Mitigation Strategy, or REMS, is necessary to assure the safe use of the biological product. If the FDA concludes a REMS is needed, the sponsor of the BLA must submit a proposed REMS; the FDA will not approve the BLA without a REMS, if required.

Before approving a BLA, the FDA will inspect the facilities at which the product is manufactured. The FDA will not approve the product unless it determines that the manufacturing processes and facilities are in compliance with GMP requirements and adequate to assure consistent production of the product within required specifications. For a gene therapy product, the FDA also will not approve the product if the manufacturer is not in compliance with the GTPs. These are FDA regulations that govern the methods used in, and the facilities and controls used for, the manufacture of human cells, tissues, and cellular and tissue based products, or HCT/Ps, which are human cells or tissue intended for implantation, transplant, infusion, or transfer into a human recipient. The primary intent of the GTP requirements is to ensure that cell and tissue based products are manufactured in a manner designed to prevent the introduction, transmission and spread of communicable disease. FDA regulations also require tissue establishments to register and list their HCT/Ps with the FDA and, when applicable, to evaluate donors through screening and testing. Additionally, before approving a BLA, the FDA will typically inspect one or more clinical sites to assure that the clinical studies were conducted in compliance with IND study requirements and GCP requirements. To assure GMP, GTP and GCP compliance, an applicant must incur significant expenditure of time, money and effort in the areas of training, record keeping, production, and quality control.

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

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

One of the performance goals agreed to by the FDA under the PDUFA is to review 90% of standard BLAs in 10 months and 90% of priority BLAs in six months, whereupon a review decision is to be made. The FDA does not always meet its PDUFA goal dates for standard and priority BLAs and its review goals are subject to change from time to time. The review process and the PDUFA goal date may be extended by three months if the FDA requests or the BLA sponsor otherwise provides additional information or clarification regarding information already provided in the submission within the last three months before the PDUFA goal date.

Orphan drug designation

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

If a product that has orphan designation subsequently receives the first FDA approval for the disease or condition for which it has such designation, the product is entitled to orphan product exclusivity, which means that the FDA may not approve any other applications to market the same drug or biological product for the same indication for seven years, except in limited circumstances, such as a showing of clinical superiority to the product with orphan exclusivity. Competitors, however, may receive approval of different products for the indication for which the orphan product has exclusivity or obtain approval for the same product but for a different indication for which the orphan product has exclusivity. Orphan product exclusivity also could block the approval of one of our products for seven years if a competitor obtains approval of the same biological product as defined by the FDA or if our product candidate is determined to be contained within the competitor's product for the same indication or disease. If a drug or biological product designated as an orphan product receives marketing approval for an indication broader than what is designated, it may not be entitled to orphan product exclusivity. Orphan drug status in the European Union has similar, but not identical, benefits.

Expedited development and review programs

The FDA has a Fast Track program that is intended to expedite or facilitate the process for reviewing new drugs and biological products that meet certain criteria. Specifically, new drugs and biological products are eligible for Fast Track designation if they are intended to treat a serious or life-threatening condition and demonstrate the potential to address unmet medical needs for the condition. Fast Track designation applies to the combination of the product and the specific indication for which it is being studied. The sponsor of a new drug or biologic may request the FDA to designate the drug or biologic as a Fast Track product at any time during the clinical development of the product. Unique to a Fast Track product, the FDA may consider for review sections of the marketing application on a rolling basis before the complete application is submitted, if the sponsor provides a schedule for the submission of the sections of the application, the FDA agrees to accept sections of the application and determines that the schedule is acceptable, and the sponsor pays any required user fees upon submission of the first section of the application.

Any product submitted to the FDA for marketing, including under a Fast Track program, may be eligible for other types of FDA programs intended to expedite development and review, such as priority review and accelerated approval. Any product is eligible for priority review if it has the potential to provide safe and effective therapy where no satisfactory alternative therapy exists or a significant improvement in the treatment, diagnosis or prevention of a disease compared to marketed products. The FDA will attempt to direct additional resources to the evaluation of an

application for a new drug or biological product designated for priority review in an effort to facilitate the review. Additionally, a product may be eligible for accelerated approval. Drug or biological products studied for their safety and effectiveness in treating serious or life-threatening illnesses and that provide meaningful therapeutic benefit over existing treatments may receive accelerated approval, which means that they may be approved on the basis of adequate and well-controlled clinical studies establishing that the product has an effect on a surrogate endpoint that is reasonably likely to predict a clinical benefit, or on the basis of an effect on a clinical endpoint other than survival or irreversible morbidity. As a condition of approval, the FDA may require that a sponsor of a drug or biological product receiving accelerated approval perform adequate and well-controlled post-marketing clinical studies. 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. Fast Track designation, priority review and accelerated approval do not change the standards for approval but may expedite the development or approval process.

Post-approval requirements

Maintaining substantial compliance with applicable federal, state, and local statutes and regulations requires the expenditure of substantial time and financial resources. Rigorous and extensive FDA regulation of biological products continues after approval, particularly with respect to GMP. We will rely, and expect to continue to rely, on third parties for the production of clinical and commercial quantities of any products that we may commercialize. Manufacturers of our products are required to comply with applicable requirements in the GMP regulations, including quality control and quality assurance and maintenance of records and documentation. Other post-approval requirements applicable to biological products, include reporting of GMP deviations that may affect the identity, potency, purity and overall safety of a distributed product, record-keeping requirements, reporting of adverse effects, reporting updated safety and efficacy information, and complying with electronic record and signature requirements. After a BLA is approved, the product also may be subject to official lot release. As part of the manufacturing process, the manufacturer is required to perform certain tests on each lot of the product before it is released for distribution. If the product is subject to official release by the FDA, the manufacturer submits samples of each lot of product to the FDA together with a release protocol showing a summary of the history of manufacture of the lot and the results of all of the manufacturer's tests performed on the lot. The FDA also may perform certain confirmatory tests on lots of some products, such as viral vaccines, before releasing the lots for distribution by the manufacturer. In addition, the FDA conducts laboratory research related to the regulatory standards on the safety, purity, potency, and effectiveness of biological products.

We also must comply with the FDA's advertising and promotion requirements, such as those related to direct-to-consumer advertising, the prohibition on promoting products for uses or in patient populations that are not described in the product's approved labeling (known as "off-label use"), industry-sponsored scientific and educational activities, and promotional activities involving the internet. Discovery of previously unknown problems or the failure to comply with the applicable regulatory requirements may result in restrictions on the marketing of a product or withdrawal of the product from the market as well as possible civil or criminal sanctions. Failure to comply with the applicable U.S. requirements at any time during the product development process, approval process or after approval, may subject an applicant or manufacturer to administrative or judicial civil or criminal sanctions and adverse publicity. FDA sanctions could include refusal to approve pending applications, withdrawal of an approval,

clinical hold, warning or untitled letters, product recalls, product seizures, total or partial suspension of production or distribution, injunctions, fines, refusals of government contracts, mandated corrective advertising or communications with doctors, debarment, restitution, disgorgement of profits, or civil or criminal penalties. Any agency or judicial enforcement action could have a material adverse effect on us.

Biological product manufacturers and other entities involved in the manufacture and distribution of approved biological products are required to register their establishments with the FDA and certain state agencies, and are subject to periodic unannounced inspections by the FDA and certain state agencies for compliance with GMPs and other laws. Accordingly, manufacturers must continue to expend time, money, and effort in the area of production and quality control to maintain GMP compliance. Discovery of problems with a product after approval may result in restrictions on a product, manufacturer, or holder of an approved BLA, including withdrawal of the product from the market. In addition, changes to the manufacturing process or facility generally require prior FDA approval before being implemented and other types of changes to the approved product, such as adding new indications and additional labeling claims, are also subject to further FDA review and approval.

U.S. patent term restoration and marketing exclusivity

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

A biological product can obtain pediatric market exclusivity in the United States. Pediatric exclusivity, if granted, adds six months to existing exclusivity periods and patent terms. This six-month exclusivity, which runs from the end of other exclusivity protection or patent term, may be granted based on the voluntary completion of a pediatric study in accordance with an FDA-issued "Written Request" for such a study.

The Patient Protection and Affordable Care Act, or Affordable Care Act, signed into law on March 23, 2010, includes a subtitle called the Biologics Price Competition and Innovation Act of 2009 which created an abbreviated approval pathway for biological products shown to be similar to, or interchangeable with, an FDA-licensed reference biological product. This amendment to the PHS Act attempts to minimize duplicative testing. 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 and, for products administered multiple times, the biologic and the reference biologic may be switched after one has been previously administered without increasing safety risks or risks of diminished efficacy relative to exclusive use of the reference biologic. However, complexities associated with the larger, and often more complex, structure of biological products, as well as the process by which such products are manufactured, pose significant hurdles to implementation that are still being worked out by the FDA.

A reference biologic is granted twelve years of exclusivity from the time of first licensure of the reference product. On April 10, 2013, President Obama released his proposed budget for fiscal year 2014 and proposed to cut this twelve-year period of exclusivity down to seven years. He also proposed to prohibit additional periods of exclusivity for brand biologics due to minor changes in product formulations, a practice often referred to as “evergreening.” The first biologic product submitted under the abbreviated approval pathway that is determined to be interchangeable with the reference product has exclusivity against other biologics submitting under the abbreviated approval pathway for the lesser of (i) one year after the first commercial marketing, (ii) 18 months after approval if there is no legal challenge, (iii) 18 months after the resolution in the applicant’s favor of a lawsuit challenging the biologics’ patents if an application has been submitted, or (iv) 42 months after the application has been approved if a lawsuit is ongoing within the 42-month period.

Additional regulation

In addition to the foregoing, state and federal laws regarding environmental protection and hazardous substances, including the Occupational Safety and Health Act, the Resource Conservancy and Recovery Act and the Toxic Substances Control Act, affect our business. These and other laws govern our use, handling and disposal of various biological, chemical and radioactive substances used in, and wastes generated by, our operations. If our operations result in contamination of the environment or expose individuals to hazardous substances, we could be liable for damages and governmental fines. We believe that we are in material compliance with applicable environmental laws and that continued compliance therewith will not have a material adverse effect on our business. We cannot predict, however, how changes in these laws may affect our future operations.

U.S. Foreign Corrupt Practices Act

The U.S. Foreign Corrupt Practices Act, to which we are subject, prohibits corporations and individuals from engaging in certain activities to obtain or retain business or to influence a person working in an official capacity. It is illegal to pay, offer to pay or authorize the payment of anything of value to any foreign government official, government staff member, political party or political candidate in an attempt to obtain or retain business or to otherwise influence a person working in an official capacity.

Government regulation outside of the United States

In addition to regulations in the United States, we will be subject to a variety of regulations in other jurisdictions governing, among other things, clinical studies and any commercial sales and distribution of our products. Because biologically sourced raw materials are subject to unique contamination risks, their use may be restricted in some countries.

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

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

To obtain regulatory approval of an investigational biological product under European Union regulatory systems, we must submit a marketing authorization application. The application used to file the BLA in the United States is similar to that required in the European Union, with the exception of, among other things, country-specific document requirements. The European Union also provides opportunities for market exclusivity. For example, in the European Union, upon receiving marketing authorization, new chemical entities generally receive eight years of data exclusivity and an additional two years of market exclusivity. If granted, data exclusivity prevents regulatory authorities in the European Union from referencing the innovator's data to assess a generic application. During the additional two-year period of market exclusivity, a generic marketing authorization can be submitted, and the innovator's data may be referenced, but no generic product can be marketed until the expiration of the market exclusivity. However, there is no guarantee that a product will be considered by the European Union's regulatory authorities to be a new chemical entity, and products may not qualify for data exclusivity. Products receiving orphan designation in the European Union can receive ten years of market exclusivity, during which time no similar medicinal product for the same indication may be placed on the market. An orphan product can also obtain an additional two years of market exclusivity in the European Union for pediatric studies. No extension to any supplementary protection certificate can be granted on the basis of pediatric studies for orphan indications.

The criteria for designating an "orphan medicinal product" in the European Union are similar in principle to those in the United States. Under Article 3 of Regulation (EC) 141/2000, a medicinal product may be designated as orphan if (1) it is intended for the diagnosis, prevention or treatment of a life-threatening or chronically debilitating condition; (2) either (a) such condition affects no more than five in 10,000 persons in the European Union when the application is made, or (b) the product, without the benefits derived from orphan status, would not generate sufficient return in the European Union to justify investment; and (3) there exists no satisfactory method of diagnosis, prevention or treatment of such condition authorized for marketing in the European Union, or if such a method exists, the product will be of significant benefit to those affected by the condition, as defined in Regulation (EC) 847/2000. Orphan medicinal products are eligible for financial incentives such as reduction of fees or fee waivers and are, upon grant of a marketing authorization, entitled to ten years of market exclusivity for the approved therapeutic indication. The application for orphan drug designation must be submitted before the application for marketing authorization. The applicant will receive a fee reduction for the marketing authorization application if the orphan drug designation has been

granted, but not if the designation is still pending at the time the marketing authorization is submitted. Orphan drug designation does not convey any advantage in, or shorten the duration of, the regulatory review and approval process.

The 10-year market exclusivity may be reduced to six years if, at the end of the fifth year, it is established that the product no longer meets the criteria for orphan designation, for example, if the product is sufficiently profitable not to justify maintenance of market exclusivity. Additionally, marketing authorization may be granted to a similar product for the same indication at any time if:

- The second applicant can establish that its product, although similar, is safer, more effective or otherwise clinically superior;
- The applicant consents to a second orphan medicinal product application; or
- The applicant cannot supply enough orphan medicinal product.

For other countries outside of the European Union, such as countries in Eastern Europe, Latin America or Asia, the requirements governing the conduct of clinical studies, product licensing, pricing and reimbursement vary from country to country. In all cases, again, the clinical studies are conducted in accordance with GCP and the applicable regulatory requirements and the ethical principles that have their origin in the Declaration of Helsinki.

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

Facilities

Our corporate headquarters are located in Cambridge, Massachusetts. Our current leased facility encompasses approximately 17,600 square feet of office and laboratory space. The lease for this facility expires on March 31, 2015, subject to our option to renew for up to one additional three-year term.

On June 3, 2013, we entered into a lease for our new corporate headquarters, which will encompass approximately 43,600 square feet of office, research and development and laboratory space, located at 150 Second Street, Cambridge, Massachusetts. The nine-year lease commences on the earlier of January 1, 2014 and the date on which specified renovations work is substantially complete and we occupy the space. We have the option to extend this lease by an additional five years.

Employees

As of March 31, 2013, we had 50 full-time employees, 13 of whom have Ph.D. or M.D. degrees. Of these full-time employees, 37 employees are engaged in research and development activities and 13 employees are engaged in finance, legal, human resources, facilities and general management. We have no collective bargaining agreements with our employees and we have not experienced any work stoppages. We consider our relations with our employees to be good.

Legal proceedings

From time to time, we are subject to various legal proceedings and claims that arise in the ordinary course of our business activities. Although the results of litigation and claims cannot be predicted with certainty, as of the date of this prospectus, we do not believe we are party to any claim or litigation the outcome of which, if determined adversely to us, would individually or in the aggregate be reasonably expected to have a material adverse effect on our business. Regardless of the outcome, litigation can have an adverse impact on us because of defense and settlement costs, diversion of management resources and other factors.

Management

Executive officers, significant employees and directors

The following table sets forth information regarding our executive officers, significant employees and directors, as of May 31, 2013:

Name	Age	Position(s)
Executive Officers:		
Nick Leschly	40	President, Chief Executive Officer and Director
Jeffrey T. Walsh	47	Chief Operating Officer and Secretary
Mitchell H. Finer, Ph.D.	54	Chief Scientific Officer
David Davidson, M.D.	49	Chief Medical Officer
Linda C. Bain, CPA	42	Vice President, Finance and Business Operations and Treasurer
Significant Employees:		
Mark D. Angelino, Ph.D.	40	Vice President, Pharmaceutical Sciences
Richard E.T. Smith, Ph.D.	42	Vice President, Investor Relations
Faraz Ali	40	Vice President, Head of Program Management and Commercial Development
Cyrus Mozayeni	38	Sr. Director, Business Development
Kathleen Wilkinson	41	Sr. Director, Human Resources
Non-Management Directors:		
Daniel S. Lynch(1)(2)	55	Chairman of the Board
Wendy L. Dixon, Ph.D.(1)	57	Director
Steven Gillis, Ph.D.(1)	60	Director
John M. Maraganore, Ph.D.(2)	50	Director
Geert-Jan Mulder, M.D.(4)	46	Director
Dr. Axel Polack(3)	56	Director
David P. Schenkein, M.D.(3)	56	Director
Robert I. Tepper, M.D.(2)	57	Director

(1) Member of the audit committee.

(2) Member of the compensation committee.

(3) Member of the nominating and corporate governance committee.

(4) Dr. Mulder has indicated to us his intention to resign from our board of directors upon the consummation of this offering.

Nick Leschly has served as our president and chief executive officer since September 2010. Previously, he served as our interim chief executive officer from March 2010 to September 2010. Formerly a partner of Third Rock Ventures, L.P. since its founding in 2007, Mr. Leschly played an

integral role in the overall formation, development and business strategy of several of Third Rock's portfolio companies, including Agios Pharmaceuticals, Inc. and Edimer Pharmaceuticals, Inc. Prior to joining Third Rock, he worked at Millennium Pharmaceuticals, Inc., leading several early-stage drug development programs and served as the product and alliance leader for VELCADE. Mr. Leschly also founded and served as chief executive officer of MedXtend Corporation. He received his B.S. in molecular biology from Princeton University and his M.B.A. from Wharton Business School. We believe that Mr. Leschly's operation and historical experience with our Company gained from serving as our president, chief executive officer and member of the board of directors, combined with his experience in the venture capital industry and drug research and development qualify him to serve as a member of our board of directors.

Jeffrey T. Walsh has served as our chief operating officer since May 2011 and as our secretary since March 2013. Mr. Walsh has 25 years of experience in executive leadership positions with responsibility for finance, business development, commercial and business operations, strategic planning and legal functions with established and emerging public and private life sciences companies. From November 2008 to February 2011, Mr. Walsh served as chief business officer of Taligen Therapeutics, Inc. where he played a key role in the growth of the company and the ultimate sale of Taligen Therapeutics, Inc. to Alexion Pharmaceuticals, Inc. in January 2011. Mr. Walsh started his career at SmithKline Beecham Corporation in finance and worldwide business development roles. He subsequently held senior business development, finance and operations roles at PathoGenesis Corp. (acquired by Chiron Corporation), Allscripts Healthcare Solutions Inc., EXACT Sciences Corporation and Inotek Pharmaceuticals Corp. Mr. Walsh received his B.A. in sociology and economics from Yale University and his M.B.A. from the Kellogg Graduate School of Management at Northwestern University.

Mitchell H. Finer, Ph.D. has served as our chief scientific officer since March 2010. Prior to joining us, Dr. Finer served as senior vice president of development and operations for Novocell, Inc. (now ViaCyte, Inc.), a stem cell engineering company researching treatments for diabetes and other chronic diseases from November 2008 through March 2010. From July 2005 through November 2008, Dr. Finer served as chief executive officer of Intracel Holdings LLC. From June 2003 to June 2005, he held the position of president and chief executive officer of Genteric Inc., or Genteric, which filed a voluntary petition for reorganization under Chapter 11 of the U.S. bankruptcy code in August 2004. Previously, he had served as Genteric's chief scientific officer from November 2002 to June 2003 and as vice president of research and development for the Gencell division of Aventis Pharma (now Sanofi) from April 2002 to November 2002. He was also a founder and vice president of research for Cell Genesys Inc., and a founder of Abgenix, Inc. and Avalanche Biotechnologies, Inc. Dr. Finer received his B.A. in biochemistry and bacteriology from the University of California at Berkeley and his Ph.D. in biochemistry and molecular biology from Harvard University. He completed a postdoctoral fellowship at the Whitehead Institute for Biomedical Research.

David Davidson, M.D. has served as our chief medical officer since February 2012. Prior to joining us, Dr. Davidson served as a senior medical director at Genzyme Corporation, or Genzyme, where he led clinical research for programs in Phases I through IV across a wide range of therapeutic areas for more than a decade. Most recently, Dr. Davidson was the medical leader for Genzyme's gene therapy and Pompe disease enzyme replacement therapy programs. In addition to Dr. Davidson's translational medicine experience, he has also worked on a number of commercial products, including Fabrazyme and Myozyme/Lumizyme, and was integral in crafting the new drug application that resulted in the approval of Welchol. Prior to Genzyme, Dr. Davidson was a medical director at GelTex Pharmaceuticals Inc. Previously, he completed

clinical and research fellowships in infectious diseases at the Harvard Longwood Combined Infectious Diseases Program. Dr. Davidson received his B.A. from Columbia University and his M.D. from New York University School of Medicine. In addition, he completed an internal medicine internship, residency training and an endocrinology research fellowship at the University of Chicago Hospitals.

Linda C. Bain, CPA has served as our vice president of finance and business operations since October 2011 and as our treasurer since March 2013. Previously, she served as vice president of corporate finance at Genzyme from September 2008 to September 2011, at Fidelity Investments from September 2007 to September 2008 and a number of positions at AstraZeneca from May 2000 to September 2007. She received her B.S. from the University of the Orange Free State in South Africa.

Mark D. Angelino, Ph.D. has served as our vice president of pharmaceutical sciences since May 2012. Previously, Dr. Angelino served as senior director of research and development and Cambridge site head at Baxter Healthcare Corporation from December 2010 to May 2012 and as vice president of pharmaceutical development at Archemix Corporation from May 2008 to December 2010. Dr. Angelino received his B.S. in Chemical Engineering from The Cooper Union and his M.S. in chemical engineering practice and Ph.D. in chemical engineering from the Massachusetts Institute of Technology.

Richard E. T. Smith, Ph.D. has served as our vice president of investor relations since March 2013. From March 2012 to March 2013, Dr. Smith served as a consultant for a number of biotechnology companies. Previously, Dr. Smith served as vice president of investor relations and corporate communications at Pharmasset, Inc. from October 2008 until January 2012, when Pharmasset was acquired by Gilead Sciences. From May 2004 through August 2008, Dr. Smith was an equity research analyst at J.P. Morgan Securities covering biotechnology companies. Dr. Smith received his B.Sc. in Applied Zoology from the University of Leeds, his M.Sc. in Toxicology from the University of Surrey and his Ph.D. in Clinical Virology from the University of Oxford.

Faraz Ali has served as our vice president and head of program management and commercial development since May 2011. In 2011, he served as a consultant to Third Rock Ventures, L.P. From 2001 to 2010, Mr. Ali held a number of positions at Genzyme, including most recently, senior director of U.S. marketing and strategic planning of the personalized genetic health business unit from August 2006 to December 2010. Mr. Ali received his B.S. in electrical engineering from Stanford University and his M.B.A. from Harvard Business School.

Cyrus Mozayeni, M.D. has served as our senior director of business development since June 2010. Previously, he served as director of strategic/business development at PPD Dermatology (Magen Biosciences, Inc. until April 2009) from April 2007 to May 2010. Dr. Mozayeni received his B.S. in neuroscience from Brown University, his M.D. from the University of Virginia School of Medicine and his M.B.A. from the Kellogg Graduate School of Management at Northwestern University.

Kathleen Wilkinson has served as our senior director of human resources since November 2012. Previously, she served as human resources director of Adnexus Therapeutics from September 2009 to November 2012, consulted with Codon Devices Inc. from February 2009 to April 2009 and served as senior human resources director of Codon Devices from June 2007 to February 2009. Ms. Wilkinson received her B.A. in sociology from Harvard University.

Wendy L. Dixon, Ph.D. has served as a member of our board of directors since April 2013. In 2012, Dr. Dixon was a principal at Great Meadow Consulting LLC and in 2010, she served as senior

advisor at The Monitor Group. Since 2005, Dr. Dixon has advised and consulted and in some instances served as a member of the board of director for a number of biopharmaceutical companies, including Alkermes PLC, Incyte Corporation, Orexigen Therapeutics, Furiex Pharmaceuticals and formerly on Ardea Biosciences, Inc. (sold to AstraZeneca PLC in 2012) and Dentsply International. Dr. Dixon also served as Chief Marketing Officer and President of Global Marketing for Bristol-Myers Squibb and as a member of the CEO's Executive Committee from 2001 to 2009. She has had an over 30-year career in the pharmaceutical and biotechnology business, combining a technical background and experience in drug development and regulatory affairs with commercial responsibilities in building and leading organizations and launching and growing more than 20 pharmaceutical products including Tagamet, Fosamax, Singulair, Plavix, Abilify, Reyataz and Baraclude. From 1996 to 2001, she was Senior Vice President Marketing at Merck and prior to that she held executive management positions at West Pharmaceuticals, Osteotech and Centocor, and various positions at SmithKline and French (now GlaxoSmithKline) in marketing, regulatory affairs, project management and as a biochemist. Dr. Dixon received her B.Sc., M.Sc. and Ph.D. from the University of Cambridge (UK). We believe that, among other experience, qualifications, attributes and skills, Dr. Dixon's technical background in drug development, commercialization, marketing and regulatory affairs qualify her to serve as a member of our board of directors.

Steven Gillis, Ph.D. has served as a member of our board of directors since April 2011. Since 2005, Dr. Gillis has been a managing director at ARCH Venture Partners, a venture capital firm. From 1994 to 2005, Dr. Gillis served as chief executive officer and chairman of the board of directors of Corixa Corporation, which he co-founded in October 1994. Previously, Dr. Gillis served as a director, head of research and development, chief scientific officer and acting chief executive officer of Immunex Corporation, which he co-founded. As a former director and chairman of Trubion Pharmaceuticals, Inc., Dr. Gillis led its acquisition by Emergent BioSolutions in the fall of 2010. Dr. Gillis currently serves as a director of Accelerator Corporation, Allozyne, Inc., Pulmatrix, Inc., VLST Corporation and VBI Vaccines and serves as director and chairman of VentiRX Pharmaceuticals, Inc., Theraclone Sciences, Inc., Lycera Corp. and PhaseRx, Inc. Dr. Gillis received his B.A. in biology and English from Williams College and his Ph.D. in biological science from Dartmouth College. We believe that Dr. Gillis's experience in the venture capital industry, particularly with biotech and pharmaceutical companies, combined with his experience in molecular and tumor immunology, qualify him to serve as a member of our board of directors.

Daniel S. Lynch has served as chairman of our board of directors since May 2011, when he joined Third Rock Ventures, L.P., or Third Rock, as an entrepreneur-in-residence. Since October 2007, Mr. Lynch has advised and served as executive chair or member of the board of directors for a number of private biopharmaceutical companies, which include Stromedix, Inc. (until its acquisition by Biogen Idec in February 2012), Avila Therapeutics, Inc. (until its acquisition by Celgene Corporation in February 2012), BIND Biosciences, Inc., RaNA Therapeutics, Inc., Nimbus Discovery, LLC, Edimer Pharmaceuticals, Ember Therapeutics, Inc. and Blueprint Medicines, Inc. Previously, Mr. Lynch served as chief executive and chief financial officer of ImClone Systems Corporation, or ImClone. As ImClone's chief executive officer, he led ImClone through a significant turnaround, helping to restore the company's reputation and to secure FDA approval of ERBITUX (Cetuximab), a novel cancer treatment. As its chief financial officer, Mr. Lynch led negotiations to form the major partnership between ImClone and Bristol-Myers Squibb. Earlier in his career, he served in various financial positions at Bristol-Myers Squibb over a 15-year tenure. He served on the board of directors and the audit committee of U.S. Oncology, Inc. for five years until December 2010, when it was acquired by McKesson. Mr. Lynch received his B.A. in mathematics from Wesleyan University and his M.B.A. from

the Darden Graduate School of Business Administration at the University of Virginia. We believe that Mr. Lynch's experience as chief executive officer and chief financial officer of a public pharmaceutical company and as executive chairman and director for many other life science companies, qualify him to serve as a member of our board of directors.

John M. Maraganore, Ph.D. has served as a member of our board of directors since January 2012. Since December 2002, Dr. Maraganore has served as the chief executive officer and as a director of Alnylam Pharmaceuticals, Inc. From December 2002 to December 2007, Dr. Maraganore served as president of Alnylam. From April 2000 to December 2002, Dr. Maraganore served as senior vice president, strategic product development with Millennium Pharmaceuticals, Inc. Before Millennium, he served as director of molecular biology and director of market and business development at Biogen, Inc. (now Biogen Idec, Inc.). Prior to Biogen, Dr. Maraganore was a scientist at ZymoGenetics, Inc., and The Upjohn Company. Dr. Maraganore is also chairman of Regulus Therapeutics, Inc. and a director for Agios Pharmaceuticals and Tempero Pharmaceuticals. In addition, he is an advisor to Third Rock Ventures, L.P. He is also a member of the Immunology Advisory Council of Harvard Medical School and a member of the Biotechnology Industry Organization Board. Dr. Maraganore holds a B.A. in biological sciences from the University of Chicago and an M.S. and a Ph.D. in biochemistry and molecular biology from the University of Chicago. We believe that Dr. Maraganore's experience as chief executive officer and president of a public pharmaceutical company and chairman of another pharmaceutical company that just went public, qualify him to serve as a member of our board of directors.

Geert-Jan Mulder, M.D. has served as a member of our board of directors since May 2004. Dr. Mulder has been a general partner at Forbion Capital Partners since 2001. Prior to joining ABN AMRO Capital Life Sciences (now Forbion), he was clinical research manager of Byk Gulden (now Takeda) from 1999 to 2001 where his group was responsible for design and execution of early and late-stage clinical trials forming the basis for two global product registrations, Daxas and Alvesco in fields of COPD and asthma. For both products he was a member of the Global Medical Marketing group and supported the line extension program of Pantozol. From 1998 to 1999, he served as medical adviser in the field of arthritis and pain (COX-2 technology) and worked on the local and European positioning of Celebrex at Searle (now Pfizer). In addition to taking an active role in the Forbion Capital Partners investment process, Dr. Mulder serves on a number of boards and assists portfolio companies in their clinical development programs and overall strategy including Exosom Diagnostics, Inc., Pansgenetics B.V., Promedior, Inc. and Provesica, Ltd. He previously served on the board of Transave Inc. until its merger with Insmed in December 2010 and Acorda Therapeutics Inc. until its initial public offering in February 2006. Dr. Mulder is a certified Pharmaceutical Physician and earned both a masters in medicine and an M.D. from University of Utrecht. Before joining the pharmaceutical industry, he served as a resident in the field of obstetrics and gynecology. We believe that Dr. Mulder's experience in the venture capital industry, particularly with biotech and pharmaceutical companies, combined with his experience in clinical development, regulatory filings, Special Protocol Approval, orphan designations and dual experience in both the United States and Europe, qualify him to serve as a member of our board of directors. Dr. Mulder has indicated to us his intention to resign from our board of directors upon the consummation of this offering.

Dr. Axel Polack has served as a member of our board of directors since May 2007. Dr. Polack joined TVM Capital in 2000 and is a general partner for life sciences in the firm's Munich office. He currently serves on the board of Noxxon Pharma AG, Invendo Medical, f-star and Probiodrug AG. Dr. Polack's main scientific fields of expertise are molecular and viral oncology, oncogene

activation, gene regulation and molecular immunology. He works intensively on the assessment of new investment opportunities in those areas, while also providing support to existing portfolio companies. Before joining TVM Capital, Dr. Polack was general manager of Innovative Technologies Neuherberg GmbH (now Ascenion). Ascenion acts as a marketing partner to research institutions of the Helmholtz-Gemeinschaft, such as GSF—National Research Center for Environment and Health GmbH, which licenses patents and fosters start-up companies. In the eight years prior to joining Ascenion, Dr. Polack was the deputy head of the GSF—Institute of Clinical Molecular Biology. He holds a M.D. from the University of Freiburg and a Second Thesis (postdoctoral lecture qualification "Habilitation") in the field of virology. Dr. Polack's doctoral thesis was honored with the Goedecke Research prize for outstanding fundamental research in medicine. In 1995, he was appointed assistant professor/private lecturer by the Ludwig-Maximilian-University in Munich. Since 1984, he has co-authored more than 50 publications in peer review journals. We believe that Dr. Polack's experience in the venture capital industry, particularly with biotech and pharmaceutical companies, combined with his experience in virology, gene regulation, qualify him to serve as a member of our board of directors.

David P. Schenkein, M.D. has served as a member of our board of directors since April 2013. Since August 2009, Dr. Schenkein has served as the chief executive officer of Agios Pharmaceuticals. From April 2006 to July 2009, Dr. Schenkein served as senior vice president of oncology development and Genentech. Dr. Schenkein is also a director for Agios Pharmaceuticals, Foundation Medicine and Blueprint Medicine. Dr. Schenkein received his B.A. in chemistry from Wesleyan University and his M.D. from Upstate Medical School. We believe that Dr. Schenkein's experience as chief executive officer of Agios and his membership on the board of directors of a number of biopharmaceutical companies qualify him to serve as a member of our board of directors.

Robert I. Tepper, M.D. has served as a member of our board of directors since September 2010. Dr. Tepper is a distinguished scientist with over 25 years of experience building and operating leading R&D operations. Dr. Tepper co-founded Third Rock Ventures, L.P. in March 2007 and focuses on the formation, development and scientific strategy of the portfolio companies, as well as actively identifying and evaluating new investments. He also assumes active leadership roles in Third Rock's portfolio companies, functioning as chief scientific officer through the first 12-18 months post launch. Prior to joining Third Rock Ventures, L.P., Dr. Tepper served as president of research and development Millennium Pharmaceuticals, or Millenium, from 2003 to 2007 and was vital in its expansion from a drug discovery company to a fully integrated biopharmaceutical company. Before joining Millennium in 1994, he served as principal investigator in the laboratory of tumor biology at Massachusetts General Hospital Cancer Center. Dr. Tepper is also a founder and former member of the scientific advisory board of Cell Genesys/Abgenix. Dr. Tepper holds an A.B. in biochemistry from Princeton University and an M.D. from Harvard Medical School. Dr. Tepper serves as an adjunct faculty member at Harvard Medical School and Massachusetts General Hospital and is an advisory board member of several leading healthcare institutions, including the Partners HealthCare Center for Personalized Genetic Medicine, Harvard Medical School and Tufts Medical School. Dr. Tepper is a board member of Alcresta, Allena Pharmaceuticals, Cerulean Pharma Inc., Constellation Pharmaceuticals Inc. and Kala Pharmaceuticals, Inc. and is also on the board of overseers at Tufts University. We believe that Dr. Tepper's experience in the venture capital industry, particularly with biotech and pharmaceutical companies, combined with his experience building and operating research and development operations and as faculty and advisory board members of several healthcare institutions, qualify him to serve as a member of our board of directors.

Board composition

We currently have nine directors, all of whom were elected pursuant to the terms of our voting agreement, which will terminate upon completion of this offering. Upon the termination of these provisions, we will not be bound by contractual obligations regarding the election of our directors.

Effective upon the closing of this offering, we will divide the terms of office of the directors into three classes:

- Class I, whose term will expire at the annual meeting of stockholders to be held in 2014;
- Class II, whose term will expire at the annual meeting of stockholders to be held in 2015; and
- Class III, whose term will expire at the annual meeting of stockholders to be held in 2016.

Upon the closing of this offering, Class I shall consist of Dr. Gillis, Mr. Leschly and Dr. Polack, Class II shall consist of Mr. Lynch, Dr. Maraganore and Dr. Tepper and Class III shall consist of Dr. Dixon and Dr. Schenkein. Dr. Mulder, currently a member of our board of directors, has indicated to us his intention to resign from our board of directors upon the consummation of this offering. At each annual meeting of stockholders after the initial classification, the successors to directors whose terms will then expire shall serve from the time of election and qualification until the third annual meeting following election and until their successors are duly elected and qualified. A resolution of the board of directors may change the authorized number of directors. Any additional directorships resulting from an increase in the number of directors will be distributed among the three classes so that, as nearly as possible, each class will consist of one-third of the directors. This classification of the board of directors may have the effect of delaying or preventing changes in control or management of our company.

Following the closing of this offering, our nominating and corporate governance committee and board of directors may consider a broad range of factors relating to the qualifications and background of nominees, which may include diversity and is not limited to race, gender or national origin. We have no formal policy regarding board diversity. Our nominating and corporate governance committee's and board of directors' priority in selecting board members is identification of persons who will further the interests of our company through his or her established record of professional accomplishment, the ability to contribute positively to the collaborative culture among board members, and professional and personal experiences and expertise relevant to our growth strategy.

Board committees

Our board of directors has established three standing committees: the audit committee, the compensation committee and the nominating and corporate governance committee.

Audit committee

Effective upon this offering, our audit committee will be composed of Dr. Dixon, Dr. Gillis and Mr. Lynch, with Dr. Gillis serving as chairman of the committee. Our board of directors has determined that each member of the audit committee meets the independence requirements of Rule 10A-3 under the Exchange Act and the applicable listing standards of Nasdaq. Our board of directors

has determined that Mr. Lynch is an "audit committee financial expert" within the meaning of the SEC regulations and applicable listing standards of Nasdaq. The audit committee's responsibilities upon completion of this offering will include:

- appointing, approving the compensation of, and assessing the independence of our independent registered public accounting firm;
- approving audit and permissible non-audit services, and the terms of such services, to be provided by our independent registered public accounting firm;
- reviewing the internal audit plan with the independent registered public accounting firm and members of management responsible for preparing our financial statements;
- reviewing and discussing with management and the independent registered public accounting firm our annual and quarterly financial statements and related disclosures as well as critical accounting policies and practices used by us;
- reviewing the adequacy of our internal control over financial reporting;
- establishing policies and procedures for the receipt and retention of accounting-related complaints and concerns;
- recommending, based upon the audit committee's review and discussions with management and the independent registered public accounting firm, whether our audited financial statements shall be included in our Annual Report on Form 10-K;
- monitoring the integrity of our financial statements and our compliance with legal and regulatory requirements as they relate to our financial statements and accounting matters;
- preparing the audit committee report required by the rules of the Securities and Exchange Commission, or SEC, to be included in our annual proxy statement;
- reviewing all related party transactions for potential conflict of interest situations and approving all such transactions; and
- reviewing quarterly earnings releases and scripts.

Compensation committee

Effective upon this offering, our compensation committee will be composed of Mr. Lynch, Dr. Maraganore and Dr. Tepper, with Mr. Lynch serving as chairman of the committee. Our board of directors has determined each member of the compensation committee is "independent" as defined under the applicable listing standards of Nasdaq. The compensation committee's responsibilities upon completion of this offering will include:

- annually reviewing and approving corporate goals and objectives relevant to the compensation of our chief executive officer;
- evaluating the performance of our chief executive officer in light of such corporate goals and objectives and determining the compensation of our chief executive officer;
- reviewing and approving the compensation of our other executive officers;
- appointing, compensating and overseeing the work of any compensation consultant, legal counsel or other advisor retained by the compensation committee;

- conduct the independence assessment outlined in Nasdaq rules with respect to any compensation consultant, legal counsel or other advisor retained by the compensation committee;
- annually review and reassess the adequacy of the committee charter in its compliance with the listing requirements of Nasdaq;
- reviewing and establishing our overall management compensation, philosophy and policy;
- overseeing and administering our compensation and similar plans;
- reviewing and approving our policies and procedures for the grant of equity-based awards;
- reviewing and making recommendations to the board of directors with respect to director compensation;
- reviewing and discussing with management the compensation discussion and analysis to be included in our annual proxy statement or Annual Report on Form 10-K; and
- reviewing and discussing with the board of directors corporate succession plans for the chief executive officer and other key officers.

Nominating and corporate governance committee

Effective upon this offering, our nominating and corporate governance committee will be composed of Dr. Polack and Dr. Schenkein, with Dr. Polack serving as chairman of the committee. Our board of directors has determined that each member of the nominating and corporate governance committee is "independent" as defined under the applicable listing standards of Nasdaq. The nominating and corporate governance committee's responsibilities upon completion of this offering will include:

- developing and recommending to the board of directors criteria for board and committee membership;
- establishing procedures for identifying and evaluating board of director candidates, including nominees recommended by stockholders;
- identifying individuals qualified to become members of the board of directors;
- recommending to the board of directors the persons to be nominated for election as directors and to each of the board's committees;
- developing and recommending to the board of directors a set of corporate governance guidelines; and
- overseeing the evaluation of the board of directors and management.

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

Leadership structure and risk oversight

Our board of directors is currently chaired by Mr. Lynch. As a general policy, our board of directors believes that separation of the positions of chairman and chief executive officer reinforces the independence of the board of directors from management, creates an environment that

encourages objective oversight of management's performance and enhances the effectiveness of the board of directors as a whole. As such, Mr. Leschly serves as our president and chief executive officer while Mr. Lynch serves as our chairman of the board of directors but is not an officer.

Our board of directors oversees the management of risks inherent in the operation of our business and the implementation of our business strategies. Our board of directors performs this oversight role by using several different levels of review. In connection with its reviews of the operations and corporate functions of our company, our board of directors addresses the primary risks associated with those operations and corporate functions. In addition, our board of directors reviews the risks associated with our company's business strategies periodically throughout the year as part of its consideration of undertaking any such business strategies.

Each of our board committees also oversees the management of our company's risk that falls within the committee's areas of responsibility. In performing this function, each committee has full access to management, as well as the ability to engage advisors. Our vice president of finance reports to the audit committee and is responsible for identifying, evaluating and implementing risk management controls and methodologies to address any identified risks. In connection with its risk management role, our audit committee meets privately with representatives from our independent registered public accounting firm. The audit committee oversees the operation of our risk management program, including the identification of the primary risks associated with our business and periodic updates to such risks, and reports to our board of directors regarding these activities.

Compensation committee interlocks and insider participation

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

Code of business conduct and ethics

We have adopted a code of business conduct and ethics that applies to all of our employees, officers and directors, including those officers responsible for financial reporting. Upon the closing of this offering, our code of business conduct and ethics will be available on our website. We intend to disclose any amendments to the code, or any waivers of its requirements, on our website.

Executive and director compensation

2012 summary compensation table

The following table sets forth the compensation earned during the fiscal year ended December 31, 2012 to our chief executive officer and our next two highest-paid executive officers as of December 31, 2012. We refer to these officers as our named executive officers.

Name and Principal Position	Year	Salary($)	Bonus($)(1)	Option awards($)(2)	Non-equity incentive plan compensation($)(3)	Total($)
Nick Leschly *President and Chief Executive Officer*	2012	346,085	—	130,738	124,200	601,023
Jeffrey T. Walsh *Chief Operating Officer*	2012	300,758	—	—	108,000	408,758
David M. Davidson, MD *Chief Medical Officer*	2012	260,456	45,000	223,857	82,156	611,469

(1) The amount reported consists of Dr. Davidson's signing bonus.

(2) The amounts reported in the Option awards column represent the grant date fair value of the stock options granted to our named executive officers during 2012 as computed in accordance with Accounting Standards Codification, or ASC, Topic 718, not including any estimates of forfeitures. The assumptions used in calculating the grant date fair value of the stock options reported in the Option awards column are set forth in Note 12 to our consolidated financial statements included elsewhere in this prospectus. Note that the amounts reported in this column reflect the accounting cost for these stock options, and do not correspond to the actual economic value that may be received by the named executive officers from the options.

(3) Amounts represent cash bonuses earned in 2012, and paid during 2013, based on achievement of performance goals and other factors deemed relevant by our board of directors. Our 2012 company objectives related primarily to clinical development and partnering achievements.

Narrative disclosure to summary compensation table

Employment arrangements with our named executive officers

Nick Leschly. We have entered into an amended and restated employment agreement, effective as of the closing of this offering, with Nick Leschly for the position of president and chief executive officer. Mr. Leschly currently receives a base salary of $390,000, which is subject to adjustment at the discretion of the board of directors. Mr. Leschly is also eligible for an annual performance bonus of up to 50% of his base salary, payable at the discretion of the board of directors. Mr. Leschly is eligible to participate in our employee benefit plans, subject to the terms of those plans.

Jeffrey T. Walsh. We have entered into an amended and restated employment agreement, effective as of the closing of this offering, with Jeffrey T. Walsh for the position of chief operating officer. Mr. Walsh currently receives a base salary of $320,000, which is subject to adjustment at the discretion of the board of directors. Mr. Walsh is also eligible for an annual performance bonus of up to 40% of his base salary, payable at the discretion of the board of directors. Mr. Walsh is eligible to participate in our employee benefit plans, subject to the terms of those plans.

David M. Davidson, M.D. We have entered into an amended and restated employment agreement, effective as of the closing of this offering, with David M. Davidson, M.D. for the position of chief medical officer. Dr. Davidson currently receives a base salary of $315,000, which is subject to adjustment at the discretion of the board of directors. Dr. Davidson is also eligible for an annual performance bonus of up to 35% of his base salary, payable at the discretion of the board of directors. Dr. Davidson is eligible to participate in our employee benefit plans, subject to the terms of those plans.

These employment agreements also contain provisions that provide for certain payments and benefits in the event of an involuntary termination of employment. In addition, the named executive officers may be entitled to accelerated vesting of their outstanding and unvested awards in certain circumstances. The information below describes certain compensation that may become due payable as a result of certain events. These payments and benefits are in addition to benefits available generally to salaried employees, including distributions under our Section 401(k) plan, accrued benefits under our health and welfare plans and arrangements and vacation pay or other accrued benefits under our medical and dental insurance plans, that are not generally described. Outstanding equity awards for the named executive officers as of December 31, 2012 are set forth under "Outstanding equity awards at December 31, 2012."

Involuntary termination of employment

Pursuant to their employment agreements, each named executive officer is eligible to receive certain payments and benefits in the event his employment is terminated by us without "cause" (as defined in his offer letter) or in the event he terminates his employment with "good reason" (as defined in his offer letter). Upon the timely execution of a severance agreement, including a general release of claims, each named executive officer is eligible to receive the following payments and benefits:

- 12 months of base salary continuation; and
- if he elects to continue his group healthcare benefits, to the extent authorized by and consistent with COBRA, we will pay the named executive officer a monthly cash payment equal to the monthly employer contribution we would have made to provide him health insurance if he had remained employed by us until the earlier of (1) 12 months following the date of termination or (2) the end of the named executive officer's COBRA health continuation period.

Sale event

Pursuant to the employment agreements and the award agreements governing equity awards granted to the named executive officers prior to the date of the employment agreements, in the event of a "sale event" of the company (as defined in the 2010 Stock Option and Grant Plan), any such unvested stock options or other stock-based awards will immediately accelerate, vest and become fully exercisable or non-forfeitable as of the effective date of the sale event.

In addition, in the event that any of the named executive officers terminates his employment with us for good reason or his employment with us is terminated by us without cause, in each case within 12 months following a "sale event" (as defined in the 2013 Stock Option and Incentive Plan), he will be entitled to receive the following payments and benefits upon the timely execution of a severance agreement, including a general release of claims:

- a lump sum cash payment equal to one times (or one and a half times in the case of Mr. Leschly) the sum of (1) the named executive officer's then-current base salary (or base salary in effect immediately prior to the sale event, if higher) and (2) the named executive officer's target annual incentive compensation; and
- if he elects to continue his group healthcare benefits, to the extent authorized by and consistent with COBRA, we will pay the named executive officer a monthly cash payment

equal to the monthly employer contribution we would have made to provide him health insurance if he had remained employed by us until the earlier of (1) 12 months (or 18 months in the case of Mr. Leschly) following the date of termination or (2) the end of the named executive officer's COBRA health continuation period; and

- all stock options and other stock-based awards granted to the named executive officer after the date of his employment agreement will become fully exercisable and non-forfeitable as of the date of the named executive officer's termination.

Definitions

For purposes of Mr. Leschly's employment agreement, "cause" means his:

- commission of any felony or commission of any crime involving fraud, dishonesty or moral turpitude;
- commission or attempted commission of, or participation in, a fraud or act of dishonesty against us;
- material breach of any contract between Mr. Leschly and us or material breach of any legal duty Mr. Leschly owes to us;
- conduct that constitutes insubordination, incompetence or neglect of duties; or
- failure to perform the duties, functions and responsibilities of his position.

For purposes of each of the employment agreements with Mr. Walsh and Dr. Davidson, "cause" means the named executive officer's:

- dishonest statements or acts with respect to us or any of our affiliates, or any of our current or prospective customers, suppliers, vendors or other third parties with which such entity does business;
- commission of any felony or any misdemeanor involving moral turpitude, deceit, dishonesty or fraud;
- failure to perform assigned duties to our reasonable satisfaction, which failure continues, in our reasonable judgment, after written notice to the named executive officer;
- gross negligence, willful misconduct or insubordination with respect to us or any of our affiliates; or
- violation of any provision of any agreement(s) between the named executive officer and us relating to noncompetition, nondisclosure and/or assignment of inventions.

For purposes of the each of the employment agreements with the named executive officers, "good reason" means:

- a material diminution in the named executive officer's responsibilities, authority and function;
- a material reduction in base salary other than pursuant to a salary reduction program affecting substantially all of our employees (or senior executives in the case of Dr. Davidson) that does not adversely affect the named executive officer to a greater

extent than other similarly situated employees; provided, however, that any reduction in base salary that exceeds 10% of the named executive officer's then-current base salary shall constitute good reason;

- a material change in the geographic location (of more than 30 miles in the case of Mr. Walsh) at which the named executive officer must regularly report to work or perform services, except for required travel on business (for Mr. Walsh and Dr. Davidson, to an extent substantially consistent with usual business travel obligations); and
- a material breach by us of any provision of our equity incentive plans or award agreements thereunder or any other material agreement between the named executive officer and us concerning the terms of the named executive officer's employment, benefits or compensation.

In addition, under Mr. Leschly's employment agreement, "good reason" also includes:

- an adverse change in the his job title or a change in reporting relationship as a result of which he no longer reports to our board of directors; and
- removal from, or failure to be elected to, our board of directors.

Equity compensation

Outstanding equity awards at December 31, 2012

The following table sets forth information concerning the outstanding equity awards held by each of the named executive officers as of December 31, 2012.

	Option awards					Stock awards	
Name	Number of securities underlying unexercised options exercisable (#)	Number of securities underlying unexercised options unexercisable (#)	Number of securities underlying unexercised unearned options (#)	Option exercise price ($/share)	Option expiration date	Number of shares that have not vested (#)	Market value of shares that have not vested ($)(1)
Nick Leschly	—	92,265(2)	—	$ 2.09	6/4/2022	—	—
	53,985	75,579(3)	—	2.09	7/13/2021	—	—
			—			150,909(4)	$2,263,635
Jeffrey T. Walsh	—	—	26,206(5)	2.09	7/13/2021	—	—
	90,767	138,540(6)	—	2.09	7/13/2021	—	—
David M. Davidson, M.D.	—	157,239(7)	—	2.09	4/13/2022	—	—

(1) There was no public market for our common stock at December 31, 2012. We have estimated the market value of the unvested stock awards assuming an initial public offering price of $15.00 per share, the midpoint of the price range set forth on the cover of this prospectus.

(2) Represents options to purchase shares of our common stock granted on June 4, 2012. The shares underlying these options vest as follows: 25% vest on May 1, 2013, with the remainder of the shares vesting in equal monthly installments over the following three years through May 1, 2016. Vesting of all unvested shares shall accelerate in connection with an acquisition event pursuant to the terms of the option agreement.

(3) Represents options to purchase shares of our common stock granted on July 13, 2011. The shares underlying these options vest as follows: 25% vest on April 15, 2012, with the remainder of the shares vesting in equal monthly installments over the following three years through April 15, 2015. Vesting of all unvested shares shall accelerate in connection with an acquisition event pursuant to the terms of the option agreement.

(4) Under the terms of Mr. Leschly's November 15, 2010 restricted stock agreement, the remaining unvested shares will vest in equal monthly installments through October 1, 2014. Vesting of all restricted shares shall accelerate in connection with an acquisition event pursuant to the terms of the restricted stock agreement.

(5) Represents options to purchase shares of our common stock granted on July 13, 2011. The shares underlying these options vest as follows: 25% vest upon the one-year anniversary of the achievement of a performance-goal, with the remainder of the shares vesting in equal monthly installments over the following three years thereafter. Vesting of all unvested shares shall accelerate in connection with an acquisition event pursuant to the terms of the option agreement.

(6) Represents options to purchase shares of our common stock granted on July 13, 2011. The shares underlying these options vests as follows: 25% vest on May 16, 2012, with the remainder of the shares vesting in equal monthly installments over the following three years through May 16, 2015. Vesting of all unvested shares shall accelerate in connection with an acquisition event pursuant to the terms of the option agreement.

(7) Represents options to purchase shares of our common stock granted on April 13, 2012. The shares underlying these options vests as follows: 25% vest on February 13, 2013, with the remainder of the shares vesting in equal monthly installments over the following three years through February 13, 2016. Vesting of all unvested shares shall accelerate in connection with an acquisition event pursuant to the terms of the option agreement.

Director compensation

The following table sets forth a summary of the compensation we paid to our non-employee directors during 2012. Other than as set forth in the table and described more fully below, we did not pay any compensation, reimburse any expense of, make any equity awards or non-equity awards to, or pay any other compensation to any of the other non-employee members of our board of directors in 2012. Mr. Leschly, our president and chief executive officer, receives no compensation for his service as a director, and, consequently, is not included in this table. The compensation received by Mr. Leschly as an employee during 2012 is presented in “2012 summary compensation table” above.

Name(1)	Fees earned or paid in cash($)	Option awards($)(2)	Total($)
Daniel S. Lynch	50,000	—	50,000
John M. Maraganore, Ph.D.	30,000	46,463	76,463

(1) As of December 31, 2012, Mr. Lynch and Dr. Maraganore held options to purchase 65,508 and 33,629 shares of common stock, respectively. None of the other non-employee members of our board of directors held options to purchase common stock or any other unvested share-based awards as of that date.

(2) The amounts reported in the Option Awards column represent the grant date fair value of the stock options granted to our non-employee directors during 2012 as computed in accordance with ASC Topic 718, not including any estimates of forfeitures. The assumptions used in calculating the grant date fair value of the stock options reported in the Option Awards column are set forth in Note 12 to our consolidated financial statements included elsewhere in this prospectus. Note that the amounts reported in this column reflect the accounting cost for these stock options, and do not correspond to the actual economic value that may be received by the non-employee directors from the options.

We have entered into offer letters with Mr. Lynch and Drs. Maraganore, Dixon and Schenkein regarding their service on our board of directors, which provide for annual cash retainers and reimbursement of expenses related to service as directors. These offer letters will terminate prior to the effectiveness of this registration statement, and each of these directors will be eligible to participate in the non-employee director compensation program described below following this offering. Each of these directors was granted an option to purchase shares of our common stock in connection with their appointment to the board of directors.

Our board of directors has adopted a non-employee director compensation policy, effective as of the closing of this offering, that is designed to provide a total compensation package that enables us to attract and retain, on a long-term basis, high caliber non-employee directors. Under the policy, all non-employee directors will be paid cash compensation from and after the completion of this offering, as set forth below:

	Annual Retainer
Board of Directors:	
All non-employee members	$ 35,000
Additional retainer for Non-Executive Chairman of the Board	$ 35,000
Audit Committee:	
Chairman	$ 15,000
Non-Chairman members	$ 7,500
Compensation Committee:	
Chairman	$ 10,000
Non-Chairman members	$ 5,000
Nominating and Corporate Governance Committee:	
Chairman	$ 7,000
Non-Chairman members	$ 3,000

Under the non-employee director compensation policy, each person who is initially appointed or elected to the board of directors will be eligible for an option grant to purchase up to 13,708 shares of our common stock under our stock option plan on the date he or she first becomes a non-employee director, which will vest annually over a three-year period. In addition, on the date of the annual meeting of stockholders, each continuing non-employee director who has served on the board of directors for a minimum of six months will be eligible to receive an annual option grant to purchase up to 6,854 shares of our common stock, which will vest in full upon the earlier of the first anniversary of the date of grant or the date of the following annual meeting of stockholders. All of the foregoing options will be granted at fair market value on the date of grant.

Compensation risk assessment

We believe that our executive compensation program does not encourage excessive or unnecessary risk taking. This is primarily due to the fact that our compensation programs are designed to encourage our executive officers and other employees to remain focused on both short-term and long-term strategic goals, in particular in connection with our pay-for-performance compensation philosophy. As a result, we do not believe that our compensation programs are reasonably likely to have a material adverse effect on us.

Equity compensation plans and other benefit plans

2013 Stock Option and Incentive Plan

Our 2013 Stock Option and Incentive Plan, or the 2013 Plan, was adopted by our board of directors and approved by our stockholders in June 2013 and will become effective immediately prior to this offering . The 2013 Plan will replace the 2010 Plan (as defined below).

We have initially reserved 955,000 shares of our common stock for the issuance of awards under the 2013 Plan. The 2013 Plan provides that the number of shares reserved and available for issuance under the plan will automatically increase each January 1, beginning on January 1, 2014, by 4% of the outstanding number of shares of our common stock on the immediately preceding December 31 or such lesser number of shares as determined by our compensation committee. This number is subject to adjustment in the event of a stock split, stock dividend or other change in our capitalization.

The shares we issue under the 2013 Plan will be authorized but unissued shares or shares that we reacquire. The shares of common stock underlying any awards that are forfeited, cancelled, held back upon exercise or settlement of an award to satisfy the exercise price or tax withholding, reacquired by us prior to vesting, satisfied without any issuance of stock, expire or are otherwise terminated (other than by exercise) under the 2013 Plan are added back to the shares of common stock available for issuance under the 2013 Plan.

Stock options and stock appreciation rights with respect to no more than 955,000 shares of stock may be granted to any one individual in any one calendar year and the maximum “performance-based award” payable to any one individual under the 2013 Plan is 955,000 shares of stock or $2.0 million in the case of cash-based awards. No more than 1,000,000 shares may be issued as incentive stock options in any one calendar year period.

The 2013 Plan will be administered by our compensation committee. Our compensation committee has full power to select, from among the individuals eligible for awards, the individuals to whom awards will be granted, to make any combination of awards to participants, and to determine the specific terms and conditions of each award, subject to the provisions of the 2013 Plan. Persons eligible to participate in the 2013 Plan will be those full or part-time officers, employees, non-employee directors and other key persons (including consultants) as selected from time to time by our compensation committee in its discretion.

The 2013 Plan permits the granting of both (1) options to purchase common stock intended to qualify as incentive stock options under Section 422 of the Internal Revenue Code of 1986, as amended, or the Code, and (2) options that do not so qualify. The option exercise price of each option will be determined by our compensation committee but may not be less than 100% of the fair market value of our common stock on the date of grant. The term of each option will be fixed by our compensation committee and may not exceed ten years from the date of grant. Our compensation committee will determine at what time or times each option may be exercised.

Our compensation committee may award stock appreciation rights subject to such conditions and restrictions as it may determine. Stock appreciation rights entitle the recipient to shares of common stock, or cash, equal to the value of the appreciation in our stock price over the exercise price. The exercise price of each stock appreciation right may not be less than 100% of fair market value of the common stock on the date of grant.

Our compensation committee may award restricted shares of common stock and restricted stock units to participants subject to such conditions and restrictions as it may determine. These conditions and restrictions may include the achievement of certain performance goals and/or continued employment with us through a specified vesting period. Our compensation committee may also grant shares of common stock that are free from any restrictions under the 2013 Plan. Unrestricted stock may be granted to participants in recognition of past services or for other valid consideration and may be issued in lieu of cash compensation due to such participant.

Our compensation committee may grant performance share awards to participants that entitle the recipient to receive share awards of common stock upon the achievement of certain performance goals and such other conditions as our compensation committee shall determine. Our compensation committee may grant dividend equivalent rights to participants that entitle the recipient to receive credits for dividends that would be paid if the recipient had held a specified number of shares of common stock.

Our compensation committee may grant cash bonuses under the 2013 Plan to participants, subject to the achievement of certain performance goals.

Our compensation committee may grant awards of restricted stock, restricted stock units, performance shares or cash-based awards under the 2013 Plan that are intended to qualify as "performance-based compensation" under Section 162(m) of the Code. Those awards would only vest or become payable upon the attainment of performance goals that are established by our compensation committee and related to one or more performance criteria. The performance criteria that could be used with respect to any such awards include: total shareholder return, earnings before interest, taxes, depreciation and amortization, net income (loss) (either before or after interest, taxes, depreciation and/or amortization), changes in the market price of our common stock, economic value-added, funds from operations or similar measure, sales or revenue, development, clinical or regulatory milestones, acquisitions or strategic transactions, operating income (loss), cash flow (including, but not limited to, operating cash flow and free cash flow), return on capital, assets, equity, or investment, return on sales, gross or net profit levels, productivity, expense, margins, operating efficiency, customer satisfaction, working capital, earnings (loss) per share of stock, sales or market shares and number of customers, any of which may be measured either in absolute terms or as compared to any incremental increase or as compared to results of a peer group. From and after the time that we become subject to Section 162(m) of the Code, the maximum award that is intended to qualify as "performance-based compensation" under Section 162(m) of the Code that may be made to any one employee during any one calendar year period is 955,000 shares of common stock with respect to a stock-based award and $2.0 million with respect to a cash-based award.

The 2013 Plan provides that upon the effectiveness of a "sale event," as defined in the 2013 Plan, in the event that all awards are not assumed or continued or substituted by the successor entity, all options and stock appreciation rights that are not exercisable immediately prior to the effective time of the sale event shall become fully exercisable as of the effective time of the sale event, all other awards with time-based vesting, conditions or restrictions, shall become fully vested and nonforfeitable as of the effective time of the sale event and all awards with conditions and restrictions relating to the attainment of performance goals may become vested and nonforfeitable in the discretion of the compensation committee and all awards granted under the 2013 Plan shall terminate. In addition, in connection with the termination of the 2013 Plan upon a sale event, we may make or provide for a cash payment to participants holding options and stock appreciation rights equal to the difference between the per share cash consideration payable to stockholders in the sale event and the exercise price of the options or stock appreciation rights.

Our board of directors may amend or discontinue the 2013 Plan and our compensation committee may amend or cancel outstanding awards for purposes of satisfying changes in law or any other lawful purpose, but no such action may adversely affect rights under an award without the holder's consent. Certain amendments to the 2013 Plan require the approval of our stockholders.

No awards may be granted under the 2013 Plan after the date that is ten years from the date of stockholder approval of the 2013 Plan. No awards under the 2013 Plan have been made prior to the date hereof.

2013 Employee Stock Purchase Plan

Our 2013 Employee Stock Purchase Plan was adopted by our board of directors and approved by our stockholders in June 2013 and will become effective upon closing of this offering. Our 2013 Employee Stock Purchase Plan authorizes the initial issuance of up to a total of 238,000 shares of our common stock to participating employees.

All employees who have been employed by us or our designated subsidiaries for at least six weeks and whose customary employment is for more than 20 hours a week are eligible to participate in our 2013 Employee Stock Purchase Plan. Any employee who owns, or would own upon such purchase under our 2013 Employee Stock Purchase Plan, 5% or more of the voting power or value of our stock is not eligible to purchase shares under our 2013 Employee Stock Purchase Plan.

We may make one or more offerings to our employees to purchase stock under our 2013 Employee Stock Purchase Plan. Unless otherwise determined by the administrator of our 2013 Employee Stock Purchase Plan, the first offering will begin on January 1st of the year designated by the administrator and end on the following June 30th. Unless otherwise determined by the administrator, subsequent offerings will begin on the first business day occurring on or after each January 1st and July 1st and will end on the last business day occurring on or before the following June 30th and December 31st, respectively, each referred to as offering periods. The administrator may designate different offering periods in its discretion but no offering shall exceed six months in duration or overlap with another offering.

Each employee who is a participant in our 2013 Employee Stock Purchase Plan may purchase shares by authorizing payroll deductions of up to 10% of his or her eligible compensation during an offering period. Unless the participating employee has previously withdrawn from the offering, his or her accumulated payroll deductions will be used to purchase common stock on the last business day of the offering period at a price equal to 85% of the fair market value of the common stock on or the last business day of the offering period, whichever is lower, provided that no more than shares of common stock or such other maximum number established by the compensation committee may be purchased by any one employee during each offering period. Under applicable tax rules, an employee may purchase no more than $25,000 worth of common stock, valued at the start of the purchase period, under our 2013 Employee Stock Purchase Plan in any calendar year.

The accumulated payroll deductions of any employee who is not a participant on the last day of an offering period will be refunded. An employee's rights under our 2013 Employee Stock Purchase Plan terminate upon voluntary withdrawal from the plan or when the employee ceases employment for any reason.

Our 2013 Employee Stock Purchase Plan may be terminated or amended by our board of directors at any time. Amendments that increase the number of shares of our common stock authorized under our 2013 Employee Stock Purchase Plan and certain other amendments require the approval of our stockholders.

2010 Stock Option and Grant Plan

Our 2010 Stock Option and Grant Plan, or the 2010 Plan, was approved by our board of directors on September 15, 2010 and was subsequently approved by our stockholders on October 4, 2010. The

2010 Plan was most recently amended in January 2013. Under the 2010 Plan, as of March 31, 2013, we had reserved for issuance an aggregate of (i) 4,320,864 shares of our common stock plus (ii) the number of shares of common stock returned to the 2002 Plan, as defined below, after January 16, 2013. The number of shares of common stock reserved for issuance is subject to adjustment in the event of a stock split, stock dividend or other change in our capitalization.

The shares we issue under the 2010 Plan will be authorized but unissued shares or shares we reacquire. The shares of common stock underlying any awards that are forfeited, canceled, repurchased, expire or are otherwise terminated (other than by exercise) under the 2010 Plan are added to the shares of common stock available for issuance under the 2010 Plan. Upon this offering, such shares will be added to the shares of common stock available for issuance under the 2013 Plan.

Our board of directors has acted as administrator of the 2010 Plan. The administrator has full power to select, from among the individuals eligible for awards, the individuals to whom awards will be granted, and to determine the specific terms and conditions of each award, subject to the provisions of the 2010 Plan. Persons eligible to participate in the 2010 Plan are those full or part-time officers, employees, directors, consultants and other key persons (including prospective employees, but conditioned upon their employment) of us and our subsidiaries as selected from time to time by the administrator in its discretion.

The 2010 Plan permits the granting of (1) options to purchase common stock intended to qualify as incentive stock options under Section 422 of the Code and (2) options that do not so qualify. The option exercise price of each option will be determined by the administrator but may not be less than 100% of the fair market value of the common stock on the date of grant. The term of each option will be fixed by the administrator and may not exceed ten years from the date of grant. The administrator will determine at what time or times each option may be exercised. In addition, the 2010 Plan permits the granting of restricted shares of common stock, restricted stock units and unrestricted stock.

The 2010 Plan provides that upon the occurrence of a “sale event” as defined in the 2010 Plan, all outstanding stock options will terminate at the effective time of such sale event, unless the parties to the sale event agree that such awards will be assumed or continued by the successor entity. In the event of a termination of the 2010 Plan and all options issued thereunder in connection with a sale event, the optionees will be provided an opportunity to exercise their options prior to the completion of the sale event. In the case of a sale event in which our stockholders will receive cash consideration, the administrator has the right to provide for cash payment to holders of vested options in an amount equal to the difference between the per share cash consideration and the exercise price of such options. Restricted stock and restricted stock units will be forfeited immediately prior to the effective time of a sale event unless such awards are assumed or continued by the successor entity. In the event that the shares of restricted stock are forfeited in connection with a sale event, such shares of restricted stock shall be repurchased at a price per share equal to the lower of the original per share purchase price and the fair market value of such shares. The administrator has the right to provide for cash payment to holders of restricted stock or restricted stock units in an amount equal to the per share cash consideration in the sale event.

No awards may be granted under the 2010 Plan after the date that is ten years from the date the 2010 Plan was adopted by the board of directors. Our board of directors has determined not to make any further awards under the 2010 Plan following the closing of this offering.

2002 Employee, Director and Consultant Plan

Our Second Amended and Restated 2002 Employee, Director and Consultant Stock Plan, or the 2002 Plan, was approved by our board of directors and our stockholders on June 2, 2004. Our board of directors has not granted any awards under our 2002 Plan since it terminated on October 4, 2010 and does not plan to grant any further awards under our 2002 Plan. As of March 31, 2013, there were options to purchase 285,755 shares of common stock outstanding under the 2002 Plan.

The shares of common stock underlying any awards that are forfeited, canceled, repurchased, expire or are otherwise terminated (other than by exercise) under the 2002 Plan are added to the shares of common stock available for issuance under the 2010 Plan. Upon this offering, such shares will be added to the shares of common stock available for issuance under the 2013 Plan.

The 2002 Plan provides that upon the occurrence of a "corporate transaction" as defined in the 2002 Plan, the parties to such corporate transaction may provide that (i) the options will be assumed or continued by the successor entity, (ii) optionees will be provided an opportunity to exercise their options prior to the completion of the corporate transaction, or (iii) vested options will be terminated in exchange for a cash payment equal to the difference between the fair market value of the shares subject to the options and the exercise price.

Executive Cash Incentive Bonus Plan

Our board of directors has adopted the Executive Cash Incentive Bonus Plan, or the Bonus Plan, which is effective as of the closing of this offering. The Bonus Plan provides for cash bonus payments based upon the attainment of performance targets established by our compensation committee. The payment targets will be related to corporate, financial and operational measures or objectives, or Corporate Performance Goals, as well as individual performance objectives.

Our compensation committee may select Corporate Performance Goals from among the following: achievement of specified research and development, publication, clinical and/or regulatory milestones; cash flow (including, but not limited to, operating cash flow and free cash flow); sales or revenue; corporate revenue; earnings before interest, taxes, depreciation and amortization; net income (loss) (either before or after interest, taxes, depreciation and/or amortization); changes in the market price of our common stock; economic value-added; funds from operations or similar measure; acquisitions or strategic transactions; operating income (loss); return on capital, assets, equity, or investment; stockholder returns; return on sales; gross or net profit levels; productivity; expense efficiency; margins; operating efficiency; customer satisfaction; working capital; earnings (loss) per share of our common stock; bookings, new bookings or renewals; sales or market shares; number of customers; number of new customers or customer references; operating income and/or net annual recurring revenue, any of which may be measured in absolute terms, as compared to any incremental increase, in terms of growth, as compared to results of a peer group, against the market as a whole, compared to applicable market indices and/or measured on a pre-tax or post-tax basis.

Each executive officer who is selected to participate in the Bonus Plan will have a target bonus opportunity set for each performance period. The bonus formulas will be adopted in each performance period by the compensation committee and communicated to each executive. The Corporate Performance Goals will be measured at the end of each performance period after our financial reports have been published or such other appropriate time as the compensation

committee determines. If the Corporate Performance Goals and individual performance objectives are met, payments will be made as soon as practicable following the end of each performance period. Subject to the rights contained in any agreement between the executive officer and the company, an executive officer must be employed by the company on the bonus payment date to be eligible to receive a bonus payment. The Bonus Plan also permits the compensation committee to approve additional bonuses to executive officers in its sole discretion.

401(k) plan

We maintain a 401(k) plan for employees. The 401(k) plan is intended to qualify under Section 401(k) of the Code, so that contributions to the 401(k) plan by employees or by us, and the investment earnings thereon, are not taxable to the employees until withdrawn from the 401(k) plan, and so that contributions by us, if any, will be deductible by us when made. Under the 401(k) plan, employees may elect to reduce their current compensation by up to the statutorily prescribed annual limit and to have the amount of such reduction contributed to the 401(k) plan. The 401(k) plan permits us to make contributions up to the limits allowed by law on behalf of all eligible employees. Historically, we have not made any matching contributions to the 401(k) plan.

Rule 10b5-1 sales plans

Our directors and executive officers may adopt written plans, known as Rule 10b5-1 plans, in which they will contract with a broker to buy or sell shares of our common stock on a periodic basis. Under a Rule 10b5-1 plan, a broker executes trades pursuant to parameters established by the director or officer when entering into the plan, without further direction from the director or officer. The director or officer may amend or terminate the plan in limited circumstances. Our directors and executive officers may also buy or sell additional shares of our common stock outside of a Rule 10b5-1 plan when they are not in possession of material, nonpublic information.

Certain relationships and related party transactions

The following is a description of transactions since January 1, 2010 to which we have been a party, in which the amount involved exceeds $120,000, and in which any of our directors, executive officers or holders of more than 5% of our capital stock, or an affiliate or immediate family member thereof, had or will have a direct or indirect material interest. We believe the terms obtained or consideration that we paid or received, as applicable, in connection with the transactions described below were comparable to terms available or the amounts that would be paid or received, as applicable, from unaffiliated third parties.

Sales and purchases of securities

Series B financing

In March 2010, we issued an aggregate of 61,555,660 shares of our Series B Preferred Stock for aggregate consideration of $16.8 million in cash and $3.3 million in converted bridge notes to five investors. In April 2011, we issued, pursuant to a second tranche closing, an aggregate of 53,648,066 shares of our Series B Preferred Stock for aggregate consideration of $17.5 million to the same five investors. The table below sets forth the aggregate number of shares of Series B Preferred Stock sold to our directors, executive officers or holders of more than 5% of our capital stock, or an affiliate or immediate family member thereof:

Name	Shares	Aggregate purchase price
Third Rock Ventures, L.P.	64,377,682	$21,000,000
TVM V Life Science Ventures GmbH & Co. KG	17,749,014	$5,789,728
Cooperative AAC LS U.A.	10,649,408	$3,473,837

In May 2007, December 2007, May 2008, August 2008, December 2008, April 2009, July 2009, October 2009 and December 2009, we issued warrants to purchase 1,133,100, 472,124, 472,124, 472,124, 472,124, 321,044, 321,044, 283,274, and 574,800 shares, respectively, of either (i) our Series A-1 Preferred Stock or (ii) such preferred stock that we may issue in a subsequent qualified financing. In March 2010, in connection with the Series B Preferred Stock financing, the 2007, 2008 and the April, July and October 2009 warrants were amended to provide that such warrants would be exercisable only for shares of our Series A-1 Preferred Stock at a per share price of $0.6619 and the December 2009 warrants were amended to provide that such warrants would be exercisable only for shares of our Series B Preferred Stock at a per share price of $0.3262. The table below set forth the number and class of shares issuable pursuant to warrants amended in March 2010 held by our directors, executive officers or holders of more than 5% of our capital stock, or an affiliate or immediate family member thereof:

Name	Warrants to purchase shares of Series A-1 preferred stock	Warrants to purchase shares of Series B preferred stock
TVM V Life Science Ventures GmbH & Co. KG	3,075,111	287,400
Cooperative AAC LS U.A.	1,656,206	172,440

Series C financing

In April 2011, we issued an aggregate of 39,942,483 shares of our Series C Preferred Stock for aggregate consideration of $15.0 million to five investors. The table below sets forth the number of shares of Series C Preferred Stock sold to our directors, executive officers or holders of more than 5% of our capital stock, or an affiliate or immediate family member thereof:

Name	Shares	Aggregate purchase price
ARCH Venture Fund VII, L.P.	19,971,242	$7,500,000
Third Rock Ventures, L.P.	14,379,294	$5,400,000
TVM V Life Science Ventures GmbH & Co. KG	3,994,248	$ 1,500,000
Cooperative AAC LS U.A.	1,331,416	$ 500,000

Series D financing

In July 2012, we issued an aggregate of 120,409,385 shares of our Series D Preferred Stock for aggregate consideration of $60.0 million to 17 investors. The table below sets forth the number of shares of Series D Preferred Stock sold to our directors, executive officers or holders of more than 5% of our capital stock, or an affiliate or immediate family member thereof:

Name	Shares	Aggregate purchase price
Entities Affiliated with Fidelity Investments	37,728,275	$18,800,000
Entities Affiliated with Capital Research and Management Company	29,500,300	$14,700,000
ARCH Venture Fund VII, L.P.	14,047,762	$ 7,000,000
Third Rock Ventures, L.P.	11,037,527	$ 5,500,000
TVM V Life Science Ventures GmbH & Co. KG	3,010,234	$ 1,500,000
Cooperative AAC LS U.A.	1,003,411	$ 500,000

Consulting services provided by Third Rock Ventures, LLC

During the fiscal years ended December 31, 2010, 2011 and 2012, we incurred consulting fees to Third Rock Ventures, LLC in the amount of $0.8, $0.4 and $0.1 million, respectively. Third Rock Ventures, LLC is a management company that is party to a services agreement with Third Rock Ventures, L.P., the beneficial owner of more than five percent of our voting securities. Robert I. Tepper, M.D., one of our directors, is a managing member of TRV GP, LLC, which is the general partner of Third Rock Ventures GP, L.P., the general partner of Third Rock Ventures, L.P. and a managing member of Third Rock Ventures, LLC. These consulting fees were paid to Third Rock Ventures, LLC in consideration of certain strategic and business operations consulting services provided to us during this period by Third Rock Ventures, LLC by individuals other than Dr. Tepper. None of these consulting fees were paid directly or indirectly to Dr. Tepper. The consulting fees paid to Third Rock Ventures, LLC did not exceed five percent of the consolidated gross revenues of Third Rock Ventures, LLC during any of these fiscal years. We are not currently party to a consulting agreement with Third Rock Ventures, LLC and we do not expect to engage Third Rock Ventures, LLC for consulting services on a going forward basis.

Director and executive officer compensation

Please see “Executive and director compensation—Director compensation” for a discussion of options granted to our non-employee directors. Please see “Executive and director compensation—Equity compensation” for additional information regarding compensation of executive officers.

Employment agreements

We have entered into employment agreements with certain of our executive officers. For more information regarding these agreements, see “Executive and director compensation—Employment agreements with our named executive officers.”

Indemnification agreements and directors’ and officers’ liability insurance

We intend to enter into indemnification agreements with each of our executive officers and directors prior to this offering. We also maintain a general liability insurance policy which covers certain liabilities of directors and officers of our Company arising out of claims based on acts or omissions in their capacities as directors or officers.

Registration rights agreements

We and certain holders of our preferred stock have entered into an investor rights agreement pursuant to which these stockholders will have, among other things, registration rights under the Securities Act of 1933, as amended, with respect to common stock that they will hold following this offering. Upon the closing of this offering, all outstanding shares of our preferred stock will be converted into common stock. See “Description of capital stock—Registration rights” for a further description of the terms of these agreements.

Procedures for related party transactions

We have adopted a related person transaction approval policy that will govern the review of related person transactions following the closing of this offering. Pursuant to this policy, if we want to enter into a transaction with a related person or an affiliate of a related person, our chief operating officer will review the proposed transaction to determine, based on applicable Nasdaq and Securities and Exchange Commission rules, if such transaction requires pre-approval by the audit committee and/or board of directors. If pre-approval is required, such matters will be reviewed at the next regular or special audit committee and/or board of directors meeting. We may not enter into a related person transaction unless our chief operating officer has either specifically confirmed in writing that no further reviews are necessary or has confirmed that all requisite corporate reviews have been obtained.

Principal stockholders

The following table sets forth information relating to the beneficial ownership of our common stock as of May 31, 2013, by:

- each person, or group of affiliated persons, known by us to beneficially own more than 5% of our outstanding shares of common stock;
- each of our directors;
- each of our named executive officers; and
- all directors and executive officers as a group.

The number of shares beneficially owned by each entity, person, director or executive officer is determined in accordance with the rules of the Securities and Exchange Commission, and the information is not necessarily indicative of beneficial ownership for any other purpose. Under such rules, beneficial ownership includes any shares over which the individual has sole or shared voting power or investment power as well as any shares that the individual has the right to acquire within 60 days of May 31, 2013 through the exercise of any stock option, warrants or other rights. Except as otherwise indicated, and subject to applicable community property laws, the persons named in the table have sole voting and investment power with respect to all shares of common stock held by that person.

The percentage of shares beneficially owned is computed on the basis of 16,869,488 shares of our common stock outstanding as of May 31, 2013, which reflects the assumed conversion of all of our outstanding shares of preferred stock into an aggregate of 16,588,510 shares of common stock. Shares of our common stock that a person has the right to acquire within 60 days of May 31, 2013 are deemed outstanding for purposes of computing the percentage ownership of the person holding such rights, but are not deemed outstanding for purposes of computing the percentage ownership of any other person, except with respect to the percentage ownership of all directors and executive officers as a group. Unless otherwise indicated below, the address for each beneficial owner listed is c/o bluebird bio, Inc., 840 Memorial Drive, 4th Floor, Cambridge, MA 02139.

Name and address of beneficial owner	Number of shares beneficially owned	Percentage of shares beneficially owned: Before offering	Percentage of shares beneficially owned: After offering
5% or greater stockholders:			
Third Rock Ventures, L.P.(1) 29 Newbury Street Boston, MA 02116	4,734,248	28.1%	21.6%
TVM V Life Science Ventures GmbH & Co. KG(2) Maximilianstrasse 35 Entrance C 80539 Munich, Germany	2,431,633	14.3%	11.0%
Entities affiliated with Fidelity Investments(3) 82 Devonshire St. Boston, MA 02109	1,989,150	11.8%	9.1%
ARCH Venture Fund VII, L.P.(4) 8725 West Higgins Road Suite 290 Chicago, IL 60631	1,793,588	10.6%	8.2%
Entities affiliated with Capital Research and Management Company(5) 333 S. Hope Street, 55th Floor Los Angeles, CA 90071	1,555,348	9.2%	7.1%
Coöperative AAC LS U.A. (Forbion)(6) PO Box 5187 1410 AD Naarden The Netherlands	1,251,526	7.4%	5.7%
Directors and named executive officers:			
Nick Leschly(7)	429,045	2.5%	2.0%
Robert I. Tepper, M.D.(8)	4,734,248	28.1%	21.6%
Dr. Axel Polack(9)	2,431,633	14.3%	11.0%
Steven Gillis, Ph.D.(10)	1,793,588	10.6%	8.2%
Geert-Jan Mulder, M.D.(11)	1,251,526	7.4%	5.7%
Daniel S. Lynch(12)	36,848	*	*
John M. Maraganore, Ph.D.(13)	19,319	*	*
Wendy L. Dixon, Ph.D.	—	—	—
David P. Schenkein, M.D.	—	—	—
Jeffrey T. Walsh(14)	124,207	*	*
David Davidson, M.D.(15)	55,688	*	*
All executive officers and directors as a group (13 persons)(16)	11,043,470	62.6%	48.8%

* Represents beneficial ownership of less than one percent of our outstanding common stock.

(1) Consists of (i) 3,394,194 shares of common stock underlying shares of Series B Convertible Preferred Stock, or Series B Stock, (ii) 758,121 shares of common stock underlying shares of Series C Convertible Preferred Stock, or Series C Stock, and (iii) 581,933 shares of common stock underlying shares of Series D Convertible Preferred Stock, or Series D Stock. All shares are held directly by Third Rock Ventures, L.P. ("TRV LP"). Each of Third Rock Ventures GP, LP ("TRV GP"), the general partner of TRV LP, and Third Rock Ventures GP, LLC ("TRV LLC"), the general partner of TRV GP, may be deemed to have voting and dispositive power over the shares held by TRV LP. Investment decisions with respect to the shares held by TRV LP are made by an investment committee at TRV GP comprised of Mark Levin, Kevin Starr, Bob Tepper, Neil Exter, Kevin Gillis, Lou Tartaglia, Craig Muir, Cary Pfeffer, Alexis Borisy and Craig Greaves. No stockholder, director, officer, manager, member or employee of TRV GP or TRV LLC has beneficial ownership (within the meaning of Rule 13d-3 promulgated under the Exchange Act) of any shares held by TRV LP.

(2) Consists of (i) 325,255 shares of common stock underlying shares of Series A-1 Convertible Preferred Stock, or Series A-1 Stock, and 162,124 shares of common stock underlying warrants to purchase Series A-1 Stock that are exercisable as of May 31, 2013 or will become exercisable within 60 days after such date, (ii) 624,021 shares of common stock underlying shares of Series A-2 Convertible Preferred Stock, or Series A-2 Stock, (iii) 935,783 shares of common stock underlying shares of Series B Stock and 15,152 shares of common stock underlying warrants to purchase Series B Stock that are exercisable as of May 31, 2013 or will become exercisable within 60 days after such date, (iv) 210,589 shares of common stock underlying shares of Series C Stock and (v) 158,709 shares of common stock underlying shares of Series D Stock. All shares are held directly by TVM V Life Science Ventures GmbH & Co. KG. ("TVM LSV V"). Its general partner TVM Capital, or TVM, and its authorized officers Axel Polack, Helmut Schuehsler, Alexandra Goll, Hubert Birner and Stefan Fischer may be deemed to share voting and dispositive power over the shares held by TVM LSV V. No stockholder, director, officer, manager, member or employee of TVM and no director, officer, manager, member or employee of TVM LSV V has beneficial ownership (within the meaning of Rule 13d-3 promulgated under the Exchange Act) of any shares held by TVM LSV V.

(3) Consists of (i) 1,017,341 shares of common stock underlying shares of Series D Stock held by Mag & Co. f/b/o Fidelity Contrafund: Fidelity Contrafund, (ii) 245,632 shares of common stock underlying shares of Series D Stock held by Mag & Co. f/b/o Fidelity Contrafund: Fidelity Advisor New Insights Fund, (iii) 514,996 shares of common stock underlying shares of Series D Stock held by Ball & Co. f/b/o Fidelity Mt. Vernon Street Trust: Fidelity Growth Company Fund, (iv) 28,244 shares of common stock underlying shares of Series D Stock held by Mag & Co. f/b/o Fidelity Select Portfolios: Biotechnology Portfolio, (v) 1,864 shares of common stock underlying shares of Series D Stock held by Bangle & Co f/b/o Fidelity Advisor Series VII: Fidelity Advisor Biotechnology Fund and (vi) 181,073 shares of common stock underlying shares of Series D Stock held by Sailboat & Co. f/b/o Fidelity Magellan Fund: Fidelity Magellan Fund. Each of these entities is a registered investment fund (each, a "Fund") advised by Fidelity Management & Research Company ("FMR Co."), a registered investment adviser under the Investment Advisers Act of 1940, as amended. The address of FMR Co., a wholly-owned subsidiary of FMR LLC and an investment adviser registered under Section 203 of the Investment Advisers Act of 1940 is 82 Devonshire Street, Boston, Massachusetts 02109. FMR LLC, through its control of FMR Co., Edward C. Johnson 3d, as Chairman of FMR LLC, and each Fund has power to dispose of the securities owned by such Fund. Neither FMR LLC nor Edward C. Johnson 3d has sole power to vote or direct the voting of the shares owned directly by each Fund, which power resides with each Fund's Board of Trustees.

(4) Consists of (i) 1,052,946 shares of common stock underlying shares of Series C Stock and (ii) 740,642 shares of common stock underlying shares of Series D Stock. All shares are held directly by ARCH Venture Fund VII, L.P. ("ARCH VII"). ARCH Venture Partners VII, L.P. (the "GPLP"), as the sole general partner of ARCH VII, may be deemed to beneficially own certain of the shares held of record by ARCH VII. The GPLP disclaims beneficial ownership of all shares held of record by ARCH VII in which the GPLP does not have an actual pecuniary interest. ARCH Venture Partners VII, LLC (the "GPLLC"), as the sole general partner of the GPLP, may be deemed to beneficially own certain of the shares held of record by ARCH VII. The GPLLC disclaims beneficial ownership of all shares held of record by ARCH VII in which it does not have an actual pecuniary interest. Keith Crandell, Clinton Bybee and Robert Nelsen are the managing directors of the GPLLC, and may be deemed to share voting and dispositive power over the shares held of record by ARCH VII. The managing directors disclaim beneficial ownership of all shares held of record by ARCH VII in which they do not have an actual pecuniary interest. Steven Gillis, one of our directors, owns an interest in GPLP. Mr. Gillis does not have voting or disposition authority over the shares held by ARCH VII.

(5) Consists of (i) 1,179,648 shares of common stock underlying shares of Series D Stock held by Clipperbay & Co. HG22 as nominee for SMALLCAP World Fund, Inc. and (ii) 375,700 shares of common stock underlying shares of Series D Stock held by Piping & Co. HG19 as nominee for American Funds Insurance Series—Global Small Capitalization Fund. Capital Research and Management Company serves as the investment adviser for SMALLCAP World Fund, Inc. and American Funds Insurance Series – Global Small Capitalization Fund. Capital Research and Management Company or its affiliates has voting and dispositive power of all of the shares held by these funds and may be deemed to be the beneficial owner for purposes of reporting requirements of the Exchange Act. Capital Research and Management Company, however, expressly disclaims that it is, in fact, the beneficial owner of such securities. Capital Research and Management Company is an investment adviser registered under the Investment Advisers Act of 1940.

(6) Consists of (i) 139,395 shares of common stock underlying shares of Series A-1 Stock and 87,314 shares of common stock underlying warrants to purchase Series A-1 Stock that are exercisable as of May 31, 2013 or will become exercisable within 60 days after such date, (ii) 331,158 shares of common stock underlying shares of Series A-2 Stock, (iii) 561,470 shares of common stock underlying shares of Series B Stock and 9,091 shares of common stock underlying warrants to purchase Series B Stock that are exercisable as of May 31, 2013 or will become exercisable within 60 days after such date, (iv) 70,196 shares of common stock underlying shares of Series C Stock and (v) 52,902 shares of common stock underlying shares of Series D Stock. All shares are held by Coöperative AAC LS U.A., or Coöperative. Forbion 1 Management B.V., or Forbion, the director of Coöperative, may be deemed to have voting and dispositive power over the shares held by Coöperative. Investment decisions with respect to the shares held by Coöperative can made by any two of the six duly authorized representatives of Coöperative, which comprise directors L.P.A. Bergstein, M.A. van Osch, H.A. Slootweg and proxy holders S.J.H. van Deventer, G.J. Mulder and C. Takke. No stockholder, director, officer, manager, member or employee of Coöperative or Forbion has beneficial ownership (within the meaning of Rule 13d-3 promulgated under the Exchange Act) of any shares held by Coöperative.

(7) Includes 99,789 shares of common stock underlying options that are exercisable as of May 31, 2013 or will become exercisable within 60 days after such date. Excludes 602,742 shares of common stock underlying options that are not exercisable within 60 days after such date.

(8) Consists of 4,734,248 shares of common stock into which the shares of preferred stock beneficially owned by Third Rock Ventures, L.P. are convertible. Dr. Tepper is a partner of Third Rock Ventures, L.P. and and is member of the investment committee of Third Rock Ventures GP, LP, the general partner of Third Rock Ventures, L.P., which may be deemed to having voting and dispositive power over the shares held by Third Rock Ventures, L.P. Dr. Tepper does not have beneficial ownership (within the meaning of Rule 13d-3 promulgated under the Exchange Act) of any shares held by Third Rock Ventures, L.P.

(9) Consists of (i) 2,254,357 shares of common stock into which the shares of preferred stock beneficially owned by TVM V Life Science Ventures GmbH & Co. KG are convertible and (ii) 177,276 shares of common stock underlying preferred stock warrants that are exercisable as of May 31, 2013 or will become exercisable within 60 days after such date. Dr. Polack is a managing limited partner of TVM V Life Science Ventures GmbH & Co. KG and may be deemed to have voting and investment power, jointly not solely, over the shares held by TVM V Life Science Ventures GmbH & Co. KG. Dr. Polack does not have beneficial ownership (within the meaning of Rule 13d-3 promulgated under the Exchange Act) of any shares held by TVM V Life Science Ventures GmbH & Co. KG.

(10) Consists of 1,793,588 shares of common stock into which the shares of preferred stock beneficially owned by ARCH Venture Fund II, L.P. are convertible. ARCH Venture Fund II, L.P. is an affiliated fund of ARCH Venture Partners. Dr. Gillis is a managing director with ARCH Venture Partners and owns an interest in ARCH Venture Partners VII, L.P. Dr. Gillis does not have voting or disposition authority over the shares held by ARCH Venture Fund II, L.P.

(11) Consists of (i) 1,155,121 shares of common stock into which the shares of preferred stock beneficially owned by Coöperative AAC LS U.A. are convertible and (ii) 96,405 shares of common stock underlying preferred stock warrants that are exercisable as of May 31, 2013 or will become exercisable within 60 days after such date. Dr. Mulder is a general partner, proxy holder and duly authorized representative of Coöperative AAC LS U.A. and has shared voting and dispositive power over the shares held by Coöperative AAC LS U.A. with its five other duly authorized representatives. Dr. Mulder does not have beneficial ownership (within the meaning of Rule 13d-3 promulgated under the Exchange Act) of any shares held by Coöperative AAC LS U.A.

(12) Consists of 36,848 shares of common stock underlying options that are exercisable as of May 31, 2013 or will become exercisable within 60 days after such date.

(13) Consists of 19,319 shares of common stock underlying options that are exercisable as of May 31, 2013 or will become exercisable within 60 days after such date.

(14) Consists of 124,207 shares of common stock underlying options that are exercisable as of May 31, 2013 or will become exercisable within 60 days after such date. Excludes 234,457 shares of common stock underlying options that are not exercisable within 60 days after such date.

(15) Consists of 55,688 shares of common stock underlying options that are exercisable as of May 31, 2013 or will become exercisable within 60 days after such date. Excludes 204,702 shares of common stock underlying options that are not exercisable within 60 days after such date.

(16) Includes (i) 273,681 shares of common stock underlying preferred stock warrants that are exercisable as of May 31, 2013 or will become exercisable within 60 days after such date and (ii) 503,219 shares of common stock underlying options that are exercisable as of May 31, 2013 or will become exercisable within 60 days after such date.

Description of capital stock

General

Upon completion of this offering, our authorized capital stock will consist of 125,000,000 shares of common stock, par value $0.01 per share, and 5,000,000 shares of preferred stock, par value $0.01 per share. The following description of our capital stock is intended as a summary only and is qualified in its entirety by reference to our amended and restated certificate of incorporation, or our certificate of incorporation, and amended and restated bylaws, or our by-laws, to be in effect at the closing of this offering, which are filed as exhibits to the registration statement, of which this prospectus forms a part, and to the applicable provisions of the Delaware General Corporation Law. We refer in this section to our amended and restated certificate of incorporation as our certificate of incorporation, and we refer to our amended and restated by-laws as our by-laws.

Common stock

As of May 31, 2013, there were 16,869,488 shares of our common stock outstanding, including 116,612 shares of unvested restricted stock subject to repurchase by us, held of record by 51 stockholders, and assuming the conversion of all outstanding shares of preferred stock for shares of our common stock. Based on shares outstanding as of May 31, 2013, upon completion of this offering, there will be 21,869,488 shares of our common stock outstanding.

Holders of our common stock are entitled to one vote for each share of common stock held of record for the election of directors and on all matters submitted to a vote of stockholders. Holders of our common stock are entitled to receive dividends ratably, if any, as may be declared by our board of directors out of legally available funds, subject to any preferential dividend rights of any preferred stock then outstanding. Upon our dissolution, liquidation or winding up, holders of our common stock are entitled to share ratably in our net assets legally available after the payment of all our debts and other liabilities, subject to the preferential rights of any preferred stock then outstanding. Holders of our common stock have no preemptive, subscription, redemption or conversion rights. The rights, preferences and privileges of holders of common stock are subject to, and may be adversely affected by, the rights of the holders of shares of any series of preferred stock that we may designate and issue in the future. Except as described below in “Anti-takeover effects of Delaware law, our certificate of incorporation and our by-laws,” a majority vote of common stockholders is generally required to take action under our certificate of incorporation and by-laws.

Preferred stock

Upon completion of this offering, our board of directors will be authorized, without action by the stockholders, to designate and issue up to an aggregate of 5,000,000 shares of preferred stock in one or more series. The board of directors can fix the rights, preferences and privileges of the shares of each series and any of its qualifications, limitations or restrictions. Our board of directors may authorize the issuance of preferred stock with voting or conversion rights that could adversely affect the voting power or other rights of the holders of common stock. The issuance of preferred stock, while providing flexibility in connection with possible future financings and acquisitions and other corporate purposes could, under certain circumstances, have the effect of delaying or preventing a change in control of our company and might harm the market price of our common stock.

Our board of directors will make any determination to issue such shares based on its judgment as to our best interests and the best interests of our stockholders. We have no current plans to issue any shares of preferred stock.

Certain of our stockholders hold, as of the date of this prospectus, 12,981,286 shares of our Series A-1 preferred stock, 22,304,324 shares of our Series A-2 preferred stock, 115,203,726 shares of our Series B preferred stock, 39,942,483 shares of our Series C preferred stock and 120,409,385 shares of our Series D preferred stock. Upon completion of this offering, each share of Series A-1, Series A-2, Series B, Series C and Series D preferred stock outstanding will be converted into our common stock on a 18.967-for-1 basis. Holders of substantially all of the shares of our preferred stock are subject to lock-up agreements with the underwriters that restrict the sale of our securities for 180 days following the date of this prospectus. See “Underwriting” for a description of these lock-up agreements

Warrants

As of March 31, 2013, warrants to purchase a total of 102,394 shares of our common stock were outstanding with a weighted average exercise price of $0.19 per share. These warrants expire beginning in March 2020.

As of March 31, 2013, warrants to purchase a total of 5,835,456 shares of our Series A-1 preferred stock were outstanding with an exercise price of $0.6619 per share. These warrants to purchase 5,835,456 Series A-1 preferred shares, which will be converted into warrants to purchase 307,648 shares of common stock with an exercise price of $12.55 per share upon completion of this offering, are exercisable immediately and expire beginning in November 2015 through April 2019.

As of March 31, 2013, warrants to purchase a total of 574,800 shares of our Series B preferred stock were outstanding with an exercise price of $0.3262 per share. These warrants to purchase 574,800 Series B preferred shares, which will be converted into warrants to purchase 30,304 shares of common stock with an exercise price of $6.19 per share upon completion of this offering, are exercisable immediately and expire in April 2019.

Registration rights

We entered into an amended and restated investors’ rights agreement, dated as of July 23, 2012, with the holders of shares of our common stock issuable upon conversion of the shares of preferred stock. These shares will represent approximately 74.4% of our outstanding common stock after this offering, or 71.9% if the underwriters exercise their option to purchase additional shares in full. These shares also may be sold under Rule 144 under the Securities Act of 1933, as amended, depending on their holding period and subject to restrictions in the case of shares held by persons deemed to be our affiliates.

Under the amended and restated investors’ rights agreement, holders of registrable shares can demand that we file a registration statement or request that their shares be included on a registration statement that we are otherwise filing, in either case, registering the resale of their shares of common stock. These registration rights are subject to conditions and limitations, including the right, in certain circumstances, of the underwriters of an offering to limit the number of shares included in such registration and our right, in certain circumstances, not to effect a requested S-1 registration within 60 days before or 180 days following any offering of our securities, including this offering or a requested S-3 registration within 30 days before or 90 days following any offering of our securities, including this offering.

Demand registration rights

Following the six-month anniversary of the date of this prospectus, the holders of at least a majority of the registrable shares may require us to file a registration statement under the Securities Act on a Form S-1 or S-3, if available, at our expense with respect to the resale of their registrable shares, and we are required to use our best efforts to effect the registration.

Piggyback registration rights

If we propose to register any of our securities under the Securities Act for our own account or the account of any other holder, the holders of registrable shares are entitled to notice of such registration and to request that we include registrable shares for resale on such registration statement, subject to the right of any underwriter to limit the number of shares included in such registration.

We will pay all registration expenses, other than underwriting discounts and commissions, related to any demand or piggyback registration. The amended and restated investors' rights agreement contains customary cross-indemnification provisions, pursuant to which we are obligated to indemnify the selling stockholders, in the event of misstatements or omissions in the registration statement attributable to us except in the event of fraud and they are obligated to indemnify us for misstatements or omissions attributable to them.

The registration rights will terminate upon the later of the date on which all registrable shares have been sold and the fifth anniversary of the closing date of this offering.

Voting agreement and right of first refusal and co-sale agreement

We entered into an amended and restated voting agreement and an amended and restated right of first refusal and co-sale agreement, each dated as of July 23, 2012, with all holders of our preferred stock and certain holders of our common stock. These agreements provide for certain rights and obligations, such as board composition requirements and stock transfer restrictions. These agreements will terminate upon the completion of this offering; however, the lock-up provision under the amended and restated right of first refusal and co-sale agreement will survive termination pursuant to the terms of the agreement. The lock-up provision under the investors' rights agreement shall also survive the completion of this offering. See "Shares eligible for future sales—Lock-up agreements."

Anti-takeover effects of Delaware law, our certificate of incorporation and our by-laws

Our certificate of incorporation and by-laws include a number of provisions that may have the effect of encouraging persons considering unsolicited tender offers or other unilateral takeover proposals to negotiate with our board of directors rather than pursue non-negotiated takeover attempts. These provisions include the items described below.

Board composition and filling vacancies

In accordance with our certificate of incorporation, our board is divided into three classes serving three-year terms, with one class being elected each year. Our certificate of incorporation also provides that directors may be removed only for cause and then only by the affirmative vote

of the holders of 75% or more of the shares then entitled to vote at an election of directors. Furthermore, any vacancy on our board of directors, however occurring, including a vacancy resulting from an increase in the size of our board, may only be filled by the affirmative vote of a majority of our directors then in office, even if less than a quorum.

No written consent of stockholders

Our certificate of incorporation provides that all stockholder actions are required to be taken by a vote of the stockholders at an annual or special meeting, and that stockholders may not take any action by written consent in lieu of a meeting.

Meetings of stockholders

Our by-laws provide that only a majority of the members of our board of directors then in office may call special meetings of stockholders and only those matters set forth in the notice of the special meeting may be considered or acted upon at a special meeting of stockholders. Our by-laws limit the business that may be conducted at an annual meeting of stockholders to those matters properly brought before the meeting.

Advance notice requirements

Our by-laws establish advance notice procedures with regard to stockholder proposals relating to the nomination of candidates for election as directors or new business to be brought before meetings of our stockholders. These procedures provide that notice of stockholder proposals must be timely given in writing to our corporate secretary prior to the meeting at which the action is to be taken. Generally, to be timely, notice must be received at our principal executive offices not less than 90 days or more than 120 days prior to the first anniversary date of the annual meeting for the preceding year. The notice must contain certain information specified in the by-laws. These provisions may have the effect of precluding the conduct of certain business at a meeting if the proper procedures are not followed. These provisions may also discourage or deter a potential acquirer from conducting a solicitation of proxies to elect the acquirer's own slate of directors or otherwise attempting to obtain control of our company.

Amendment to by-laws and certificate of Incorporation

As required by the Delaware General Corporation Law, any amendment of our certificate of incorporation must first be approved by a majority of our board of directors and, if required by law or our certificate of incorporation, thereafter be approved by a majority of the outstanding shares entitled to vote on the amendment, and a majority of the outstanding shares of each class entitled to vote thereon as a class, except that the amendment of the provisions relating to stockholder action, directors, limitation of liability, exclusive jurisdiction of Delaware Courts and the amendment of our by-laws and certificate of incorporation must be approved by not less than 75% of the outstanding shares entitled to vote on the amendment, and not less than 75% of the outstanding shares of each class entitled to vote thereon as a class. Our by-laws may be amended by the affirmative vote of a majority of the directors then in office, subject to any limitations set forth in the by-laws; and may also be amended by the affirmative vote of at least 75% of the outstanding shares entitled to vote on the amendment, or, if the board of directors recommends that the stockholders approve the amendment, by the affirmative vote of the majority of the outstanding shares entitled to vote on the amendment, in each case voting together as a single class.

Blank check preferred stock

Our certificate of incorporation provides for 5,000,000 authorized shares of preferred stock. The existence of authorized but unissued shares of preferred stock may enable our board of directors to render more difficult or to discourage an attempt to obtain control of us by means of a merger, tender offer, proxy contest or otherwise. For example, if in the due exercise of its fiduciary obligations, our board of directors were to determine that a takeover proposal is not in the best interests of us or our stockholders, our board of directors could cause shares of preferred stock to be issued without stockholder approval in one or more private offerings or other transactions that might dilute the voting or other rights of the proposed acquirer or insurgent stockholder or stockholder group. In this regard, our certificate of incorporation grants our board of directors broad power to establish the rights and preferences of authorized and unissued shares of preferred stock. The issuance of shares of preferred stock could decrease the amount of earnings and assets available for distribution to holders of shares of common stock. The issuance may also adversely affect the rights and powers, including voting rights, of these holders and may have the effect of delaying, deterring or preventing a change in control of us.

Section 203 of the Delaware General Corporation Law

Upon completion of this offering, we will be subject to the provisions of Section 203 of the Delaware General Corporation Law. In general, Section 203 prohibits a publicly-held Delaware corporation from engaging in a "business combination" with an "interested stockholder" for a three-year period following the time that this stockholder becomes an interested stockholder, unless the business combination is approved in a prescribed manner. A "business combination" includes, among other things, a merger, asset or stock sale or other transaction resulting in a financial benefit to the interested stockholder. An "interested stockholder" is a person who, together with affiliates and associates, owns, or did own within three years prior to the determination of interested stockholder status, 15% or more of the corporation's voting stock.

Under Section 203, a business combination between a corporation and an interested stockholder is prohibited unless it satisfies one of the following conditions:

- before the stockholder became interested, the board of directors approved either the business combination or the transaction which resulted in the stockholder becoming an interested stockholder;
- upon consummation of the transaction which resulted in the stockholder becoming an interested stockholder, the interested stockholder owned at least 85% of the voting stock of the corporation outstanding at the time the transaction commenced, excluding for purposes of determining the voting stock outstanding, shares owned by persons who are directors and also officers, and employee stock plans, in some instances; or
- at or after the time the stockholder became interested, the business combination was approved by the board of directors of the corporation and authorized at an annual or special meeting of the stockholders by the affirmative vote of at least two-thirds of the outstanding voting stock which is not owned by the interested stockholder.

A Delaware corporation may "opt out" of these provisions with an express provision in its original certificate of incorporation or an express provision in its certificate of incorporation or by-laws resulting from a stockholders' amendment approved by at least a majority of the outstanding voting shares. We have not opted out of these provisions. As a result, mergers or other takeover or change in control attempts of us may be discouraged or prevented.

Exclusive jurisdiction of certain actions

Our certificate of incorporation requires, to the fullest extent permitted by law, that derivative actions brought in our name, actions against our directors, officers and employees for breach of fiduciary duty and other similar actions may be brought only in the Court of Chancery in the State of Delaware, unless we otherwise consent. Although we believe this provision benefits us by providing increased consistency in the application of Delaware law in the types of lawsuits to which it applies, the provision may have the effect of discouraging lawsuits against our directors and officers.

Nasdaq Global Market listing

We have applied for listing of our common stock on The Nasdaq Global Market under the trading symbol “BLUE.”

Transfer agent and registrar

The transfer agent and registrar for our common stock is American Stock Transfer & Trust Company, LLC.

Shares eligible for future sale

Prior to this offering, there has been no public market for our common stock. Future sales of our common stock, including shares issued upon the exercise of outstanding options or warrants, in the public market after this offering, or the perception that those sales may occur, could cause the prevailing market price for our common stock to fall or impair our ability to raise equity capital in the future. As described below, only a limited number of shares of our common stock will be available for sale in the public market for a period of several months after completion of this offering due to contractual and legal restrictions on resale described below. Future sales of our common stock in the public market either before (to the extent permitted) or after restrictions lapse, or the perception that those sales may occur, could adversely affect the prevailing market price of our common stock at such time and our ability to raise equity capital at a time and price we deem appropriate.

Sale of restricted shares

As of May 31, 2013, based on the number of shares of our common stock then outstanding, upon the closing of this offering, including 116,612 shares of unvested restricted stock subject to repurchase by us, and assuming (1) the conversion of our outstanding preferred stock into common stock, (2) no exercise of the underwriters' option to purchase additional shares of common stock and (3) no exercise of outstanding options or warrants, we would have had outstanding an aggregate of approximately 21,869,488 shares of common stock. Of these shares, all of the 5,000,000 shares of common stock to be sold in this offering, and any shares sold upon exercise of the underwriters' option to purchase additional shares will be freely tradable in the public market without restriction or further registration under the Securities Act of 1933, as amended, or the Securities Act, unless the shares are held by any of our "affiliates" as such term is defined in Rule 144 of the Securities Act. All remaining shares of common stock held by existing stockholders immediately prior to the completion of this offering will be "restricted securities" as such term is defined in Rule 144. These restricted securities were issued and sold by us, or will be issued and sold by us, in private transactions and are eligible for public sale only if registered under the Securities Act or if they qualify for an exemption from registration under the Securities Act, including the exemptions provided by Rule 144 or Rule 701, which rules are summarized below.

As a result of the lock-up agreements referred to below and the provisions of Rule 144 and Rule 701 under the Securities Act, the shares of our common stock (excluding the shares sold in this offering) that will be available for sale in the public market are as follows:

Approximate Number of Shares	First Date Available for Sale into Public Market
	180 days after the date of this prospectus upon expiration of the lock-up agreements referred to below, subject in some cases to applicable volume limitations under Rule 144

Lock-up agreements

In connection with this offering, we, our directors, our executive officers and stockholders holding approximately 98.7% of our shares of common stock outstanding as of May 31, 2013 (assuming conversion of all of our outstanding shares of preferred stock), and substantially all of our option holders who are not also stockholders have agreed, subject to certain exceptions, with the underwriters not to dispose of or hedge any shares of our common stock or securities convertible into or exchangeable for shares of common stock during the period from the date of

the lock-up agreement continuing through the date 180 days after the date of this prospectus, except with the prior written consent of J.P. Morgan Securities LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated, together the representatives of the underwriters. The representatives of the underwriters have advised us that they have no current intent or arrangement to release any of the shares subject to the lock-up agreements prior to the expiration of the lock-up period.

Following the lock-up periods set forth in the agreements described above, and assuming that the representatives of the underwriters do not release any parties from these agreements, all of the shares of our common stock that are restricted securities or are held by our affiliates as of the date of this prospectus will be eligible for sale in the public market in compliance with Rule 144 under the Securities Act.

In addition, pursuant to each of our amended and restated investors' rights agreement and amended and restated right of first refusal and co-sale agreement, the parties thereto have agreed that, if requested in writing by the representatives of the underwriters of the initial public offering of our securities, they will not sell, make any short sale of, grant any option for the purchase of, or otherwise dispose of any shares of our stock during the same 180-day restricted period referred to above. We expect the representatives of the underwriters to invoke this written request prior to the completion of this offering and, accordingly, that the parties to these agreements will be subject to the related transaction restrictions.

As of the date of this prospectus, holders of approximately 16.7 million shares of common stock (including shares of our preferred stock that will be converted into shares of our common stock upon completion of this offering), or 98.9% of our outstanding shares of common stock on an as converted basis, are, collectively subject to lock-up restrictions as parties to these agreements or lock-up agreements with the underwriters.

Rule 144

In general, under Rule 144, as currently in effect, once we have been subject to the public company reporting requirements of the Securities Exchange Act of 1934, as amended, or the Exchange Act, for at least 90 days, a person (or persons whose shares are required to be aggregated) who is not deemed to have been one of our "affiliates" for purposes of Rule 144 at any time during the three months preceding a sale, and who has beneficially owned restricted securities within the meaning of Rule 144 for at least six months, including the holding period of any prior owner other than one of our "affiliates," is entitled to sell those shares in the public market (subject to the lock-up agreement referred to above, if applicable) without complying with the manner of sale, volume limitations or notice provisions of Rule 144, but subject to compliance with the public information requirements of Rule 144. If such a person has beneficially owned the sales proposed to be sold for at least one year, including the holding period of any prior owner other than "affiliates," then such person is entitled to sell such shares in the public market without complying with any of the requirements of Rule 144 (subject to the lock-up agreement referred to above, if applicable). In general, under Rule 144, as currently in effect, once we have been subject to the public company reporting requirements of the Exchange Act for at least 90 days, our "affiliates," as defined in Rule 144, who have beneficially owned the shares proposed to be sold for at least six months are entitled to sell in the public market, upon expiration of any applicable lock-up agreements and within any three-month period, a number of those shares of our common stock that does not exceed the greater of:

- one percent of the number of common shares then outstanding, which will equal approximately 2.2 million shares of common stock immediately after this offering

(calculated on the basis of the number of shares of our common stock outstanding as of May 31, 2013, the assumptions described above and assuming no exercise of the underwriter's option to purchase additional shares and no exercise of outstanding options or warrants); or

- the average weekly trading volume of our common stock on The Nasdaq Global Market during the four calendar weeks preceding the filing of a notice on Form 144 with respect to such sale.

Such sales under Rule 144 by our "affiliates" or persons selling shares on behalf of our "affiliates" are also subject to certain manner of sale provisions, notice requirements and to the availability of current public information about us. Notwithstanding the availability of Rule 144, the holders of substantially all of our restricted securities have entered into lock-up agreements as referenced above and their restricted securities will become eligible for sale (subject to the above limitations under Rule 144) upon the expiration of the restrictions set forth in those agreements.

Rule 701

In general, under Rule 701 as currently in effect, any of our employees, directors, officers, consultants or advisors who acquired common stock from us in connection with a written compensatory stock or option plan or other written agreement in compliance with Rule 701 under the Securities Act before the effective date of the registration statement of which this prospectus is a part (to the extent such common stock is not subject to a lock-up agreement) is entitled to rely on Rule 701 to resell such shares beginning 90 days after we become subject to the public company reporting requirements of the Exchange Act in reliance on Rule 144, but without compliance with the holding period requirements contained in Rule 144. Accordingly, subject to any applicable lock-up agreements, beginning 90 days after we become subject to the public company reporting requirements of the Exchange Act, under Rule 701 persons who are not our "affiliates," as defined in Rule 144, may resell those shares without complying with the minimum holding period or public information requirements of Rule 144, and persons who are our "affiliates" may resell those shares without compliance with Rule 144's minimum holding period requirements (subject to the terms of the lock-up agreement referred to below, if applicable).

Equity incentive plans

We intend to file with the Securities and Exchange Commission a registration statement under the Securities Act covering the shares of common stock that we may issue upon exercise of outstanding options reserved for issuance under the 2002 Employee, Director and Consultant Plan, the 2010 Stock Option and Grant Plan and the 2013 Stock Option and Incentive Plan. Such registration statement is expected to be filed and become effective as soon as practicable after the completion of this offering. Accordingly, shares registered under such registration statement will be available for sale in the open market following its effective date, subject to Rule 144 volume limitations and the lock-up agreements described above, if applicable.

Material U.S. federal income tax considerations for non-U.S. holders

The following is a summary of the material U.S. federal income tax considerations of the ownership and disposition of our common stock to non-U.S. holders. It is not intended to be a complete analysis of all the U.S. federal income tax considerations that may be relevant to non-U.S. holders. This summary is based upon the provisions of the Internal Revenue Code of 1986, as amended, or the Code, Treasury regulations promulgated thereunder, administrative rulings and judicial decisions, all as of the date hereof. These authorities may be changed, possibly with retroactive effect, which may result in U.S. federal income tax consequences different from those set forth below. We have not sought any ruling from the Internal Revenue Service, or the IRS, with respect to the statements made and the conclusions reached in the following summary. There can be no assurance that the IRS will agree with such statements and conclusions or that any contrary position taken by the IRS would not be sustained by a court.

This summary also does not address the tax considerations arising under the laws of any foreign, state or local jurisdiction. In addition, this discussion does not address tax considerations applicable to an investor's particular circumstances or to investors that may be subject to special tax rules, including, without limitation:

- banks, insurance companies or other financial institutions;
- persons subject to the alternative minimum tax;
- tax-exempt organizations;
- an integral part or controlled entity of a foreign sovereign;
- dealers in securities or currencies;
- traders in securities that elect to use a mark-to-market method of accounting for their securities holdings;
- persons that own, or are deemed to own, more than five percent of our capital stock (except to the extent specifically set forth below);
- controlled foreign corporations or passive foreign investment companies
- certain former citizens or long-term residents of the United States;
- persons who hold our common stock as a position in a hedging transaction, "straddle," "conversion transaction" or other risk reduction transaction;
- persons deemed to sell our common stock under the constructive sale provisions of the Code; or
- persons who hold our common stock other than as a capital asset (generally, an asset held for investment purposes).

If an entity that is classified as a partnership for U.S. federal income tax purposes holds our common stock, the tax treatment of persons treated as its partners for U.S. federal income tax purposes will generally depend upon the status of the partner and the activities of the partnership. Prospective investors that are classified as partnerships for U.S. federal income tax purposes and prospective investors that may hold our common stock through an entity classified as a partnership for U.S. federal income tax purposes, should consult their own tax advisors.

YOU ARE URGED TO CONSULT YOUR TAX ADVISOR WITH RESPECT TO THE APPLICATION OF THE UNITED STATES FEDERAL INCOME TAX LAWS TO YOUR PARTICULAR SITUATION, AS WELL AS ANY TAX CONSEQUENCES OF THE PURCHASE, OWNERSHIP AND DISPOSITION OF OUR COMMON STOCK ARISING UNDER THE UNITED STATES FEDERAL ESTATE OR GIFT TAX RULES OR UNDER THE LAWS OF ANY STATE, LOCAL, FOREIGN OR OTHER TAXING JURISDICTION OR UNDER ANY APPLICABLE TAX TREATY.

Non-U.S. holder defined

For purposes of this discussion, you are a non-U.S. holder if you are a holder that, for U.S. federal income tax purposes, is not a U.S. person or a partnership. For purposes of this discussion, you are a U.S. person if you are:

- an individual citizen or resident of the United States;
- a corporation or other entity taxable as a corporation created or organized in the United States or under the laws the United States or any political subdivision thereof;
- an estate whose income is subject to U.S. federal income tax regardless of its source; or
- a trust (a) if a court within the United States is able to exercise primary jurisdiction over the administration of the trust and one or more U.S. persons have the authority to control all substantial decisions of the trust or (b) that has made an election to be treated as a U.S. person.

Distributions

We have not made any distributions on our common stock and do not plan to make any distributions for the foreseeable future. However, if we do make distributions on our common stock, those payments will constitute dividends for U.S. tax purposes to the extent paid from our current or accumulated earnings and profits, as determined under U.S. federal income tax principles. To the extent those distributions exceed both our current and our accumulated earnings and profits, they will constitute a return of capital and will first reduce your basis in our common stock, but not below zero, and then will be treated as gain from the sale of stock, which will be subject to tax as described in “Gain on Disposition of Common Stock,” below.

Any dividend paid to you generally will be subject to U.S. withholding tax either at a rate of 30% of the gross amount of the dividend or such lower rate as may be specified by an applicable income tax treaty. In order to receive a reduced treaty rate, you must provide us with an IRS Form W-8BEN or other appropriate version of IRS Form W-8 certifying qualification for the reduced rate.

Dividends received by you that are effectively connected with your conduct of a U.S. trade or business are exempt from such withholding tax. In order to obtain this exemption, you must provide us with an IRS Form W-8ECI properly certifying such exemption. Such effectively connected dividends, although not subject to withholding tax, are taxed at the same graduated rates applicable to U.S. persons, net of certain deductions and credits. In addition, if you are a corporate non-U.S. holder, dividends you receive that are effectively connected with your conduct of a U.S. trade or business may also be subject to a “branch profits tax” at a rate of 30% or such lower rate as may be specified by an applicable income tax treaty.

If you are eligible for a reduced rate of withholding tax pursuant to a tax treaty, you may obtain a refund of any excess amounts withheld if you file an appropriate claim for refund with the IRS in a timely manner.

Gain on disposition of common stock

You generally will not be required to pay U.S. federal income tax on any gain realized upon the sale or other disposition of our common stock unless:

- the gain is effectively connected with your conduct of a U.S. trade or business;
- you are an individual non-U.S. holder who holds our common stock as a capital asset, who is present in the United States for a period or periods aggregating 183 days or more during the calendar year in which the sale or disposition occurs and certain other conditions are met; or
- our common stock constitutes a "U.S. real property interest" by reason of our status as a "United States real property holding corporation" for U.S. federal income tax purposes, or a USRPHC, at any time within the shorter of the five-year period preceding the disposition or your holding period for our common stock.

If you are a non-U.S. holder described in the first bullet above, you will be required to pay tax on the net gain derived from the sale under regular graduated U.S. federal income tax rates. Corporate non-U.S. holders described in the first bullet above may be subject to the "branch profits tax" at a 30% rate or such lower rate as may be specified by an applicable income tax treaty. If you are an individual non-U.S. holder described in the second bullet above, you will be required to pay a flat 30% tax on the gain derived from the sale, which may be offset by U.S.-source capital losses (even though you are not considered a resident of the United States). You should consult any applicable income tax or other treaties, which may provide different rules.

We believe that we are not currently and do not anticipate becoming a USRPHC. However, because the determination of whether we are a USRPHC depends on the fair market value of our U.S. real property relative to the fair market value of our other business assets, there can be no assurance that we will not become a USRPHC in the future. Even if we become a USRPHC, however, as long as our common stock is treated for federal income tax purposes as regularly traded on an established securities market during the applicable calendar year, such common stock will not be treated as "U.S. real property interests" unless you actually or constructively hold more than five percent of such regularly traded common stock at any time during the shorter of the five-year period preceding the disposition or your holding period for our common stock. However, no assurance can be provided that our common stock will be treated as regularly traded on an established securities market for purposes of the rules described above. If we were treated as a USRPHC during the applicable period and the exception described above did not apply, gain on the sale or other taxable disposition of our stock will be subject to tax in the same manner as gain that is effectively connected with the conduct of a U.S. trade or business, except that the "branch profits tax" will not apply.

Backup withholding and information reporting

Generally, we must report annually to the IRS the amount of dividends paid to you, your name and address, and the amount of tax withheld, if any. A similar report will be sent to you. Pursuant to applicable income tax treaties or other agreements, the IRS may make these reports available to tax authorities in your country of residence.

Payments of dividends or of proceeds on the disposition of stock made to you may be subject to information reporting and backup withholding (currently at a rate of 28%) unless you establish an exemption, for example by properly certifying your non-U.S. status on a Form W-8BEN or another appropriate version of IRS Form W-8. Notwithstanding the foregoing, backup withholding and information reporting may apply if either we or our paying agent has actual knowledge, or reason to know, that you are a U.S. person.

Backup withholding is not an additional tax; rather, the U.S. income tax liability of persons subject to backup withholding will be reduced by the amount of tax withheld. If withholding results in an overpayment of taxes, a refund or credit may be obtained, provided that the required information is furnished to the IRS in a timely manner.

FATCA withholding and information reporting

Legislation enacted in March 2010, commonly referred to as FATCA, will impose United States federal withholding at a rate of 30% on payments to certain non-U.S. entities (including financial intermediaries), including dividends on and the gross proceeds from dispositions of our common stock, unless various information reporting and due diligence requirements, which are different from and in addition to the certification requirements described elsewhere in this discussion, have been satisfied (generally relating to ownership by U.S. persons of interests in or accounts with those entities). The withholding rules applicable to payments of dividends on our common stock will be phased in beginning January 1, 2014. The withholding rules will apply to gross proceeds from dispositions of U.S. common stock beginning January 1, 2017. Although Treasury regulations implementing FATCA were recently finalized, these rules remain unclear in several respects and are subject to material changes. Prospective investors should consult their tax advisors regarding the possible implications of FATCA on their investment in our common stock.

Underwriting

We are offering the shares of common stock described in this prospectus through a number of underwriters. J.P. Morgan Securities LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated are acting as joint book-running managers of the offering and as representatives of the underwriters. We have entered into an underwriting agreement with the underwriters. Subject to the terms and conditions of the underwriting agreement, we have agreed to sell to the underwriters, and each underwriter has severally agreed to purchase, at the public offering price less the underwriting discounts and commissions set forth on the cover of this prospectus, the number of shares of common stock listed next to its name in the following table:

Name	Number of shares
J.P. Morgan Securities LLC	
Merrill Lynch, Pierce, Fenner & Smith Incorporated	
Cowen and Company, LLC	
Canaccord Genuity Inc.	
Wedbush Securities Inc.	
Total	

The underwriters are committed to purchase all the shares of common stock offered by us if they purchase any shares. The underwriting agreement also provides that if an underwriter defaults, the purchase commitments of non-defaulting underwriters may also be increased or the offering may be terminated.

The underwriters propose to offer the shares of common stock directly to the public at the initial public offering price set forth on the cover of this prospectus and to certain dealers at that price less a concession not in excess of $ per share. Any such dealers may resell shares to certain other brokers or dealers at a discount of up to $ per share from the initial public offering price. After the initial public offering of the shares, the offering price and other selling terms may be changed by the underwriters. Sales of shares made outside of the United States may be made by affiliates of the underwriters.

The underwriters have an option to buy up to 750,000 additional shares of common stock from us to cover sales of shares by the underwriters which exceed the number of shares specified in the table above. The underwriters have 30 days from the date of this prospectus to exercise this option to purchase additional shares. If any shares are purchased with this option to purchase additional shares, the underwriters will purchase shares in approximately the same proportion as shown in the table above. If any additional shares of common stock are purchased, the underwriters will offer the additional shares on the same terms as those on which the shares are being offered.

The underwriting fee is equal to the public offering price per share of common stock less the amount paid by the underwriters to us per share of common stock. The underwriting fee is $ per share. The following table shows the per share and total underwriting discounts and commissions to be paid to the underwriters assuming both no exercise and full exercise of the underwriters' option to purchase additional shares.

	Without exercise of option to purchase additional shares	With full exercise of option to purchase additional shares
Per share	$	$
Total	$	$

We estimate that the total expenses of this offering, including registration, filing and listing fees, printing fees and legal and accounting expenses, but excluding the underwriting discounts and commissions, will be approximately $3.0 million. We have agreed to reimburse the underwriters for all expenses relating to the clearance of this offering with the Financial Industry Regulatory Authority (in an amount not to exceed $20,000).

A prospectus in electronic format may be made available on the web sites maintained by one or more underwriters, or selling group members, if any, participating in the offering. The underwriters may agree to allocate a number of shares to underwriters and selling group members for sale to their online brokerage account holders. Internet distributions will be allocated by the representatives to underwriters and selling group members that may make Internet distributions on the same basis as other allocations.

We have agreed that we will not (i) offer, pledge, sell, contract to sell, sell any option or contract to purchase, purchase any option or contract to sell, grant any option, right or warrant to purchase, or otherwise transfer or dispose of, directly or indirectly, or file with the Securities and Exchange Commission a registration statement under the Securities Act of 1933, as amended (the "Securities Act"), relating to, any shares of our common stock or any securities convertible into or exchangeable or exercisable for any shares of our common stock, or publicly disclose the intention to make any offer, sale, pledge, disposition or filing, or (ii) enter into any swap or other arrangement that transfers all or a portion of the economic consequences associated with the ownership of any shares of our common stock or any such other securities (regardless of whether any of these transactions are to be settled by the delivery of shares of our common stock or such other securities, in cash or otherwise), in each case without the prior written consent of J.P. Morgan Securities LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated for a period of 180 days after the date of this prospectus, other than the shares of our common stock to be sold hereunder and any shares of our common stock issued upon the exercise of options granted under our existing management incentive plans.

Our directors and executive officers, and certain of our significant shareholders have entered into lock-up agreements with the underwriters prior to the commencement of this offering pursuant to which each of these persons or entities, with limited exceptions, for a period of 180 days after the date of this prospectus, may not, without the prior written consent of J.P. Morgan Securities LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated, (1) offer, pledge, sell, contract to sell, sell any option or contract to purchase, purchase any option or contract to sell, grant any option, right or warrant to purchase, or otherwise transfer or dispose of, directly

or indirectly, any shares of our common stock or any securities convertible into or exercisable or exchangeable for our common stock (including without limitation, common stock or such other securities which may be deemed to be beneficially owned by such directors, executive officers and shareholders in accordance with the rules and regulations of the Securities and Exchange Commission and securities which may be issued upon exercise of a stock option or warrant), or publicly disclose the intention to make any offer, sale, pledge or disposition, (2) enter into any swap or other agreement that transfers, in whole or in part, any of the economic consequences of ownership of our common stock or such other securities, whether any such transaction described in clause (1) or (2) above is to be settled by delivery of common stock or such other securities, in cash or otherwise or (3) make any demand for or exercise any right with respect to the registration of any shares of our common stock or any security convertible into or exercisable or exchangeable for our common stock.

We have agreed to indemnify the underwriters against certain liabilities, including liabilities under the Securities Act of 1933, as amended.

We have applied to have our common stock approved for listing/quotation on The Nasdaq Global Market under the symbol “BLUE.”

In connection with this offering, the underwriters may engage in stabilizing transactions, which involves making bids for, purchasing and selling shares of common stock in the open market for the purpose of preventing or retarding a decline in the market price of the common stock while this offering is in progress. These stabilizing transactions may include making short sales of the common stock, which involves the sale by the underwriters of a greater number of shares of common stock than they are required to purchase in this offering, and purchasing shares of common stock on the open market to cover positions created by short sales. Short sales may be “covered” shorts, which are short positions in an amount not greater than the underwriters’ option to purchase additional shares referred to above, or may be “naked” shorts, which are short positions in excess of that amount. The underwriters may close out any covered short position either by exercising their option to purchase additional shares, in whole or in part, or by purchasing shares in the open market. In making this determination, the underwriters will consider, among other things, the price of shares available for purchase in the open market compared to the price at which the underwriters may purchase shares through the option to purchase additional shares. A naked short position is more likely to be created if the underwriters are concerned that there may be downward pressure on the price of the common stock in the open market that could adversely affect investors who purchase in this offering. To the extent that the underwriters create a naked short position, they will purchase shares in the open market to cover the position.

The underwriters have advised us that, pursuant to Regulation M of the Securities Act, they may also engage in other activities that stabilize, maintain or otherwise affect the price of the common stock, including the imposition of penalty bids. This means that if the representatives of the underwriters purchase common stock in the open market in stabilizing transactions or to cover short sales, the representatives can require the underwriters that sold those shares as part of this offering to repay the underwriting discount received by them.

These activities may have the effect of raising or maintaining the market price of the common stock or preventing or retarding a decline in the market price of the common stock, and, as a result, the price of the common stock may be higher than the price that otherwise

might exist in the open market. If the underwriters commence these activities, they may discontinue them at any time. The underwriters may carry out these transactions on The Nasdaq Global Market, in the over-the-counter market or otherwise.

Prior to this offering, there has been no public market for our common stock. The initial public offering price will be determined by negotiations between us and the representatives of the underwriters. In determining the initial public offering price, we and the representatives of the underwriters expect to consider a number of factors including:

- the information set forth in this prospectus and otherwise available to the representatives;
- our prospects and the history and prospects for the industry in which we compete;
- an assessment of our management;
- our prospects for future earnings;
- the general condition of the securities markets at the time of this offering;
- the recent market prices of, and demand for, publicly traded common stock of generally comparable companies; and
- other factors deemed relevant by the underwriters and us.

Neither we nor the underwriters can assure investors that an active trading market will develop for our common shares, or that the shares will trade in the public market at or above the initial public offering price.

Other than in the United States, no action has been taken by us or the underwriters that would permit a public offering of the securities offered by this prospectus in any jurisdiction where action for that purpose is required. The securities offered by this prospectus may not be offered or sold, directly or indirectly, nor may this prospectus or any other offering material or advertisements in connection with the offer and sale of any such securities be distributed or published in any jurisdiction, except under circumstances that will result in compliance with the applicable rules and regulations of that jurisdiction. Persons into whose possession this prospectus comes are advised to inform themselves about and to observe any restrictions relating to the offering and the distribution of this prospectus. This prospectus does not constitute an offer to sell or a solicitation of an offer to buy any securities offered by this prospectus in any jurisdiction in which such an offer or a solicitation is unlawful.

This document is only being distributed to and is only directed at (i) persons who are outside the United Kingdom or (ii) investment professionals falling within Article 19(5) of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005, or the Order, or (iii) high net worth entities, and other persons to whom it may lawfully be communicated, falling with Article 49(2)(a) to (d) of the Order (all such persons together being referred to as “relevant persons”). The securities are only available to, and any invitation, offer or agreement to subscribe, purchase or otherwise acquire such securities will be engaged in only with, relevant persons. Any person who is not a relevant person should not act or rely on this document or any of its contents.

In relation to each Member State of the European Economic Area which has implemented the Prospectus Directive, each, a Relevant Member State, from and including the date on which the European Union Prospectus Directive, or the EU Prospectus Directive, was implemented in that Relevant Member State, or the Relevant Implementation Date, an offer of securities

described in this prospectus may not be made to the public in that Relevant Member State prior to the publication of a prospectus in relation to the shares which has been approved by the competent authority in that Relevant Member State or, where appropriate, approved in another Relevant Member State and notified to the competent authority in that Relevant Member State, all in accordance with the EU Prospectus Directive, except that, with effect from and including the Relevant Implementation Date, an offer of securities described in this prospectus may be made to the public in that Relevant Member State at any time:

- to any legal entity which is a qualified investor as defined under the EU Prospectus Directive;
- to fewer than 100 or, if the Relevant Member State has implemented the relevant provision of the 2010 PD Amending Directive, 150 natural or legal persons (other than qualified investors as defined in the EU Prospectus Directive); or
- in any other circumstances falling within Article 3(2) of the EU Prospectus Directive, provided that no such offer of securities described in this prospectus shall result in a requirement for the publication by us of a prospectus pursuant to Article 3 of the EU Prospectus Directive.

For the purposes of this provision, the expression an ‘‘offer of securities to the public’’ in relation to any securities in any Relevant Member State means the communication in any form and by any means of sufficient information on the terms of the offer and the securities to be offered so as to enable an investor to decide to purchase or subscribe for the securities, as the same may be varied in that Member State by any measure implementing the EU Prospectus Directive in that Member State. The expression “EU Prospectus Directive” means Directive 2003/71/EC (and any amendments thereto, including the 2010 PD Amending Directive, to the extent implemented in the Relevant Member State) and includes any relevant implementing measure in each Relevant Member State, and the expression “2010 PD Amending Directive” means Directive 2010/73/EU.

Certain of the underwriters and their affiliates have provided in the past to us and our affiliates and may provide from time to time in the future certain commercial banking, financial advisory, investment banking and other services for us and such affiliates in the ordinary course of their business, for which they have received and may continue to receive customary fees and commissions. In addition, from time to time, certain of the underwriters and their affiliates may effect transactions for their own account or the account of customers, and hold on behalf of themselves or their customers, long or short positions in our debt or equity securities or loans, and may do so in the future.

Notice to prospective investors in Switzerland

The shares may not be publicly offered in Switzerland and will not be listed on the SIX Swiss Exchange, or the SIX, or on any other stock exchange or regulated trading facility in Switzerland. This document has been prepared without regard to the disclosure standards for issuance prospectuses under art. 652a or art. 1156 of the Swiss Code of Obligations or the disclosure standards for listing prospectuses under art. 27 ff. of the SIX Listing Rules or the listing rules of any other stock exchange or regulated trading facility in Switzerland. Neither this prospectus nor any other offering or marketing material relating to the shares or the offering may be publicly distributed or otherwise made publicly available in Switzerland.

Neither this prospectus nor any other offering or marketing material relating to the offering, the Company, the shares have been or will be filed with or approved by any Swiss regulatory authority. In particular, this document will not be filed with, and the offer of shares will not be supervised by, the Swiss Financial Market Supervisory Authority FINMA, and the offer of shares has not been and will not be authorized under the Swiss Federal Act on Collective Investment Schemes, or the CISA. The investor protection afforded to acquirers of interests in collective investment schemes under the CISA does not extend to acquirers of shares.

Notice to prospective investors in the Dubai International Financial Centre

This prospectus relates to an Exempt Offer in accordance with the Offered Securities Rules of the Dubai Financial Services Authority, or the DFSA. This prospectus is intended for distribution only to persons of a type specified in the Offered Securities Rules of the DFSA. It must not be delivered to, or relied on by, any other person. The DFSA has no responsibility for reviewing or verifying any documents in connection with Exempt Offers. The DFSA has not approved this prospectus nor taken steps to verify the information set forth herein and has no responsibility for the prospectus. The shares to which this prospectus relates may be illiquid and/or subject to restrictions on their resale. Prospective purchasers of the shares offered should conduct their own due diligence on the shares. If you do not understand the contents of this prospectus you should consult an authorized financial advisor.

Legal matters

The validity of the issuance of our common stock offered in this prospectus will be passed upon for us by Goodwin Procter LLP, Boston, Massachusetts. Certain legal matters in connection with this offering will be passed upon for the underwriters by Ropes & Gray LLP, Boston, Massachusetts.

Experts

The consolidated financial statements as of December 31, 2011, and for the year then ended, appearing in this Prospectus and Registration Statement have been audited by McGladrey LLP, an independent registered public accounting firm, as stated in their report appearing elsewhere herein, and are included in reliance upon such report and upon the authority of such firm as experts in accounting and auditing.

The consolidated financial statements of bluebird bio, Inc. at December 31, 2012, and for the year then ended, appearing in this Prospectus and Registration Statement have been audited by Ernst & Young LLP, independent registered public accounting firm, as set forth in their report thereon appearing elsewhere herein, and are included in reliance upon such report given on the authority of such firm as experts in accounting and auditing.

Where you can find more information

We have filed with the Securities and Exchange Commission, or SEC, a registration statement on Form S-1, or the registration statement, under the Securities Act of 1933, as amended, with respect to the shares of common stock offered hereby. This prospectus, which constitutes a part of the registration statement, does not contain all of the information set forth in the registration statement or the exhibits and schedules filed therewith. For further information with respect to bluebird bio, Inc. and the common stock offered hereby, reference is made to the registration statement and the exhibits and schedules filed therewith. Statements contained in this prospectus regarding the contents of any contract or any other document that is filed as an exhibit to the registration statement are not necessarily complete, and each such statement is qualified in all respects by reference to the full text of such contract or other document filed as an exhibit to the registration statement. A copy of the registration statement and the exhibits and schedules filed therewith may be inspected without charge at the public reference room maintained by the SEC, located at 100 F Street N.E., Washington, D.C. 20549, and copies of all or any part of the registration statement may be obtained from such offices upon the payment of the fees prescribed by the SEC. Please call the SEC at 1-800-SEC-0330 for further information about the public reference room. The SEC also maintains a website that contains reports, proxy and information statements and other information regarding registrants that file electronically with the SEC. The address is www.sec.gov.

Upon completion of this offering, we will become subject to the information and periodic reporting requirements of the Securities Exchange Act of 1934, as amended, and, in accordance therewith, will file periodic reports, proxy statements and other information with the SEC. Such periodic reports, proxy statements and other information will be available for inspection and copying at the public reference room and website of the SEC referred to above. We maintain a website at www.bluebirdbio.com. The reference to our website address does not constitute incorporation by reference of the information contained on our website, and you should not consider the contents of our website in making an investment decision with respect to our common stock.

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Glossary

AAV	adeno-associated virus
ACALD	adult cerebral adrenoleukodystrophy, a type of ALD that develops in males 15 years or older
ALD	adrenoleukodystrophy, a rare X-linked, inherited, neurological disorder caused by mutations in the ABCD1 gene
ALDP	ALD protein, a protein that plays a critical role in the breakdown and metabolism of VLCFA
AMN	adrenomyeloneuropathy, the most common form of ALD, typically developing in adults 21 years or older
ANSM	l'agence nationale de sécurité du médicament et des produits de santé (France)
BLA	Biologics License Application
CAR	chimeric antigen receptor
CBER	FDA Center for Biologics Evaluation and Research
CCALD	childhood cerebral adrenoleukodystrophy, the most severe form of ALD, typically developing in boys between ages of 3 and 15
CIRM	California Institute for Regenerative Medicine
CMC	chemical, manufacturing and control
CMS	Centers for Medicare & Medicaid Services, an agency within the U.S. Department of Health and Human Services
CRO	contract research organization
CTA	clinical trial application
CTGTAC	Cellular, Tissue and Gene Therapies Advisory Committee
DNA	deoxyribonucleic acid,
EMA	European Medicines Agency
FDA	U.S. Food and Drug Administration
GCP	good clinical practices
GLP	good laboratory practices
GMP	good manufacturing practices
GTP	good tissue practices
GVHD	graft-versus-host disease
HCT/P	human cells, tissues, and cellular and tissue based product
HIV-1	Human Immunodeficiency Virus Type 1
HLA	Human-Leukocyte-Antigen
HSC	hematopoietic stem cell
HSCT	hematopoietic stem cell transplant, an approach of treating a patient with HSCs contributed by a donor that contain a functioning copy of the gene underlying the disease.
IBC	institutional biosafety commitee
IND	Investigational New Drug application
Inserm	institut national de la santé et de la recherché médicale (France), or the French Institute of Health and Medical Research
IRB	institutional review board
IVIM	in vitro immortalization
MAA	Marketing Authorization Application
MFDs	major functional disabilities
MHRA	Medicines and Healthcare Products Regulatory Agency (United Kingdom)

MRI	magnetic resonance imaging
NDA	new drug application
NFS	Neurological Function Score
NIH	U.S. National Institutes of Health
OBA	NIH Office of Biotechnology Activities
OCTGT	FDA Office of Cellular, Tissue and Gene Therapies
PDCO	EMA Pediatric Committee
PIP	Pediatric Investigation Plan
RAC	NIH Office of Biotechnology Activities' Recombinant DNA Advisory Committee
RBC	red blood cell
REMS	Risk Evaluation and Mitigation Strategy
SCD	sickle cell disease
TTCF	ten tray cell factories
VLCFA	very long-chain fatty acids

bluebird bio, Inc.
Index to consolidated financial statements

Report of independent registered public accounting firm

The Board of Directors and Stockholders

bluebird bio, Inc.

We have audited the accompanying consolidated balance sheet of bluebird bio, Inc. as of December 31, 2012 and the related consolidated statement of operations and comprehensive loss, convertible preferred stock and stockholders' (deficit) equity, and cash flows for the year then ended. These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on these financial statements based on our audit.

We conducted our audit in accordance with the standards of the Public Company Accounting Oversight Board (United States). Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. We were not engaged to perform an audit of the Company's internal control over financial reporting. Our audit included consideration of internal control over financial reporting as a basis for designing audit procedures that are appropriate in the circumstances, 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. An audit also includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements, assessing the accounting principles used and significant estimates made by management, and evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

In our opinion, the financial statements referred to above present fairly, in all material respects, the consolidated financial position of bluebird bio, Inc. at December 31, 2012, and the consolidated results of its operations and its cash flows for the year then ended, in conformity with U.S. generally accepted accounting principles.

/s/ Ernst & Young LLP

Boston, Massachusetts
March 21, 2013, except for Note 16(B)
as to which the date is June 3, 2013

Report of independent registered public accounting firm

The Board of Directors and Stockholders of
bluebird bio, Inc.
Cambridge, Massachusetts

We have audited the accompanying consolidated balance sheet of bluebird bio, Inc. as of December 31, 2011, and the related consolidated statements of operations and comprehensive loss, convertible preferred stock and stockholders' deficit, and cash flows for the year then ended. These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on these financial statements based on our audit.

We conducted our audit in accordance with the standards of the Public Company Accounting Oversight Board (United States). Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. The Company is not required to have, nor were we engaged to perform, an audit of its internal control over financial reporting. Our audit included consideration of internal control over financial reporting as a basis for designing audit procedures that are appropriate in the circumstances, 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. An audit also includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements, assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of bluebird bio, Inc. as of December 31, 2011, and the results of its operations and its cash flows for the year then ended, in conformity with U.S. generally accepted accounting principles.

/s/ McGladrey LLP

Boston, Massachusetts
March 21, 2013 (June 3, 2013 for Note 16 (B)).

bluebird bio, Inc.
Consolidated balance sheets
(In thousands, except per share data)

	December 31,			Pro forma March 31,
	2011	2012	2013	2013
		Actual	(unaudited)	
Assets				
Current assets:				
Cash and cash equivalents	$ 25,604	$ 67,011	$131,836	$131,836
Marketable securities	3,507	—	—	—
Prepaid expenses and other current assets	869	773	3,253	3,253
Total current assets	29,980	67,784	135,089	135,089
Property and equipment, net	728	1,288	2,120	2,120
Restricted cash	210	250	250	250
Total assets	$ 30,918	$ 69,322	$137,459	$137,459
Liabilities, convertible preferred stock, and stockholders' (deficit) equity				
Current liabilities:				
Accounts payable	$ 1,793	$ 2,173	$ 2,227	$ 2,227
Accrued expenses and other current liabilities	760	2,115	2,132	2,132
Deferred revenue, current portion	340	340	25,340	25,340
Total current liabilities	2,893	4,628	29,699	29,699
Warrant liability	637	215	256	—
Deferred rent, net of current portion	13	46	46	46
Deferred revenue, net of current portion	679	340	49,213	49,213
Total liabilities	4,222	5,229	79,214	78,958
Commitments and contingencies *(Note 8)*				
Series A-1 convertible preferred stock, $0.01 par value, 18,817 shares authorized; 12,981 shares issued and outstanding at December 31, 2011, and no shares issued and outstanding pro forma (unaudited)	9,217	—	—	—
Series A-2 convertible preferred stock, $0.01 par value, 22,304 shares authorized; 22,304 shares issued and outstanding at December 31, 2011 and 2012 and March 31, 2013 (unaudited), and no shares issued and outstanding pro forma (unaudited) (aggregate liquidation preference of $12,843)	15,837	7,137	7,137	—
Series B convertible preferred stock, $0.01 par value, 115,779 shares authorized; 115,204 shares issued and outstanding at December 31, 2011 and 2012 and March 31, 2013 (unaudited), and no shares issued and outstanding pro forma (unaudited) (aggregate liquidation preference of $56,369)	41,495	40,321	40,321	—
Series C convertible preferred stock, $0.01 par value, 39,943 shares authorized; 39,943 shares issued and outstanding at December 31, 2011 and 2012 and March 31, 2013 (unaudited), and no shares issued and outstanding pro forma (unaudited) (aggregate liquidation preference of $15,000)	15,854	12,382	12,382	—
Series D convertible preferred stock, $0.01 par value, 120,409 shares authorized; no shares, 120,409 and 120,409 shares issued and outstanding at December 31, 2011 and 2012 and March 31, 2013 (unaudited), respectively, and no shares issued and outstanding pro forma (unaudited) (aggregate liquidation preference of $60,000)	—	60,000	60,000	—
Stockholders' (deficit) equity:				
Series A-1 convertible preferred stock, $0.01 par value, 18,817 shares authorized; 12,981 shares issued and outstanding at December 31, 2012 and March 31, 2013 (unaudited), and no shares issued and outstanding pro forma (unaudited) (no liquidation preference)	—	2,337	2,337	—
Common stock,$0.01 par value, 21,511 shares authorized; 205, 309, and 348 shares issued and outstanding at December 31, 2011 and 2012 and March 31, 2013 (unaudited), respectively, and 16,737 shares issued and outstanding pro forma (unaudited)	2	3	3	167
Additional paid-in capital	7,732	15,267	15,963	138,232
Accumulated other comprehensive income	1	—	—	—
Accumulated deficit	(63,442)	(73,354)	(79,898)	(79,898)
Total stockholders' (deficit) equity	(55,707)	(55,747)	(61,595)	58,501
Total liabilities, convertible preferred stock and stockholders' (deficit) equity	$ 30,918	$ 69,322	$137,459	$137,459

See accompanying notes to consolidated financial statements.

bluebird bio, Inc.
Consolidated statements of operations and comprehensive loss
(In thousands, except per share data)

	Year ended December 31,		Three months ended March 31,	
	2011	2012	2012	2013
			(unaudited)	
Revenue:				
Collaboration revenue	$ —	$ —	$ —	$ 1,042
Research and license fees	640	340	85	85
Grant revenue	242	—	—	—
Total revenue	882	340	85	1,127
Expenses:				
Research and development	11,409	17,210	3,858	5,284
General and administrative	4,615	6,846	1,363	2,324
Total expenses	16,024	24,056	5,221	7,608
Loss from operations	(15,142)	(23,716)	(5,136)	(6,481)
Other (expense) income, net:				
Interest income	5	5	1	3
Foreign currency (losses) gains	(100)	13	8	(25)
Re-measurement of warrants	(361)	28	59	(41)
Other (expense) income, net	(456)	46	68	(63)
Net loss	$(15,598)	$(23,670)	$ (5,068)	$ (6,544)
Other comprehensive income (loss):				
Foreign currency translation adjustment	72	—	—	—
Unrealized gains (losses) on marketable securities	1	(1)	—	—
Total other comprehensive income (loss)	73	(1)	—	—
Comprehensive loss	$(15,525)	$(23,671)	$ (5,068)	$ (6,544)
Reconciliation of net loss to net loss applicable to common stockholders:				
Net loss	$(15,598)	$(23,670)	$ (5,068)	$ (6,544)
Accretion and dividends on convertible preferred stock	(4,993)	(3,057)	(1,285)	—
Gain on extinguishment of convertible preferred stock	—	23,114	—	—
Net loss applicable to common stockholders	$(20,591)	$ (3,613)	$ (6,353)	$ (6,544)
Net loss per share applicable to common stockholders—basic and diluted	$(171.59)	$ (13.79)	$ (28.49)	$ (19.94)
Weighted-average number of common shares used in net loss per share applicable to common stockholders—basic and diluted	120	262	223	328
Pro forma net loss per share applicable to common stockholders—basic and diluted (unaudited)		$ (1.81)		$ (0.39)
Pro forma weighted-average number of common shares used in net loss per share applicable to common stockholders—basic and diluted (unaudited)		13,112		16,717

See accompanying notes to consolidated financial statements.

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bluebird bio, Inc.
Consolidated statements of convertible preferred stock and stockholders' (deficit) equity
(In thousands)

	Series A-1 convertible preferred stock		Series A-2 convertible preferred stock		Series B convertible preferred stock		Series C convertible preferred stock		Series D convertible preferred stock		Series A-1 convertible preferred stock		Common stock		Additional paid-in capital	Accum-ulated other compre hensive income (loss)	Accum-ulated deficit	Total stock-holders' (deficit) equity
	Shares	Amount	Shares	Amount	Shares	Amount	Shares	Amount	Shares	Amount	Shares	Amount	Shares	Amount				
Balance at December 31, 2010	**12,981**	**$ 8,760**	**22,304**	**$15,246**	**61,556**	**$ 21,000**	**—**	**$ —**	**—**	**$ —**	**—**	**$ —**	**83**	**$ 1**	**$ 11,832**	**$ (72)**	**$(47,844)**	**$ (36,083)**
Issuance of Series C Preferred Stock, net of issuance costs	—	—	—	—	—	—	39,943	14,904	—	—	—	—	—	—	—	—	—	—
Issuance of Series B Preferred Stock	—	—	—	—	53,648	17,500	—	—	—	—	—	—	—	—	—	—	—	—
Accretion and dividends on convertible preferred stock	—	457	—	591	—	2,995	—	950	—	—	—	—	—	—	(4,993)	—	—	**(4,993)**
Issuance of restricted stock	—	—	—	—	—	—	—	—	—	—	—	—	14	—	30	—	—	**30**
Issuance of restricted stock in exchange for consulting services	—	—	—	—	—	—	—	—	—	—	—	—	2	—	3	—	—	**3**
Vesting of restricted stock issued in exchange for nonrecourse note	—	—	—	—	—	—	—	—	—	—	—	—	96	1	(1)	—	—	—
Vesting of restricted stock	—	—	—	—	—	—	—	—	—	—	—	—	8	—	—	—	—	—
Issuance of warrants for Common Stock in exchange for consulting services	—	—	—	—	—	—	—	—	—	—	—	—	—	—	102	—	—	**102**
Exercise of stock options	—	—	—	—	—	—	—	—	—	—	—	—	2	—	1	—	—	**1**
Foreign currency translation adjustment	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	72	—	**72**
Unrealized gain on marketable securities	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	**1**
Stock-based compensation	—	—	—	—	—	—	—	—	—	—	—	—	—	—	758	—	—	**758**
Net loss	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(15,598)	**(15,598)**
Balance at December 31, 2011	**12,981**	**$ 9,217**	**22,304**	**$15,837**	**115,204**	**$41,495**	**39,943**	**$15,854**	**—**	**$ —**	**—**	**$ —**	**205**	**$ 2**	**$ 7,732**	**$ 1**	**$(63,442)**	**$(55,707)**

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bluebird bio, Inc.
Consolidated statements of convertible preferred stock and stockholders' (deficit) equity
(In thousands)

-	Series A-1 convertible preferred stock		Series A-2 convertible preferred stock		Series B convertible preferred stock		Series C convertible preferred stock		Series D convertible preferred stock		Series A-1 convertible preferred stock		Common stock		Additional paid-in capital	Accumulated other comprehensive income (loss)	Accumulated deficit	Total stockholders' (deficit) equity
	Shares	Amount	Shares	Amount	Shares	Amount	Shares	Amount	Shares	Amount	Shares	Amount	Shares	Amount				
Balance at December 31, 2011	**12,981**	**$ 9,217**	**22,304**	**$15,837**	**115,204**	**$41,495**	**39,943**	**$15,854**	**—**	**$ —**	**—**	**$ —**	**205**	**$ 2**	**$ 7,732**	**$ 1**	**$(63,442)**	**$ (55,707)**
Issuance of Series D Preferred Stock, net of issuance costs	—	—	—	—	—	—	—	—	120,409	59,831	—	—	—	—	—	—	—	**—**
Accretion and dividends on convertible preferred stock	—	194	—	332	—	1,689	—	673	—	169	—	—	—	—	(3,057)	—	—	**(3,057)**
Gain on extinguishment of convertible preferred stock	—	(7,074)	—	(9,032)	—	(2,863)	—	(4,145)	—	—	—	—	—	—	9,356	—	13,758	**23,114**
Reclassification of Series A-1 Preferred Stock	(12,981)	(2,337)	—	—	—	—	—	—	—	—	12,981	2,337	—	—	—	—	—	**2,337**
Reclassification of Series A-1 Preferred Stock warrants	—	—	—	—	—	—	—	—	—	—	—	—	—	—	394	—	—	**394**
Vesting of restricted stock issued in exchange for nonrecourse note	—	—	—	—	—	—	—	—	—	—	—	—	82	1	(1)	—	—	**—**
Vesting of restricted stock	—	—	—	—	—	—	—	—	—	—	—	—	12	—	—	—	—	**—**
Exercise of stock options	—	—	—	—	—	—	—	—	—	—	—	—	10	—	21	—	—	**21**
Realized gain on marketable securities	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(1)	—	**(1)**
Stock-based compensation	—	—	—	—	—	—	—	—	—	—	—	—	—	—	822	—	—	**822**
Net loss	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(23,670)	**(23,670)**
Balance at December 31, 2012	**—**	**$ —**	**22,304**	**$ 7,137**	**115,204**	**$ 40,321**	**39,943**	**$ 12,382**	**120,409**	**$ 60,000**	**12,981**	**$ 2,337**	**309**	**$ 3**	**$ 15,267**	**$ —**	**$(73,354)**	**$(55,747)**

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bluebird bio, Inc.
Consolidated statements of convertible preferred stock and stockholders' (deficit) equity
(In thousands)

-	Series A-1 convertible preferred stock		Series A-2 convertible preferred stock		Series B convertible preferred stock		Series C convertible preferred stock		Series D convertible preferred stock		Series A-1 convertible preferred stock		Common stock		Additional paid-in capital	Accum-ulated other compre hensive income (loss)	Accum-ulated deficit	Total stock-holders' (deficit) equity
	Shares	Amount	Shares	Amount	Shares	Amount	Shares	Amount	Shares	Amount	Shares	Amount	Shares	Amount				
Balance at December 31, 2012	—	$ —	22,304	$ 7,137	115,204	$ 40,321	39,943	$ 12,382	120,409	$ 60,000	12,981	$ 2,337	309	$ 3	$ 15,267	$ —	$(73,354)	$ (55,747)
Vesting of restricted stock issued in exchange for nonrecourse note (unaudited)	—	—	—	—	—	—	—	—	—	—	—	—	21	—	—	—	—	—
Vesting of restricted stock (unaudited)	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—
Exercise of stock options (unaudited)	—	—	—	—	—	—	—	—	—	—	—	—	16	—	35	—	—	35
Stock-based compensation (unaudited)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	661	—	—	661
Net loss (unaudited)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(6,544)	(6,544)
Balance at March 31, 2013 (unaudited)	—	$ —	22,304	$ 7,137	115,204	$ 40,321	39,943	$ 12,382	120,409	$ 60,000	12,981	$ 2,337	348	$ 3	$ 15,963	$ —	$ (79,898)	$ (61,595)
Conversion of convertible preferred stock into common stock (unaudited)	—	—	(22,304)	(7,137)	(115,204)	(40,321)	(39,943)	(12,382)	(120,409)	(60,000)	(12,981)	(2,337)	16,389	164	122,013	—	—	**119,840**
Reclassification of warrants to purchase preferred stock to stockholders' equity (unaudited)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	256	—	—	**256**
Pro forma balance at March 31, 2013 (unaudited)	—	$ —	—	$ —	—	$ —	—	$ —	—	$ —	—	$ —	16,737	$ 167	$ 138,232	$ —	$ (79,898)	$ 58,501

See accompanying notes to consolidated financial statements.

bluebird bio, Inc.
Consolidated statements of cash flows
(In thousands)

	Year ended December 31,		Three months ended March 31,	
	2011	2012	2012	2013
			(unaudited)	
Operating activities				
Net loss	$(15,598)	$(23,670)	$ (5,068)	$ (6,544)
Adjustments to reconcile net loss to net cash used in operating activities:				
Depreciation	205	301	56	139
Stock-based compensation expense	758	822	233	661
Issuance of common stock warrants in exchange for consulting services	102	—	—	—
Issuance of restricted common stock in exchange for consulting services	3	—	—	—
Re-measurement of warrants	361	(28)	(59)	41
Amortization of premium on marketable securities	20	—	—	—
Loss on disposal of equipment	—	10	—	2
Changes in operating assets and liabilities:				
Prepaid expenses and other current assets	(337)	93	(522)	(1,073)
Accounts payable	870	380	(1,133)	(593)
Accrued expenses and other liabilities	380	1,388	378	(488)
Deferred revenue	1,019	(340)	(85)	73,873
Net cash (used in) provided by operating activities	(12,217)	(21,044)	(6,200)	66,018
Investing activities				
Restricted cash	(35)	(40)	(40)	—
Purchase of property and equipment	(403)	(867)	(291)	(812)
Purchase of marketable securities	(5,276)	—	—	—
Proceeds from sales or maturities of marketable securities	1,750	3,506	3,506	—
Net cash (used in) provided by investing activities	(3,964)	2,599	3,175	(812)
Financing activities				
Accumulated issuance costs of planned initial public offering	—	—	—	(415)
Proceeds from sale of convertible preferred stock, net of issuance costs	32,404	59,831	—	—
Proceeds from sale of restricted stock, net of issuance costs	30	—	—	—
Proceeds from issuance of common stock	1	21	—	34
Net cash provided by (used in) financing activities	32,435	59,852	—	(381)
Increase (decrease) in cash and cash equivalents	16,254	41,407	(3,025)	64,825
Cash and cash equivalents at beginning of period	9,350	25,604	25,604	67,011
Cash and cash equivalents at end of period	$ 25,604	$ 67,011	$22,579	$131,836
Non-cash investing and financing activities:				
Fixed asset additions included in accounts payable and accrued expenses	$ —	$ —	$ —	$ 160
Deferred issuance costs included in accounts payable and accrued expenses	$ —	$ —	$ —	$ 992
Accretion and dividends on convertible preferred stock	$ 4,993	$ 3,057	$ 1,285	$ —
Gain on extinguishment of convertible preferred stock	$ —	$ 23,114	$ —	$ —
Reclassification of warrants to purchase Series A-1 Preferred Stock to common stock	$ —	$ 394	$ —	$ —
Reclassification of Series A-1 Preferred Stock to common stock	$ —	$ 2,337	$ —	$ —

See accompanying notes to consolidated financial statements.

bluebird bio, Inc.
Notes to consolidated financial statements

Amounts as of March 31, 2013 and for the three months ended March 31, 2013 and 2012 are unaudited
(In thousands, except per share data)

1. Nature of business

bluebird bio, Inc. (the "Company") was incorporated in Delaware on April 16, 1992, and is headquartered in Cambridge, Massachusetts. The Company was formed to develop, manufacture and market therapies to safely and effectively deliver genes useful in the treatment of serious human diseases.

The Company has generated an accumulated deficit of $79,898 (unaudited) since inception and will require substantial additional capital to fund its research and development. It is subject to risks common to companies in the biotechnology industry, including, but not limited to, development by the Company or its competitors of technological innovations, risks of failure of clinical studies, dependence on key personnel, protection of proprietary technology, compliance with government regulations and ability to transition from pilot-scale manufacturing to large-scale production of products.

Liquidity

The Company believes that its cash resources of $131,836 at March 31, 2013 (unaudited), will be sufficient to allow the Company to fund its current operating plan for at least the next 12 months. As the Company continues to incur losses, transition to profitability is dependent upon the successful development, approval, and commercialization of its product candidates and achieving a level of revenues adequate to support the Company's cost structure. The Company may never achieve profitability, and unless and until it does, the Company will continue to need to raise additional capital. Management intends to fund future operations through additional private or public debt or equity offerings, and may seek additional capital through arrangements with strategic partners or from other sources. There can be no assurances, however, that additional funding will be available on terms acceptable to the Company, or at all.

2. Summary of significant accounting policies

Basis of presentation and principles of consolidation

The accompanying consolidated financial statements include the accounts of the Company and its wholly-owned subsidiaries, bluebird bio France, SARL and bluebird bio Securities Corporation. All intercompany balances and transactions have been eliminated in consolidation. These consolidated financial statements have been prepared in conformity with accounting principles generally accepted in the United States of America ("GAAP"). Any reference in these notes to applicable guidance is meant to refer to the authoritative United States generally accepted accounting principles as found in the Accounting Standards Codification ("ASC") and Accounting Standards Update ("ASU") of the Financial Accounting Standards Board ("FASB").

bluebird bio, Inc.
Notes to consolidated financial statements
(In thousands, except per share data)

Reclassifications

The Company has reclassified certain prior period amounts to conform to the current period presentation. The amounts reclassified impact prepaid expenses and other current assets, accounts payable, and accrued expenses for the year ended December 31, 2011.

Foreign currency translation

The Company's consolidated financial statements are prepared in U.S. dollars. Its foreign subsidiary uses the U.S. dollar as its functional currency and maintains its records in the local currency. Nonmonetary assets and liabilities are re-measured at historical rates and monetary assets and liabilities are re-measured at exchange rates in effect at the end of the reporting period. Income statement accounts are re-measured at average exchange rates for the reporting period. The resulting gains or losses are included in foreign currency (losses) gains in the consolidated statements of operations and comprehensive loss.

Unaudited interim financial information

The accompanying consolidated balance sheet as of March 31, 2013, the consolidated statements of operations and comprehensive loss and statements of cash flows for the three months ended March 31, 2012 and 2013, and the statement of convertible preferred stock and stockholders' deficit for the three months ended March 31, 2013 are unaudited. The interim unaudited financial statements have been prepared on the same basis as the annual audited financial statements; and in the opinion of management, reflect all adjustments, which include only normal recurring adjustments necessary for the fair statement of the Company's financial position as of March 31, 2013, and the results of its operations and comprehensive loss and its cash flows for the three months ended March 31, 2012 and 2013. The financial data and other information disclosed in these notes related to the three months ended March 31, 2012 and 2013 are unaudited. The results for the three months ended March 31, 2013 are not necessarily indicative of results to be expected for the year ending December 31, 2013, any other interim periods, or any future year or period.

Unaudited pro forma information

On February 6, 2013, the Company's board of directors authorized the management of the Company to file a registration statement with the Securities and Exchange Commission ("SEC") for the Company to sell shares of its common stock (the "Common Stock") to the public. The unaudited pro forma balance sheet as of December 31, 2012, assumes the automatic conversion of all the outstanding convertible preferred stock into shares of Common Stock upon the completion of this proposed offering and the reclassification of the Company's outstanding warrants to purchase shares of Series B convertible preferred stock ("Series B Preferred Stock") from a liability to equity, occurring upon the closing of the Company's proposed initial public offering.

Unaudited pro forma net loss per share applicable to common stockholders is computed using the weighted-average number of common shares outstanding after giving effect to the

bluebird bio, Inc.
Notes to consolidated financial statements
(In thousands, except per share data)

conversion of all the outstanding convertible preferred stock into shares of Common Stock as if such conversion had occurred at the beginning of the period presented, or the date of original issuance, if later, and excludes the gain on extinguishment of preferred stock and the accretion of dividends.

Use of estimates

The preparation of financial statements in conformity with GAAP requires management to make estimates and assumptions that affect the reported amounts in the financial statements and accompanying notes. Actual results could materially differ from those estimates. Management considers many factors in selecting appropriate financial accounting policies and controls, and in developing the estimates and assumptions that are used in the preparation of these financial statements. Management must apply significant judgment in this process. In addition, other factors may affect estimates, including: expected business and operational changes, sensitivity and volatility associated with the assumptions used in developing estimates, and whether historical trends are expected to be representative of future trends. The estimation process often may yield a range of potentially reasonable estimates of the ultimate future outcomes and management must select an amount that falls within that range of reasonable estimates. This process may result in actual results differing materially from those estimated amounts used in the preparation of the financial statements. Estimates are used in the following areas, among others: stock-based compensation expense, fair value of Common Stock and convertible preferred stock, liability-classified warrants, accrued expenses, and income taxes.

The Company utilized various valuation methodologies in accordance with the framework of the American Institute of Certified Public Accountants' Technical Practice Aid, *Valuation of Privately-Held Company Equity Securities Issued as Compensation* , to estimate the fair value of its Common Stock. Each valuation methodology includes estimates and assumptions that require the Company's judgment. These estimates and assumptions include a number of objective and subjective factors, including external market conditions affecting the biotechnology industry sector, the prices at which the Company sold shares of preferred stock, the superior rights and preferences of securities senior to the Common Stock at the time and the likelihood of achieving a liquidity event, such as an initial public offering or sale. Significant changes to the key assumptions used in the valuations could result in different fair values of Common Stock at each valuation date.

Segment information

Operating segments are identified as components of an enterprise about which separate discrete financial information is available for evaluation by the chief operating decision maker, or decision making group, in making decisions on how to allocate resources and assess performance. The Company views its operations and manages its business in one operating segment. All material long-lived assets of the Company reside in the United States.

bluebird bio, Inc.
Notes to consolidated financial statements
(In thousands, except per share data)

Cash and cash equivalents

The Company considers all highly liquid investments purchased with original maturities of 90 days or less at acquisition to be cash equivalents. Cash and cash equivalents include cash held in banks and money market accounts. Cash equivalents are reported at fair value.

Concentrations of credit risk and off-balance sheet risk

Financial instruments that potentially subject the Company to concentrations of credit risk are primarily cash, cash equivalents and restricted cash. The Company maintains its cash and cash equivalent balances in the form of money market accounts with financial institutions that management believes are creditworthy. The Company's investment policy includes guidelines on the quality of the institutions and financial instruments and defines allowable investments that the Company believes minimizes the exposure to concentration of credit risk. The Company has no financial instruments with off-balance sheet risk of loss.

Marketable securities

The Company maintains funds in an account that invests in marketable securities. Management determines the appropriate classification of the securities at the time they are acquired and evaluates the appropriateness of such classification at each balance sheet date. Available-for-sale securities consist of debt securities and are stated at fair value. Unrealized holding gains and losses are reported in the consolidated statements of operations and comprehensive loss. Premiums and discounts on investments in debt securities are amortized over the contractual lives of those securities. The method of amortization results in a constant effective yield on those securities (the effective interest method). Interest on debt securities is recognized in income as earned. Realized gains and losses, including losses from declines in value of specific securities determined by management to be other-than-temporary, are included in income. Realized gains and losses are determined on the basis of the specific cost of the securities sold. As of December 31, 2011, all marketable securities were classified as available-for-sale securities due to their short-term nature (maturity dates within one year of the balance sheet date). The Company did not have any marketable securities as of December 31, 2012 and March 31, 2013 (unaudited).

Deferred issuance costs

Deferred issuance costs, which primarily consist of direct incremental legal and accounting fees relating to the initial public offering ("IPO"), are capitalized. The deferred issuance costs will be offset against IPO proceeds upon the consummation of the offering. In the event the offering is terminated, deferred offering costs will be expensed. As of March 31, 2013 (unaudited), the Company capitalized $1,407 of deferred offering costs, which are included in prepaid expenses and other current assets on the consolidated balance sheet. No amounts were deferred as of December 31, 2012 or 2011.

bluebird bio, Inc.
Notes to consolidated financial statements
(In thousands, except per share data)

Fair value of financial instruments

The Company is required to disclose information on all assets and liabilities reported at fair value that enables an assessment of the inputs used in determining the reported fair values. FASB ASC Topic 820, *Fair Value Measurements and Disclosures* ("ASC 820"), establishes a hierarchy of inputs used in measuring fair value that maximizes the use of observable inputs and minimizes the use of unobservable inputs by requiring that the observable inputs be used when available. 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. The fair value hierarchy applies only to the valuation inputs used in determining the reported fair value of the investments and is not a measure of the investment credit quality. The three levels of the fair value hierarchy are described below:

Level 1—Valuations based on unadjusted quoted prices in active markets for identical assets or liabilities that the Company has the ability to access at the measurement date.

Level 2—Valuations based on quoted prices for similar assets or liabilities in markets that are not active or for which all significant inputs are observable, either directly or indirectly.

Level 3—Valuations that require inputs that reflect the Company's own assumptions that are both significant to the fair value measurement and unobservable.

To the extent that 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 measurement.

Items measured at fair value on a recurring basis include marketable securities (Note 3) and warrant liability (Note 7). The carrying amounts of accounts payable and accrued expenses approximate their fair values due to their short-term maturities.

Property and equipment

Property and equipment is stated at cost. Maintenance and repairs that do not improve or extend the lives of the respective assets are expensed to operations as incurred. Upon disposal, the related cost and accumulated depreciation is removed from the accounts and any resulting gain or loss is included in the results of operations. Upon retirement or sale, the cost of the disposed asset and the related accumulated depreciation are removed from the accounts and any

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resulting gain or loss is recognized. Depreciation and amortization is calculated using the straight-line method over the estimated useful lives of the assets, which are as follows:

Asset	Estimated useful life
Computer equipment and software	3 years
Office and laboratory equipment	3 to 5 years
Leasehold improvements	Shorter of the useful life or remaining lease term

Impairment of long-lived assets

The Company reviews long-lived assets when events or changes in circumstances indicate the carrying value of the assets may not be recoverable. Recoverability is measured by comparison of the book values of the assets to future net undiscounted cash flows that the assets are expected to generate. If such assets are considered to be impaired, the impairment to be recognized is measured by the amount by which the book value of the assets exceed their fair value, which is measured based on the projected discounted future net cash flows arising from the assets. No impairment losses have been recorded during the years ended December 31, 2011 and 2012 and the three months ended March 31, 2013 (unaudited).

Warrants to purchase convertible preferred stock

In conjunction with various financing transactions, the Company issued warrants to purchase shares of the Company's Series A-1 convertible preferred stock ("Series A-1 Preferred Stock") and Series B Preferred Stock. Prior to July 23, 2012, the Company's Series A-1 Preferred Stock and Series B Preferred Stock were subject to a redemption provision that was outside of the Company's control. Therefore, the associated shares were presented as temporary equity. Consequently, the warrants to purchase shares of Series A-1 Preferred Stock and Series B Preferred Stock were accounted for as liabilities through July 23, 2012 and adjusted to fair value at the end of each reporting period. The fair value of the warrants classified as liabilities is estimated using the Black-Scholes option pricing model. The estimates in the Black-Scholes option pricing model are based, in part, on subjective assumptions, including, stock price volatility, term of the warrants, risk free interest rate, dividend yield, and fair value of the preferred stock underlying the warrants. Such assumptions could differ materially in the future. The re-measurement gain or loss associated with the change in the fair value of the preferred stock warrant liability from the prior period is recognized as a component of other (expense) income, net.

On July 23, 2012, in connection with the sale of the Company's Series D convertible preferred stock ("Series D Preferred Stock") and the associated modifications to the rights, preferences and privileges of the then-existing series of preferred stock, the Series A-1 Preferred Stock was reclassified to permanent equity because the redemption rights were relinquished and no liquidation preferences were obtained. Additionally, the fair value of the warrants to purchase shares of Series A-1 Preferred Stock as of July 23, 2012 were correspondingly reclassified to additional paid-in capital consistent with the treatment of the associated shares of preferred stock. All other classes of preferred stock remain classified within temporary equity as of

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December 31, 2012, due to their associated liquidation preferences. Due to these remaining liquidating preferences, the warrants to purchase shares of Series B Preferred Stock remain classified within liabilities as of December 31, 2012 and March 31, 2013 (unaudited).

The Company will continue to re-measure the fair value of the liability associated with the warrants to purchase shares of Series B Preferred Stock at the end of each reporting period until the earlier of the exercise or expiration of the applicable warrants or until such time that the underlying preferred stock is reclassified to permanent equity.

Revenue recognition

The Company has primarily generated revenue through collaboration arrangements, research arrangements and license arrangements with strategic partners and nonprofit organizations for the development and commercialization of product candidates. Additionally, the Company has generated revenue from research and development grant programs.

The Company recognizes revenue in accordance with FASB ASC Topic 605, *Revenue Recognition* ("ASC 605"). Accordingly, revenue is recognized for each unit of accounting when all of the following criteria are met:

- Persuasive evidence of an arrangement exists
- Delivery has occurred or services have been rendered
- The seller's price to the buyer is fixed or determinable
- Collectability is reasonably assured

Amounts received prior to satisfying the revenue recognition criteria are recorded as deferred revenue in the Company's consolidated balance sheets. Amounts expected to be recognized as revenue within the 12 months following the balance sheet date are classified as deferred revenue, current portion. Amounts not expected to be recognized as revenue within the 12 months following the balance sheet date are classified as deferred revenue, net of current portion.

Collaboration revenue

As of March 31, 2013, the Company's collaboration revenue is generated exclusively from its collaboration arrangement with Celgene Corporation ("Celgene"). The terms of this arrangement contain multiple deliverables, which include at inception: (i) discovery, research and development services, (ii) participation on the joint steering committee and (iii) participation on the patent committee. The collaboration arrangement also provides Celgene with the option to obtain a license to any product candidates resulting from the collaboration. Moreover, Celgene has the option to extend the term of the collaboration arrangement, first for a period of two years and then for an additional period of one year. Additionally, the Company has the sole right to manufacture or have manufactured supplies of vectors and associated payloads manufactured for incorporation into the associated product candidate in the event a product candidate is licensed. Non-refundable payments to the Company under this arrangement may include: (i) up-front research fees, (ii) product candidate license fees, (iii) extension term research fees, (iv) payments for the manufacture and supply of vectors and payloads, (v) payments based on the

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achievement of certain milestones and (vi) royalties on product sales. Additionally, the Company may elect to share in the costs incurred from the development, commercialization and manufacture of product candidates licensed by its collaborators and earn its share of the net profits or bear its share of the net losses generated from the sale of product candidates licensed by its collaborators.

The Company analyzes multiple-element arrangements based on the guidance in FASB ASC Topic 605-25, *Revenue Recognition-Multiple-Element Arrangements* ("ASC 605-25"). Pursuant to the guidance in ASC 605-25, the Company evaluates multiple-element arrangements to determine (1) the deliverables included in the arrangement and (2) whether the individual deliverables represent separate units of accounting or whether they must be accounted for as a combined unit of accounting. This evaluation involves subjective determinations and requires management to make judgments about the individual deliverables and whether such deliverables are separable from the other aspects of the contractual relationship. Deliverables are considered separate units of accounting provided that: (i) the delivered item(s) has value to the customer on a standalone basis and (ii) if the arrangement includes a general right of return relative to the delivered item(s), delivery or performance of the undelivered item(s) is considered probable and substantially in the control of the Company. In assessing whether an item has standalone value, the Company considers factors such as the research, manufacturing and commercialization capabilities of the collaboration partner and the availability of the associated expertise in the general marketplace. In addition, the Company considers whether the collaboration partner can use the other deliverable(s) for their intended purpose without the receipt of the remaining element(s), whether the value of the deliverable is dependent on the undelivered item(s) and whether there are other vendors that can provide the undelivered element(s). The Company's collaboration arrangement does not contain a general right of return relative to the delivered item(s).

Arrangement consideration that is fixed or determinable is allocated among the separate units of accounting using the relative selling price method. Then, the applicable revenue recognition criteria in ASC 605 are applied to each of the separate units of accounting in determining the appropriate period and pattern of recognition. The Company determines the selling price of a unit of accounting following the hierarchy of evidence prescribed by ASC 605-25. Accordingly, the Company determines the estimated selling price for units of accounting within each arrangement using vendor-specific objective evidence ("VSOE") of selling price, if available, third-party evidence ("TPE") of selling price if VSOE is not available, or best estimate of selling price ("BESP") if neither VSOE nor TPE is available. The Company typically uses BESP to estimate the selling price, since it generally does not have VSOE or TPE of selling price for its units of accounting. Determining the BESP for a unit of accounting requires significant judgment. In developing the BESP for a unit of accounting, the Company considers applicable market conditions and relevant entity-specific factors, including factors that were contemplated in negotiating the agreement with the customer and estimated costs. The Company validates the BESP for units of accounting by evaluating whether changes in the key assumptions used to determine the BESP will have a significant effect on the allocation of arrangement consideration between multiple units of accounting.

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Options are considered substantive if, at the inception of the arrangement, the Company is at risk as to whether the collaboration partner will choose to exercise the option. Factors that the Company considers in evaluating whether an option is substantive include the overall objective of the arrangement, the benefit the collaborator might obtain from the arrangement without exercising the option, the cost to exercise the option and the likelihood that the option will be exercised. For arrangements under which an option is considered substantive, the Company does not consider the item underlying the option to be a deliverable at the inception of the arrangement and the associated option fees are not included in allocable arrangement consideration, assuming the option is not priced at a significant and incremental discount. Conversely, for arrangements under which an option is not considered substantive or if an option is priced at a significant and incremental discount, the Company would consider the item underlying the option to be a deliverable at the inception of the arrangement and a corresponding amount would be included in allocable arrangement consideration. All of the options included in the Company's collaboration arrangement have been determined to be substantive, and none of the options are priced at a significant and incremental discount.

The Company recognizes arrangement consideration allocated to each unit of accounting when all of the revenue recognition criteria in ASC 605 are satisfied for that particular unit of accounting. The Company will recognize as revenue arrangement consideration attributed to licenses that have standalone value from the other deliverables to be provided in an arrangement upon delivery. The Company will recognize as revenue arrangement consideration attributed to licenses that do not have standalone value from the other deliverables to be provided in an arrangement over the Company's estimated performance period as the arrangement would be accounted for as a single unit of accounting.

The Company recognizes revenue from the Celgene arrangement associated with discovery, research and development services, joint steering committee services and patent committee services ratably over the associated period of performance. If there is no discernible pattern of performance and/or objectively measurable performance measures do not exist, then the Company recognizes revenue under the arrangement on a straight-line basis over the period the Company is expected to complete its performance obligations. Conversely, if the pattern of performance in which the service is provided to the customer can be determined and objectively measurable performance measures exist, then the Company recognizes revenue under the arrangement using the proportional performance method. Revenue recognized is limited to the lesser of the cumulative amount of payments received or the cumulative amount of revenue earned, as determined using the straight-line method or proportional performance method, as applicable, as of the period ending date.

At the inception of an arrangement that includes milestone payments, the Company evaluates whether each milestone is substantive and at risk to both parties on the basis of the contingent nature of the milestone. This evaluation includes an assessment of whether: (i) the consideration is commensurate with either the Company's performance to achieve the milestone or the enhancement of the value of the delivered item(s) as a result of a specific outcome resulting from the Company's performance to achieve the milestone, (ii) the consideration relates solely to past performance and (iii) the consideration is reasonable relative to all of the

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deliverables and payment terms within the arrangement. The Company evaluates factors such as the scientific, clinical, regulatory, commercial and other risks that must be overcome to achieve the respective milestone and the level of effort and investment required to achieve the respective milestone in making this assessment. There is considerable judgment involved in determining whether a milestone satisfies all of the criteria required to conclude that a milestone is substantive. The Company has concluded that all of the clinical and regulatory milestones pursuant to its collaboration arrangement are substantive. Accordingly, in accordance with FASB ASC Topic 605-28, *Revenue Recognition-Milestone Method* ("ASC 605-28"), revenue from clinical and regulatory milestone payments will be recognized in its entirety upon successful accomplishment of the milestone, assuming all other revenue recognition criteria are met. Milestones that are not considered substantive would be recognized as revenue over the remaining period of performance, assuming all other revenue recognition criteria are met. Revenue from commercial milestone payments will be accounted for as royalties and recorded as revenue upon achievement of the milestone, assuming all other revenue recognition criteria are met.

The Company will recognize royalty revenue in the period of sale of the related product(s), based on the underlying contract terms, provided that the reported sales are reliably measurable and the Company has no remaining performance obligations, assuming all other revenue recognition criteria are met.

Research fees and license fees

The terms of the Company's research agreements and license agreements include delivery of an intellectual property license or the performance of research and development activities. The Company does not have any material research arrangements or license arrangements that contain multiple deliverables. The Company is compensated under research arrangements and license arrangements through nonrefundable up-front payments and future royalties on net product sales. Research fees are recognized as revenue on a straight-line basis over the period that the research services are expected to be performed unless the Company's pattern of performance can be determined to be other than straight-line, in which case, the Company uses the proportional performance method. Nonrefundable license fees are recognized as revenue upon delivery provided there are no undelivered elements in the arrangement.

Grant revenue

Grant revenue is primarily generated through research and development grant programs offered by federal, state, and local governments. The Company evaluates the terms of the grant to assess the Company's obligations and if the Company's obligations are satisfied over time, revenue is recognized on a straight-line basis. In situations where the performance of the Company's obligations has been satisfied when the grant is received, revenue is recognized upon receipt of the grant. Certain grants contain refund provisions. The Company reviews those refund provisions to determine the likelihood of repayment. If the likelihood of repayment of the grant is determined to be remote, the grant is recognized as revenue. If the probability of repayment is determined to be more than remote, the Company records the grant as a liability, until such time that the grant requirements have been satisfied.

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Research and development expenses

Research and development costs are charged to expense as costs are incurred in performing research and development activities, including salaries and benefits, facilities costs, overhead costs, clinical study and related clinical manufacturing costs, contract services and other related costs. Research and development costs, including up-front fees and milestones paid to collaborators, are also expensed as incurred.

Stock-based compensation

The Company accounts for its stock-based compensation awards in accordance with FASB ASC Topic 718, *Compensation—Stock Compensation* ("ASC 718"). ASC 718 requires all stock-based payments to employees, including grants of employee stock options and restricted stock and modifications to existing stock options, to be recognized in the consolidated statements of operations and comprehensive loss based on their fair values. The Company uses the Black-Scholes option pricing model to determine the fair value of options granted.

Compensation expense related to awards to employees is recognized on a straight-line basis based on the grant date fair value over the associated service period of the award, which is generally the vesting term. Awards to non-employees are adjusted through share-based compensation expense as the award vests to reflect the current fair value of such awards, and expensed using an accelerated attribution model.

The Company expenses restricted stock awards based on the fair value of the award on a straight-line basis over the associated service period of the award. Awards of restricted stock to non-employees are adjusted through share-based compensation expense at each reporting period end to reflect the current fair value of such awards and expensed using an accelerated attribution model.

The Company estimates the fair value of its stock-based awards to employees and directors using the Black-Scholes option pricing model, which requires the input of and subjective assumptions, including (a) the expected stock price volatility, (b) the calculation of expected term of the award, (c) the risk-free interest rate, and (d) expected dividends. Due to the lack of a public market for the trading of its Common Stock and a lack of company specific historical and implied volatility data, the Company has based its estimate of expected volatility on the historical volatility of a group of similar companies that are publicly traded. Due to the lack of a public market for the trading of the Company's common stock and a lack of company-specific historical and implied volatility data, the Company has based its estimate of expected volatility on the historical volatility of a group of similar companies that are publicly traded. When selecting these public companies on which it has based its expected stock price volatility, the Company selected companies with comparable characteristics to it, including enterprise value, risk profiles, position within the industry, and with historical share price information sufficient to meet the expected term of the stock-based awards. The Company computes historical volatility data using the daily closing prices for the selected companies' shares during the equivalent period of the calculated expected term of the stock-based awards. The Company will continue to apply this process until a sufficient amount of historical information regarding the volatility of its own stock price becomes

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available. The Company has estimated the expected term of its employee stock options using the “simplified” method, whereby, the expected term equals the arithmetic average of the vesting term and the original contractual term of the option due to its lack of sufficient historical data. The risk-free interest rates for periods within the expected term of the option are based on the U.S. Treasury securities with a maturity date commensurate with the expected term of the associated award. The Company has never paid, and does not expect to pay dividends in the foreseeable future.

The Company is also required to estimate forfeitures at the time of grant, and revise those estimates in subsequent periods if actual forfeitures differ from its estimates. The Company uses historical data to estimate pre-vesting option forfeitures and records stock-based compensation expense only for those awards that are expected to vest. To the extent that actual forfeitures differ from the Company’s estimates, the differences are recorded as a cumulative adjustment in the period the estimates were revised. Stock-based compensation expense recognized in the financial statements is based on awards that are ultimately expected to vest.

Consistent with the guidance in FASB ASC Topic 505-50, *Equity-Based Payments to Non-Employees*, the fair value of each non-employee stock option and warrant award is estimated at the date of grant using the Black-Scholes option pricing model with assumptions generally consistent with those used for employee stock options, with the exception of expected term, which is over the contractual life.

Income taxes

Income taxes are recorded in accordance with FASB ASC Topic 740, Income Taxes (”ASC 740”), which provides for deferred taxes using an asset and liability approach. The Company recognizes deferred tax assets and liabilities for the expected future tax consequences of events that have been included in the financial statements or tax returns. Deferred tax assets and liabilities are determined based on the difference between the financial statement and tax bases of assets and liabilities using enacted tax rates in effect for the year in which the differences are expected to reverse. Valuation allowances are provided, if based upon the weight of available evidence, it is more likely than not that some or all of the deferred tax assets will not be realized.

The Company accounts for uncertain tax positions in accordance with the provisions of ASC 740. When uncertain tax positions exist, the Company recognizes the tax benefit of tax positions to the extent that the benefit will more likely than not be realized. The determination as to whether the tax benefit will more likely than not be realized is based upon the technical merits of the tax position as well as consideration of the available facts and circumstances. As of December 31, 2011 and 2012, and March 31, 2013 (unaudited), the Company does not have any significant uncertain tax positions.

Net loss per share and unaudited pro forma net loss per share

Basic net loss per share is calculated by dividing net loss attributable to common stockholders by the weighted average shares outstanding during the period, without consideration for

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common stock equivalents. Diluted net loss per share is calculated by adjusting weighted average shares outstanding for the dilutive effect of common stock equivalents outstanding for the period, determined using the treasury-stock method. For purposes of the diluted net loss per share calculation, preferred stock, stock options, unvested restricted stock, and warrants are considered to be common stock equivalents but have been excluded from the calculation of diluted net loss per share, as their effect would be anti-dilutive for all periods presented. Therefore, basic and diluted net loss per share were the same for all periods presented.

The calculations for the unaudited pro forma basic and diluted net loss applicable to common stockholders per share assume the conversion of all outstanding shares of preferred stock into shares of common stock as if the conversions had occurred at the beginning of the period or the date of issuance, if later (and excludes the gain on extinguishment of preferred stock and the accretion of dividends).

Comprehensive loss

Comprehensive loss is comprised of net loss and other comprehensive income or loss. Other comprehensive income or loss consists of unrealized gains and losses on marketable securities and foreign currency translation adjustments.

Subsequent events

The Company considers events or transactions that occur after the balance sheet date but prior to the issuance of the financial statements to provide additional evidence relative to certain estimates or to identify matters that require additional disclosure.

Recently adopted accounting pronouncements

In February 2013, the FASB issued guidance to provide information about the amounts reclassified out of accumulated other comprehensive income (“AOCI”) by component. An entity is required to present, either on the face of the financial statements or in the notes, significant amounts reclassified out of AOCI by the respective line items of net income, but only if the amount reclassified is required to be reclassified in its entirety in the same reporting period. For amounts that are not required to be reclassified in their entirety to net income, an entity is required to cross-reference to other disclosures that provide additional details about those amounts. On January 1, 2013 the Company adopted this standard, which had no impact on its financial position or results of operations.

In June 2011, the FASB issued an amendment to the accounting guidance for presentation of comprehensive income. Under the amended guidance, a company may present the total of comprehensive income, the components of net income, and the components of other comprehensive income either in a single continuous statement of comprehensive income or in two separate but consecutive statements. In either case, a company is required to present each component of net income along with total net income, each component of other comprehensive income along with a total for other comprehensive income, and a total amount for comprehensive income. The amendment is effective for fiscal years ending, and interim periods

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within those years, beginning after December 15, 2011, and is applied retrospectively. The Company adopted this standard in the accompanying financial statements by presenting comprehensive loss in one consecutive statement along with net loss.

In May 2011, the FASB issued amended guidance on fair value measurements. This newly issued accounting standard clarifies the application of certain existing fair value measurement guidance and expands the disclosures for fair value measurements that are estimated using significant unobservable (Level 3) inputs. This accounting standard was effective on a prospective basis for annual and interim reporting periods beginning on or after December 15, 2011. The adoption of this standard has not had a material impact on the Company's financial position or results of operations.

3. Cash, cash equivalents, and marketable securities

The Company considers all highly liquid securities with original final maturities of three months or less from the date of purchase to be cash equivalents. As of December 31, 2011 and 2012 and March 31, 2013 (unaudited), cash and cash equivalents are comprised of funds in cash and money market accounts.

From time to time, the Company invests in marketable securities, which are classified as available-for-sale securities and are stated at fair value as determined by quoted market prices. As of December 31, 2011, the marketable securities held by the Company consisted of debt instruments with an amortized cost basis of $3,506 and a fair value of $3,507, resulting in cumulative unrealized gains of $1, which were included in other comprehensive loss in the consolidated statements of operations and comprehensive loss for the year ended December 31, 2011. As of December 31, 2012 and March 31, 2013 (unaudited), the Company did not hold any marketable securities.

The following table presents the cash and cash equivalents and available-for-sale marketable securities carried at fair value in accordance with the hierarchy defined in Note 2:

Description	Total	Quoted prices in active markets (Level 1)	Significant other observable inputs (Level 2)	Significant unobservable inputs (Level 3)
December 31, 2011				
Cash and cash equivalents	$25,604	$ 25,604	$ —	$ —
U.S. Government Treasury Bonds	$ 3,507	$ 3,507	$ —	$ —
	$ 29,111	$ 29,111	$ —	$ —

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Description	Total	Quoted prices in active markets (Level 1)	Significant other observable inputs (Level 2)	Significant unobservable inputs (Level 3)
December 31, 2012				
Cash and cash equivalents	$67,011	$ 67,011	$ —	$ —
	$67,011	$ 67,011	$ —	$ —

Description	Total	Quoted prices in active markets (Level 1)	Significant other observable inputs (Level 2)	Significant unobservable inputs (Level 3)
March 31, 2013 (unaudited)				
Cash and cash equivalents	$131,836	$ 131,836	$ —	$ —
	$131,836	$ 131,836	$ —	$ —

4. Property and equipment, net

Property and equipment, net, consists of the following:

	December 31, 2011	December 31, 2012	March 31, 2013 (unaudited)
Computer equipment and software	$ 173	$ 199	$ 235
Office equipment	149	148	160
Laboratory equipment	856	1,111	1,955
Leasehold improvements	206	357	434
Total property and equipment	1,384	1,815	2,784
Accumulated depreciation and amortization	(656)	(527)	(664)
Property and equipment, net	$ 728	$1,288	$ 2,120

Depreciation expense was $205, $301, $56 and $139 for the years ending December 31, 2011 and 2012 and the three months ended March 31, 2012 and 2013 (unaudited), respectively.

5. Restricted cash

As of December 31, 2011 and 2012 and March 31, 2013 (unaudited), the Company maintains a letter of credit of $150 that is required to be held in the form of a money market account in accordance with a building lease agreement. In addition, under the Company's corporate credit card agreement, the Company granted a security interest in a money market account of $60, $100 and $100 as of December 31, 2011 and 2012 and March 31, 2013 (unaudited), respectively, to the financial institution issuing the credit cards.

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6. Accrued expenses and other current liabilities

Accrued expenses and other current liabilities consist of the following:

	December 31, 2011	December 31, 2012	March 31, 2013 (unaudited)
Employee compensation	$549	$ 911	$ 618
Accrued professional fees	104	688	930
Other	107	516	584
	$760	$ 2,115	$ 2,132

7. Warrant liability

Below is a summary of the warrants outstanding:

	December 31, 2011	December 31, 2012	March 31, 2013 (unaudited)
Warrants to purchase Series A-1 Preferred Stock	5,835	5,835	5,835
Warrants to purchase Series B Preferred Stock	575	575	575
Warrants to purchase Common Stock	102	102	102
	6,512	6,512	6,512

Below is a summary of the terms and accounting treatment for the warrants outstanding:

	Shares	Weighted-average exercise price per share	Expiration	Balance sheet classification December 31, 2011	Balance sheet classification December 31, 2012	Balance sheet classification March 31, 2013 (unaudited)
Warrants to purchase Series A-1 Preferred Stock	5,835	$ 0.66	November 16, 2015 - April 15, 2019	Liability	Equity	Equity
Warrants to purchase Series B Preferred Stock	575	0.33	April 15, 2019	Liability	Liability	Liability
Warrants to purchase Common Stock	102	0.19	March 15, 2020 - April 15, 2021	Equity	Equity	Equity
	6,512	$ 0.62				

In connection with various financing transactions that were consummated in periods prior to December 31, 2011, the Company issued warrants for the purchase of up to 5,835 shares of the Company's Series A-1 Preferred Stock and up to 575 shares of the Company's Series B Preferred Stock to certain investors. Each warrant was immediately exercisable and generally expires

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approximately ten years from the original date of issuance. The warrants to purchase shares of the Company's preferred stock have an exercise price equal to the estimated fair value of the underlying instrument as of the initial date such shares were issued. Each warrant is exercisable on either a physical settlement or net share settlement basis. Upon the conversion of Series A-1 Preferred Stock and/or Series B Preferred Stock into shares of Common Stock, the associated warrants to purchase shares of the Company's preferred stock are exercisable for shares of Common Stock.

In addition, the Company issued warrants to purchase up to 50 and up to 52 shares of Common Stock in exchange for consulting services provided by non-employees during the year ended December 31, 2011, and in periods prior to the year ended December 31, 2011, respectively. The awards of warrants to purchase shares of Common Stock are accounted for as equity instruments (Note 10).

There were no exercises, cancellations, or expirations of warrants during the years ended December 31, 2011 and 2012 and during the three months ended March 31, 2013 (unaudited). All warrants were fully vested and exercisable as of December 31, 2011 and 2012 and March 31, 2013 (unaudited).

Fair value

The fair value of the warrants on the date of issuance and on each re-measurement date for those warrants classified as liabilities is estimated using the Black-Scholes option pricing model. This method of valuation involves using inputs such as the fair value of the Company's various classes of preferred stock, stock price volatility, contractual term of the warrants, risk free interest rates, and dividend yields. Due to the nature of these inputs, the valuation of the warrants is considered a Level 3 measurement.

Liabilities measured at fair value on a recurring basis are as follows:

Description	Total	Quoted prices in active markets (Level 1)	Significant other observable inputs (Level 2)	Significant unobservable inputs (Level 3)
December 31, 2011				
Warrant liability	$637	$ —	$ —	$ 637
	$637	$ —	$ —	$ 637
December 31, 2012				
Warrant liability	$ 215	$ —	$ —	$ 215
	$ 215	$ —	$ —	$ 215
March 31, 2013 (unaudited)				
Warrant liability	$ 256	$ —	$ —	$ 256
	$ 256	$ —	$ —	$ 256

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The following table sets forth a summary of changes in the fair value of the Company's preferred stock warrant liability which represents a recurring measurement that is classified within Level 3 of the fair value hierarchy wherein fair value is estimated using significant unobservable inputs:

	Year ended December 31,		Three months ended March 31,	
	2011	2012	2012	2013
			(unaudited)	
Beginning balance	$ 276	$ 637	$ 637	$ 215
Change in fair value	361	(28)	(59)	41
Reclassification	—	(394)	—	—
Ending balance	$ 637	$ 215	$ 578	$ 256

The fair value of each warrant to purchase shares of the Company's Series A-1 Preferred Stock was estimated using the Black-Scholes option pricing model with the following weighted-average assumptions:

	Year ended December 31,		Three months ended March 31,
	2011	2012*	2012
			(unaudited)
Fair value of underlying instrument	$ 0.16	$ 0.18	$ 0.15
Expected volatility	82.7%	78.9%	79.6%
Expected term (in years)	5.70	4.98	5.29
Risk-free interest rate	1.0%	0.6%	1.1%
Expected dividend yield	0.0%	0.0%	0.0%

* These warrants were re-measured to fair value and then reclassified to stockholders' deficit on July 23, 2012.

The fair value of each warrant to purchase shares of the Company's Series B Preferred Stock was estimated using the Black-Scholes option pricing model with the following weighted-average assumptions:

	Year ended December 31,		Three months ended March 31,	
	2011	2012	2012	2013
			(unaudited)	
Fair value of underlying instrument	$ 0.54	$ 0.48	$ 0.55	$ 0.57
Expected volatility	81.0%	80.4%	76.1%	82.4%
Expected term (in years)	7.29	6.29	7.04	6.04
Risk-free interest rate	1.6%	1.2%	1.6%	1.0%
Expected dividend yield	0.0%	0.0%	0.0%	0.0%

Fair value

The Company estimated the fair value of its shares of Series A-1 Preferred Stock and Series B Preferred stock as of December 31, 2011, based on the option-pricing method value and the guideline public company method under the market approach value. The Company estimated the

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fair value of its shares of Series B Preferred Stock as of December 31, 2012 and March 31, 2013 (unaudited), and estimated the fair value of its shares of Series A-1 Preferred Stock as of July 23, 2012 and March 31, 2012 (unaudited), using a hybrid approach based on a probability-weighted average of the expected return method and the option pricing method.

Expected volatility

The Company estimated the expected volatility based on actual historical volatility of the stock price of similar companies with publicly-traded equity securities. The Company calculated the historical volatility of the selected companies by using daily closing prices over a period of the expected term of the associated award. The companies were selected based on their enterprise value, risk profiles, position within the industry, and with historical share price information sufficient to meet the expected term of the associated award.

Expected term

The Company based expected term on the actual remaining contractual term of each respective warrant.

Risk-free interest rate

The Company estimated the risk-free interest rate in reference to yield on U.S. Treasury securities with a maturity date commensurate with the expected term of the associated award.

Expected dividend yield

The Company estimated the expected dividend yield based on consideration of its historical dividend experience and future dividend expectations. The Company has not historically declared or paid dividends to stockholders. Moreover, it does not intend to pay dividends in the future, but instead expects to retain any earnings to invest in the continued growth of the business. Accordingly, the Company assumed an expected dividend yield of 0.0%.

8. Commitments and contingencies

The Company leases office space under non-cancelable operating leases. Future minimum lease payments as of December 31, 2012, under the non-cancelable operating leases through the end of the lease term are as follows:

	Operating leases
2013	$ 831
2014	841
2015	213
Total minimum lease payments	$ 1,885

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Rent expense is calculated on a straight-line basis over the term of the lease. Rent expense recognized under all operating leases, including additional rent charges for utilities, parking, maintenance, and real estate taxes was $638, $815, $178 and $319 for the years ended December 31, 2011 and 2012 and for the three months ended March 31, 2012 and 2013 (unaudited), respectively.

The Company is also party to various agreements, principally relating to licensed technology, that require future payments relating to milestones not met at December 31, 2012 and March 31, 2013 (unaudited), or royalties on future sales of specified products. No milestone or royalty payments under these agreements are expected to be payable in the immediate future.

The Company enters into standard indemnification agreements in the ordinary course of business. Pursuant to the agreements, the Company indemnifies, holds harmless, and agrees to reimburse the indemnified party for losses suffered or incurred by the indemnified party, generally the Company's business partners or customers, in connection with any U.S. patent or any copyright or other intellectual property infringement claim by any third party with respect to the Company's products. The term of these indemnification agreements is generally perpetual any time after execution of the agreement. The maximum potential amount of future payments the Company could be required to make under these indemnification agreements is unlimited. The Company has never incurred costs to defend lawsuits or settle claims related to these indemnification agreements.

9. Convertible Preferred Stock

As of December 31, 2012, the authorized capital stock of the Company included 317,252 shares of preferred stock, par value $0.01 per share, of which: (i) 18,817 shares have been designated as Series A-1 Preferred Stock, (ii) 22,304 shares have been designated as Series A-2 convertible preferred stock ("Series A-2 Preferred Stock"), (iii) 115,779 shares have been designated as Series B Preferred Stock, (iv) 39,943 shares have been designated as Series C convertible preferred stock ("Series C Preferred Stock"), and (iv) 120,409 shares have been designated as Series D Preferred Stock and all collectively "Preferred Stock."

On April 15, 2011, the Company issued 53,648 shares of Series B Preferred Stock in a second closing of the financing round at a purchase price per share of $0.3262 for aggregate proceeds totaling $17,500. Additionally, on April 15, 2011, the Company entered into a Series C Preferred Stock Purchase Agreement (the "Series C Agreement") to issue a total of 79,885 shares of Series C Preferred Stock at a purchase price per share of $0.37554, with substantially the same rights, preferences and privileges as the previous classes of preferred stock. On April 15, 2011, the Company issued the initial tranche of 39,943 shares of Series C Preferred Stock at a purchase price per share of $0.37554 for aggregate proceeds totaling $14,904, net of issuance costs of $96. The remaining 39,942 shares of Series C Preferred Stock were to be issued at any time subsequent to the initial issuance through April 15, 2014, upon agreement among the holders of Series A-1 Preferred Stock, Series A-2 Preferred Stock, Series B Preferred Stock, and Series C Preferred Stock, as well as the Company's Board of Directors. In connection with the Series C Agreement, the redemption dates of Series A-1 Preferred Stock, Series A-2 Preferred Stock, and Series B Preferred

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Stock were amended to commence at any time on or after April 15, 2016; and the shares were to be redeemable in three annual installments after such date. As a result of the modification, the accretion associated with the Series A-1 Preferred Stock, Series A-2 Preferred Stock, and Series B Preferred Stock was adjusted prospectively beginning on April 15, 2011, to reflect the change in terms. The Company has evaluated the future tranche right included in the terms of the Series B Preferred Stock and Series C Preferred Stock offerings and determined that the investors' right to acquire additional shares of preferred stock is contractually embedded and not legally detachable. Such feature is not required to be bifurcated from either the Series B Preferred Stock or Series C Preferred Stock as it does not meet the definition of a derivative.

On July 23, 2012, the Company issued 120,409 shares of Series D Preferred Stock at a purchase price per share of $0.4983 for aggregate proceeds totaling $59,831, net of issuance costs of $169. Subsequent to the issuance of Series D Preferred Stock, there no longer remain shares of Series C Preferred Stock available for issuance. In connection with the issuance of Series D Preferred Stock, the rights, preferences, and privileges for all classes of preferred stock then-existing were modified, as specified below.

General

The rights, preferences and privileges of the preferred stock are as follows:

Voting

The holders of shares of preferred stock are entitled to the number of votes equal to the number of whole shares of common stock into which the shares of the applicable series of preferred stock held by such holder are convertible or any matter presented to the stockholders of the Company for their action or consideration at any meeting of stockholders of the Company or by written consent of stockholders in lieu of meetings. Except as provided by law or otherwise, the holders of shares of preferred stock vote together with the holders of shares of Common Stock as a single class.

Dividends

The holders of shares of preferred stock are entitled to receive dividends, if and when declared by the board of directors on a pari passu basis. Dividends payable on each share of preferred stock is determined as if such share had been converted into shares of Common Stock. As of December 31, 2012, no dividends have been declared or paid since the Company's inception.

All accrued, but unpaid dividends on the Company's outstanding shares of Series A-1 Preferred Stock, Series A-2 Preferred Stock, Series B Preferred Stock, and Series C Preferred Stock were forfeited as a condition to the issuance of the Series D Preferred Stock. The forfeiture of the dividends that had accumulated as of July 23, 2012, for each respective series of preferred stock was considered in combination with the other modifications to the preferred stock that occurred upon the consummation of the sale of Series D Preferred Stock, as discussed below.

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Liquidation

In the event of any voluntary or involuntary liquidation, dissolution or winding up of the Company or upon the occurrence of a Deemed Liquidation Event, as defined, the holders of shares of Series D Preferred Stock then outstanding are entitled to be paid out of the assets of the Company available for distribution to stockholders an amount per share equal to $0.4983, subject to appropriate adjustment, plus any dividends declared but unpaid thereon, before any payment is made to holders of shares of Series A-1 Preferred Stock, holders of shares of Series A-2 Preferred Stock, holders of shares of Series B Preferred Stock, holders of shares of Series C Preferred Stock, or holders of shares of Common Stock. The holders of shares of Series C Preferred Stock then outstanding and the holders of shares of Series B Preferred Stock then outstanding are entitled to be paid out of the assets of the Company available for distribution to stockholders, on a pari passu basis, an amount per share equal to $0.37554, subject to appropriate adjustment, and $0.4893, subject to appropriate adjustment, respectively, plus any dividends declared but unpaid thereon, before any payment is made to holders of shares of Series A-1 Preferred Stock, holders of shares of Series A-2 Preferred Stock, or holders of shares of Common Stock. The holders of shares of Series A-2 Preferred Stock then outstanding are entitled to be paid out of the assets of the Company available for distribution to stockholders an amount per share equal to $0.5758, subject to appropriate adjustment, plus any dividends declared but unpaid thereon, before any payment is made to holders of shares of Series A-1 Preferred Stock or holders of shares of Common Stock.

After the payment of all preferential amounts required to be paid to the holders of shares of Series A-2 Preferred Stock, Series B Preferred Stock, Series C Preferred Stock, and Series D Preferred Stock, the remaining assets of the Company available for distribution to stockholders will be distributed among the holders of shares of preferred stock and Common Stock, pro rata based on the number of shares held by each such holder, treating such securities as if they had been converted to common stock immediately prior to such dissolution, liquidation, or winding up of the Company. In the event the assets of the Company available for distribution to stockholders are insufficient to permit payment of the full amount to which each shareholder is entitled, holders of shares of capital stock will share ratably in any distribution of the remaining assets of the Company in proportion to the respective amounts which would otherwise be payable under the circumstances in the order of liquidation preference.

Conversion

Each share of Series A-1 Preferred Stock, Series A-2 Preferred Stock, Series B Preferred Stock, Series C Preferred Stock, and Series D Preferred Stock is convertible at the option of the holder, at any time and from time to time, into fully paid and non-assessable shares of common stock. Each share of Series A-1 Preferred Stock, Series A-2 Preferred Stock, Series B Preferred Stock, Series C Preferred Stock, and Series D Preferred Stock is convertible into that number of common shares as is determined by dividing the original purchase price of such share by the applicable conversion price ($0.6619, $0.6619, $0.3262, $0.37554, and $0.4983 for the Series A-1 Preferred Stock, Series A-2 Preferred Stock, Series B Preferred Stock, Series C Preferred Stock, and Series D

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Preferred Stock, respectively). As of December 31, 2012, the conversion rate is 1:1, but is subject to adjustment in the future upon the occurrence of certain events (see Note 16(B)).

Each share of Series A-1 Preferred Stock, Series A-2 Preferred Stock, Series B Preferred Stock, Series C Preferred Stock, and Series D Preferred Stock is automatically convertible into fully paid and non-assessable shares of common stock upon either: (i) the closing of the sale of shares of the Company's common stock to the public in an underwritten public offering resulting in at least $30,000 of gross proceeds to the Company and a listing of the Company's common stock on a nationally recognized securities exchange or trading system or (ii) the date and time, or the occurrence of an event, specified by vote or written consent of the holders of shares constituting a majority of the then outstanding shares of preferred stock and the holders of shares constituting a majority of the then outstanding shares of Series D Preferred Stock.

The Company evaluated each series of its preferred stock and determined that each individual series is considered an equity host under FASB ASC Topic 815, *Derivatives and Hedging*. In making this determination, the Company's analysis followed the whole instrument approach which compares an individual feature against the entire preferred stock instrument which includes that feature. The Company's analysis was based on a consideration of the economic characteristics and risks of each series of preferred stock. More specifically, the Company evaluated all of the stated and implied substantive terms and features, including: (i) whether the preferred stock included redemption features, (ii) how and when any redemption features could be exercised, (iii) whether the holders of preferred stock were entitled to dividends, (iv) the voting rights of the preferred stock and (v) the existence and nature of any conversion rights. As a result of the Company's conclusion that the preferred stock represents an equity host, the conversion feature of all series of preferred stock is considered to be clearly and closely related to the associated preferred stock host instrument. Accordingly, the conversion feature of all series of preferred stock is not considered an embedded derivative that requires bifurcation.

The Company accounts for potentially beneficial conversion features under FASB ASC Topic 470-20, *Debt with Conversion and Other Options*. At the time of each of the issuances of convertible preferred stock, the Company's common stock into which each series of the Company's preferred stock is convertible had an estimated fair value less than the effective conversion prices of the convertible preferred stock. Therefore, there was no intrinsic value on the respective commitment dates.

Redemption

Prior to July 23, 2012, the Series A-1 Preferred Stock, Series A-2 Preferred Stock, Series B Preferred Stock and Series C Preferred Stock included rights of redemption. Accordingly, each series of preferred stock was being accreted to redemption value through the respective redemption dates, including appropriate accruals for the then-existing cumulative dividend rights. Upon the issuance of Series D Preferred Stock on July 23, 2012, the redemption rights of the Series A-1 Preferred Stock, Series A-2 Preferred Stock, Series B Preferred Stock, and Series C Preferred Stock were removed in their entirety. Accordingly, upon the issuance of Series D Preferred Stock, accretion ceased for the Series A-1 Preferred Stock, Series A-2 Preferred Stock,

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Series B Preferred Stock, and Series C Preferred Stock and cumulative dividends that had been accrued through July 23, 2012, were considered in the calculation of the gain on extinguishment, as discussed below. The shares of Series D Preferred Stock do not include redemption rights.

In accordance with the guidance in FASB ASC Topic 480, *Distinguishing Liabilities from Equity*, shares of Series A-1 Preferred Stock, Series A-2 Preferred Stock, Series B Preferred Stock, and Series C Preferred Stock were classified outside of permanent equity through July 23, 2012. As the result of the elimination of the redemption rights for all classes of preferred stock that occurred in connection with the issuance of Series D Preferred Stock, the outstanding shares of Series A-1 Preferred Stock were reclassified from temporary equity to permanent equity during the year ended December 31, 2012, because these shares have no liquidation preference and therefore no possibility of being redeemed. All other classes of preferred stock remain classified within temporary equity as of December 31, 2012 and March 31, 2013 (unaudited), due to their associated liquidation preferences.

Extinguishment of preferred stock

In connection with the issuance of the Series D Preferred Stock, the rights, preferences, and privileges for all classes of preferred stock then outstanding were modified. More specifically, the redemption privileges were eliminated in their entirety for Series A-1 Preferred Stock, Series A-2 Preferred Stock, Series B Preferred Stock, and Series C Preferred Stock. Additionally, the dividend rights changed from cumulative dividend rights to non-cumulative dividend rights and all accrued, but unpaid dividends on the Company's Series A-1 Preferred Stock, Series A-2 Preferred Stock, Series B Preferred Stock, and Series C Preferred Stock as of July 23, 2012, were forfeited. Lastly, the liquidation preference for the Series B Preferred Stock was reduced from $0.6524 per share to $0.4893 per share.

The Company has accounted for the amendment to the rights, preferences, and privileges of the preferred stock as an extinguishment of the old preferred stock and issuance of new preferred stock due to the significance of the modifications to the substantive contractual terms of the preferred stock and the associated fundamental changes to the nature of the preferred stock. Accordingly, the Company recorded an aggregate gain of $23,114 within stockholders' deficit equal to the difference between the fair value of the new shares of preferred stock issued and the carrying amount of the old shares of preferred stock extinguished. The Company allocated $9,356 of the gain to additional paid-in capital to recover the amount of additional paid-in capital that had previously been reduced by accreted dividends that were forfeited as part of the extinguishment, while the remaining $13,758 was recorded to accumulated deficit. The gain on extinguishment is reflected in the calculation of net loss available to common stockholders in accordance with FASB ASC Topic 260, *Earnings per Share*. The fair value of the Series A-1 Preferred Stock, Series A-2 Preferred Stock, Series B Preferred Stock, and Series C Preferred Stock was determined using a hybrid approach based on a probability-weighted average of the expected return method and the option pricing method.

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10. Common stock

As of December 31, 2012, the authorized capital stock of the Company included 21,089 shares of Common Stock, par value $0.01 per share. On January 16, 2013, the Company increased the authorized capital stock of the Company to 21,511 shares.

General

The voting, dividend and liquidation rights of the holders of shares of Common Stock are subject to and qualified by the rights, powers and preferences of the holders of shares of preferred stock. The Common Stock has the following characteristics:

Voting

The holders of shares of Common Stock are entitled to one vote for each share of Common Stock held at all meetings of stockholders and written actions in lieu of meetings.

Dividends

The holders of shares of Common Stock are entitled to receive dividends, if and when declared by the board of directors. Cash dividends may not be declared or paid to holders of shares of common stock until paid on each series of outstanding preferred stock in accordance with their respective terms. As of December 31, 2012, no dividends have been declared or paid since the Company's inception.

Liquidation

After payment to the holders of shares of preferred stock of their liquidation preferences, the holders of shares of Common Stock are entitled to share ratably in the Company's assets available for distribution to stockholders, in the event of any voluntary or involuntary liquidation, dissolution or winding up of the Company or upon the occurrence of a deemed liquidation event.

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Reserved for future issuance

The Company has reserved for future issuance the following number of shares of Common Stock:

	December 31,		March 31,
	2011	2012	2013
			(unaudited)
Conversion of Series A-1 Preferred Stock	685	685	685
Conversion of Series A-2 Preferred Stock	1,176	1,176	1,176
Conversion of Series B Preferred Stock	6,074	6,074	6,074
Conversion of Series C Preferred Stock	4,211	2,106	2,106
Conversion of Series D Preferred Stock	—	6,348	6,348
Vesting of Restricted Stock	249	155	132
Options to purchase Common Stock	2,568	3,748	4,199
Warrants to purchase Series A-1 Preferred Stock	308	308	308
Warrants to purchase Series B Preferred Stock	30	30	30
Warrants to purchase Common Stock	102	102	102
	15,403	**20,732**	**21,160**

11. Significant agreements

Celgene Corporation

Summary of the Collaboration Agreement

On March 19, 2013, the Company entered into a Master Collaboration Agreement (the “Collaboration Agreement”) with Celgene to discover, develop and commercialize disease-altering gene therapies in oncology. The collaboration is focused on applying gene therapy technology to genetically modify a patient’s own T cells, known as chimeric antigen receptor, or CAR, T cells, to target and destroy cancer cells. Additionally, on March 19, 2013, the Company entered into a Platform Technology Sublicense Agreement (the “Sublicense Agreement”) with Celgene pursuant to which the Company obtained a sublicense to certain intellectual property from Celgene, originating under Celgene’s license from Baylor College of Medicine, for use in the collaboration.

Under the terms of the Collaboration Agreement, the Company received a $75,000 up-front, non-refundable cash payment. The Company will be responsible for conducting discovery, research and development activities through completion of Phase I clinical studies, if any, during the initial term of the agreement, or three years. The collaboration will be governed by a joint steering committee (“JSC”) formed by an equal number of representatives from the Company and Celgene. The JSC will, among other activities, review the collaboration program, review and evaluate product candidates and approve regulatory plans. In addition to the JSC, the Collaboration Agreement provides that the Company and Celgene will each appoint representatives to establish a patent committee, which will be responsible for managing the intellectual property developed and used during the collaboration.

Prior to expiration of the initial term of the Collaboration Agreement, Celgene has two options to extend the term, through March 19, 2019, with the payment of significant extension

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fees. Separately, Celgene has an option to license an unlimited number of product candidates resulting from the collaboration during a period commencing upon execution of the Collaboration Agreement and continuing through a specified period following the completion of Phase I clinical studies for each individual product candidate. In the event such option is exercised, the Company would grant Celgene an exclusive worldwide license to develop and commercialize such product candidate. Upon exercise of the option to license a product candidate, Celgene is required to pay an option fee, which is subject to reduction if the Company elects to co-develop and co-promote such product candidate in the United States. For any product candidates licensed by Celgene, the Company may be responsible, at Celgene's election, to continue performing certain development activities contemplated as part of the collaboration plan. If Celgene does not exercise its option with respect to a product candidate prior to the expiration of the applicable option period (each a "declined product candidate"), then the Company has the right to develop the product candidate outside the scope of the collaboration, subject to a Celgene opt-in right to obtain a license to that declined product candidate for significant additional cash consideration. The opt-in right exists through a specified period following the completion of a pivotal study for the specific declined product candidate and functions in the same manner as the option to license any other product candidates resulting from the collaboration.

In addition, Celgene would be required to make certain milestone payments upon the achievement of specified clinical, regulatory and commercial events. For each product candidate that is licensed by Celgene, the Company would be eligible to receive per product up to $20,000 in option fees, up to $10,000 in clinical milestone payments, up to $117,000 in regulatory milestone payments and up to $78,000 in commercial milestone payments. Clinical milestone payments are triggered upon initiation of a defined phase of clinical research for a product candidate. Regulatory milestone payments are triggered upon approval to market a product candidate by the FDA or other global regulatory authorities. Commercial milestone payments are triggered upon the first commercial sale of an approved pharmaceutical product and when an approved pharmaceutical product reaches certain defined levels of net sales by the licensee or receives approval to be marketed by certain global regulatory authorities in a specified number of countries outside of the United States. In addition, to the extent any of the product candidates licensed by Celgene are commercialized, the Company would be entitled to receive tiered royalty payments ranging from the mid-single digits to mid-teens based on a percentage of net sales. Royalty payments are subject to certain reductions, including for any royalty payments required to be made by Celgene to acquire patent rights, with an aggregate minimum floor. The Company is not eligible to receive either milestone payments or royalty payments unless and until Celgene exercises its option to license a product candidate resulting from the collaboration whereupon the parties will execute a license agreement, the terms of which are included as part of the collaboration arrangement.

Additionally, the Company may elect to co-develop and co-promote product candidates licensed by Celgene. If the Company elects to co-develop and co-promote a product candidate, then the parties would share equally in all costs incurred relating to the development, commercialization and manufacture of the product candidate within the United States and share equally in the profits generated by such product candidate in the United States. Additionally, if the

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Company elects to co-develop and co-promote a product candidate, then the option fees, milestones and royalties would decrease compared to those described above. Under this scenario, the Company would receive per product up to $10,000 in option fees, up to $10,000 in clinical milestone payments and outside of the United States, up to $54,000 in regulatory milestone payments and up to $36,000 in commercial milestone payments. Clinical milestone payments are triggered upon initiation of a defined phase of clinical research for a product candidate. Regulatory milestone payments are triggered upon approval to market a product candidate by global regulatory authorities. Commercial milestone payments are triggered when an approved pharmaceutical product reaches certain defined levels of net sales by the licensee or receives approval to be marketed by certain global regulatory authorities in a specified number of countries outside the United States. In addition, to the extent any of the product candidates licensed by Celgene and co-developed and co-promoted by the Company are commercialized, the Company would be entitled to receive tiered royalty payments ranging from the mid-single digits to mid-teens based on a percentage of net sales from sales generated outside of the United States. Royalty payments are subject to certain reductions, including for any royalty payments required to be made by Celgene to acquire patent rights, with an aggregate minimum floor. The Company is not eligible to receive profit share payments, milestone payments or royalty payments unless and until Celgene exercises its option to license a product candidate resulting from the collaboration whereupon the parties will execute a co-development, co-promote and profit share agreement, the terms of which are included as part of the collaboration arrangement.

In the event Celgene elects to license a product candidate discovered and developed as part of the Collaboration Agreement, Celgene would be solely responsible for all costs and expenses of manufacturing and supplying any product candidates. Subject to customary back-up supply rights granted to Celgene, the Company has the sole right to manufacture or have manufactured supplies of vectors and associated payloads manufactured for incorporation into the associated product candidate. Celgene would reimburse the Company for the costs incurred to manufacture and supply such vectors and associated payloads, plus a modest mark-up. The Company is not obligated to manufacture or have manufactured supplies of vectors and associated payloads for incorporation into an optioned product candidate unless and until Celgene exercises its option to license a product candidate resulting from the collaboration whereupon the parties will execute a separate manufacturing and supply agreement.

The Collaboration Agreement may be terminated by either the Company or Celgene, upon written notice, in the event of the other party’s uncured material breach. Celgene may terminate the Collaboration Agreement for any reason upon written notice to the Company. If the Collaboration Agreement is terminated, rights to product candidates in development at the time of such termination will be allocated to the parties through a mechanism included in the Collaboration Agreement. In addition, if Celgene terminates the Collaboration Agreement as a result of a breach by the Company, then any then-existing co-development and co-promotion agreement will be automatically terminated and replaced with a license agreement for such product candidate and any amounts payable by Celgene under any then-existing product license agreements will be reduced.

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Call Option

Effective upon completion of the Company's initial public offering, during the initial three-year term of the collaboration and, if extended, during the first two-year extension term of the collaboration, in the event that the Company engages in a change in control transaction, including for such purposes a merger or consolidation of the Company or the sale of all or substantially all of the Company's assets, or if another person or entity or group of persons or entities acquires at least 50% of the Company's voting capital stock, then Celgene has the right, but not the obligation, to terminate the Collaboration Agreement and obtain perpetual, non-terminable, worldwide, exclusive, fully paid-up licenses to all, but not less than all, of the product candidates previously identified under the Collaboration Agreement (the "Call Option"). Under the Call Option, the product candidates to which Celgene would have the right to acquire licenses include any product candidate previously licensed out of the collaboration during the term of the collaboration, any product candidate for which the Company has exercised the right to co-develop and co-promote within the United States, any product candidate for which Celgene previously declined its option to obtain a license and any product candidate for which at least in vivo efficacy studies have been initiated or authorized by the JSC. The purchase price for such licenses would be based on the fair value of these rights received and obligations assumed determined pursuant to a binding arbitration process.

In addition, during the initial three-year term of the collaboration, but not during any extension term, in the event that Celgene exercises the Call Option, in addition to the right to acquire the fully paid-up licenses described above, Celgene would obtain a perpetual, non-terminable, worldwide, exclusive license to the Company's intellectual property to develop one or more CAR T cell products targeting one or more oncology associated target antigens for the remainder of the initial collaboration term. Following the initial collaboration term, the license to the Company's intellectual property is limited to target antigens identified by Celgene promptly following the initial collaboration term for which Celgene reasonably intends to develop CAR T cell products. There is no limit to the number of oncology-related target antigens Celgene may select under this license. Upon commercialization of any such product candidate so licensed by Celgene, Celgene would be obligated to pay the Company a specified milestone payment upon regulatory approval and a percentage of net sales as a royalty.

The Company has concluded that the value of the Call Option is immaterial based primarily on the probability that the Call Option would become exercisable.

Accounting Analysis

The Company's arrangement with Celgene contains the following deliverables: (i) discovery, research and development services, (ii) participation on the JSC and (iii) participation on the patent committee. The Company has determined that the options to extend the term of the agreement and the options to license product candidates, including those related to Celgene's opt-in right for a declined product candidate, are substantive options. Celgene is not contractually obligated to exercise the options. Additionally, as a result of the uncertain outcome of the discovery, research and development activities, the Company is at risk with regard to

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whether Celgene will exercise the options. Moreover, the Company has determined that the options are not priced at a significant and incremental discount. Accordingly, the options are not considered deliverables at the inception of the arrangement and the associated option fees are not included in allocable arrangement consideration. The Company has determined that the potential obligation to manufacture or have manufactured supplies of vectors and associated payloads for incorporation into an optioned product candidate is contingent upon Celgene exercising its option to license a product candidate resulting from the collaboration. Therefore, consistent with the treatment of the options to license product candidates, the Company's potential obligation under a manufacturing and supply agreement is not considered a deliverable at the inception of the arrangement and the associated fees are not included in allocable arrangement consideration.

The Company has concluded that each of the three deliverables identified at the inception of the arrangement (discovery, research and development services, participation on the JSC and participation on the patent committee) has standalone value from the other undelivered elements. Additionally, the Collaboration Agreement does not include return rights related to the initial collaboration term. Accordingly, each deliverable qualifies as a separate unit of accounting.

The Company has identified the allocable arrangement consideration as the $75,000 up-front payment. The Company determined that each of the identified deliverables have the same period of performance (the three year initial term) and have the same pattern of revenue recognition, ratably over the period of performance. As a result, the $75,000 arrangement consideration will be recognized over the three year initial term.

The Company has evaluated all of the milestones that may be received in connection with Celgene's option to license a product candidate resulting from the collaboration. In evaluating if a milestone is substantive, the Company assesses whether: (i) the consideration is commensurate with either the Company's performance to achieve the milestone or the enhancement of the value of the delivered item(s) as a result of a specific outcome resulting from the Company's performance to achieve the milestone, (ii) the consideration relates solely to past performance and (iii) the consideration is reasonable relative to all of the deliverables and payment terms within the arrangement. All clinical and regulatory milestones are considered substantive on the basis of the contingent nature of the milestone, specifically reviewing factors such as the scientific, clinical, regulatory, commercial and other risks that must be overcome to achieve the milestone as well as the level of effort and investment required. Accordingly, such amounts will be recognized as revenue in full in the period in which the associated milestone is achieved, assuming all other revenue recognition criteria are met. All commercial milestones will be accounted for in the same manner as royalties and recorded as revenue upon achievement of the milestone, assuming all other revenue recognition criteria are met.

During the three months ended March 31, 2013, the Company recognized $1,042 of revenue associated with its collaboration with Celgene related to the recognition of discovery, research and development services. As of March 31, 2013, there is $73,958 of deferred revenue related to the Company's collaboration with Celgene which is classified as current or long-term in the accompanying balance sheet based on the contractual term of the arrangement.

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Association Française contre les Myopathies

In January 2011, the Company entered into a research funding agreement with the Association Française contre les Myopathies ("AFM"), a nonprofit organization dedicated to curing rare neuromuscular diseases and providing treatments to reduce the associated disabilities of such diseases. As part of the agreement, AFM funded the Company 1 million Euros to be used to advance the Company's research, process development, manufacturing, preclinical development, and clinical development in gene therapy for beta-hemoglobinopathies in ß-thalassemia and/or in Sickle Cell Disease.

The funding, or a portion thereof depending on timing, shall be repaid to AFM upon any of the following events: (i) upon out-licensing or sale of the program, (ii) upon obtaining the first product authorization for the market, or (iii) upon sale of the Company, provided that the development is active at the time of such sale. The agreement is for a period of four years. The Company believes that repayment of the funds paid under the agreement is not probable at the date of the agreement or at December 31, 2011 and 2012. The Company recognizes the revenue under this arrangement on a straight-line basis over the term of the agreement. The Company will reassess the probability of repayment at the end of each reporting period.

CIRM

In October 2012, the California Institute for Regenerative Medicine ("CIRM") approved a $9.3 million award to the Company. The Company is in the process of negotiating the terms of the award with CIRM. The award is to support a Phase I/II study to evaluate the safety and efficacy of LentiGlobin, the Company's development-stage program for the treatment of ß-thalassemia, which is expected to be initiated in the United States in 2013. The grant will be issued in quarterly installments and is expected to be utilized over a four-year period starting in the second half of 2013. As of December 31, 2012, the Company had not received or recognized any amounts under this award.

Massachusetts life science center

In October 2011, the Company was awarded a $242 tax incentive from the Massachusetts Life Sciences Center as part of the Life Sciences Tax Incentive Program. The program was established in 2008 to incentivize life science companies to create new sustained jobs in Massachusetts. If the Company does not meet and maintain its job creation commitment for at least five years, the total amount awarded may be recovered by the Massachusetts Department of Revenue. The Company recognized this award as grant revenue in 2011, as the Company had satisfied its job creation commitments and the Company's long-range hiring plan was significantly in excess of the requirement. The Company concluded that the likelihood of refund was remote.

12. Stock-based compensation

In December 1996, the board of directors adopted the 1996 Stock Option Plan. In April 2002, the Board of Directors canceled the 1996 Stock Option Plan and adopted the 2002 Employee, Director and Consultant Plan. In September 2010, the board of directors adopted the 2010 Stock Option and

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Grant Plan (the “Plan”). With the adoption of the Plan, the 2002 Employee, Director and Consultant Plan was terminated; and no further options or awards are permitted to be granted under this plan. Any options or awards outstanding under the 2002 Employee, Director and Consultant Plan at the time of adoption of the Plan remained outstanding and effective. The Plan allows for the granting of incentive stock options, non-qualified stock options, and restricted stock awards to the Company’s employees, members of the board of directors, and consultants of the Company.

Originally, upon the adoption of the Plan, the number of shares of Common Stock authorized pursuant to stock-based compensation plans was 1,767. On April 15, 2011, the Plan was amended to increase the number shares of Common Stock authorized to 2,568; on April 24, 2012, the Plan was amended to increase the number of shares of Common Stock authorized to 2,806; on July 23, 2012, the Plan was amended to increase the number of shares of Common Stock authorized under the Plan to 3,748; and on January 16, 2013, the Plan was amended to increase the number of common shares that may be issued under the Plan to 4,625. Approximately 546 remain available for grant as of March 31, 2013 (unaudited). This number can be increased by the board of directors, subject to the approval of the shareholders.

The Plan provides for the issuance of stock options, restricted stock awards, unrestricted stock awards, and restricted stock units to employees, officers, directors, consultants, and key personnel of the Company. The Company has not granted unrestricted stock awards or restricted stock unit awards under the Plan since its inception. Options generally expire ten years following the date of grant, unless the award recipient is an owner of more than ten percent of the combined voting power of all classes of stock of the Company, in which case the contractual term cannot exceed five years following the date of grant. Options typically vest in four years, but vesting provisions can vary based on the discretion of the administrator to the Plan. Options carry an exercise price equal to the estimated fair value of the Company’s common stock on the date of grant, unless the award recipient is an owner of more than ten percent of the combined voting power of all classes of stock of the Company, in which case the exercise price cannot be less than 110 percent of the estimated fair value of the Company’s common stock on the date of grant. Generally options to purchase shares of the Company’s common stock are exercisable on a physical settlement basis, but net share settlement is permitted in certain instances. Restricted stock awards have varying vesting terms. Recipients of restricted stock awards are entitled to voting rights and to receive dividends, if and when declared. Awards of restricted stock generally carry a purchase price equal to the estimated fair value of the Company’s common stock on the date of grant. Upon termination, the unvested portion of an award of restricted stock is subject to a right of repurchase by the Company in an amount equal to the original purchase price.

Shares of the Company’s common stock underlying any awards that are forfeited, canceled, withheld upon exercise of an option, or settlement of an award to cover the exercise price or tax withholding, reacquired by the Company prior to vesting, satisfied without the issuance of shares of the Company’s common stock, or otherwise terminated other than by exercise will be added back to the shares of common stock available for issuance under the Plan. Shares available for issuance under the Plan may be authorized but unissued shares of the Company’s common stock or shares of the Company’s common stock that have been reacquired by the Company. The Plan will expire on September 15, 2020, the tenth anniversary of its approval by the Company’s board of directors.

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Stock-based compensation expense

The Company recognized stock-based compensation expense totaling $758, $822, $233 and $661 during the years ended December 31, 2011 and 2012, and the three months ended March 31, 2012 and 2013 (unaudited), respectively. Share-based compensation expense recognized by award type is as follows:

	Year ended December 31,		Three months ended March 31,	
	2011	2012	2012	2013
			(unaudited)	
Stock options	$ 574	$ 742	$ 215	$ 639
Warrants	102	—	—	—
Restricted stock awards	82	80	18	22
	$ 758	$ 822	$ 233	$ 661

Total compensation cost recognized for all stock-based compensation awards in the consolidated statements of operations and comprehensive loss is as follows:

	Year ended December 31,		Three months ended March 31,	
	2011	2012	2012	2013
			(unaudited)	
Research and development	$ 325	$ 408	$ 118	$ 347
General and administrative	433	414	115	314
	$ 758	$ 822	$ 233	$ 661

The fair value of each option issued to employees was estimated at the date of grant using the Black-Scholes option pricing model with the following weighted-average assumptions:

	Year ended December 31,		Three months ended March 31,	
	2011	2012	2012	2013
			(unaudited)	
Fair value of the underlying instrument	$ 2.09	$ 2.20	$ 2.09	$ 5.50
Expected volatility	83.0%	79.6%	78.8%	82.0%
Expected term (in years)	6.1	6.1	6.1	6.1
Risk-free interest rate	1.7%	1.0%	1.1%	1.0%
Expected dividend yield	0.0%	0.0%	0.0%	0.0%

The intrinsic value of options exercised during the years ended December 31, 2011 and 2012, and the three months ended March 31, 2012 and 2013 (unaudited), was $1, $17, $0 and $31, respectively.

The weighted-average fair values of options granted during 2011, 2012 and the three months ended March 31, 2012 and 2013 (unaudited) were $1.48, $1.51, $1.42 and $3.84, respectively.

The aggregate fair value of restricted stock awards that vested during the years ended December 31, 2011 and 2012, and the three months ended March 31, 2012 and 2013 (unaudited), based on the estimated fair value of the underlying stock on the day of vesting was $116, $97, $28 and $23, respectively.

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As of March 31, 2013, there was $6,467 of unrecognized compensation expense related to unvested stock options and restricted stock awards that is expected to be recognized over a weighted-average period of 3.6 years.

Restricted common stock

A summary of the Company's restricted stock activity and related information is as follows:

	Shares	Weighted-average grant date fair value
Unvested balance at December 31, 2011	249	$ 1.00
Granted	—	—
Vested	(94)	$ 1.04
Forfeited	—	—
Unvested balance at December 31 2012	155	$ 0.95
Granted (unaudited)	—	—
Vested (unaudited)	(23)	$ 1.04
Forfeited (unaudited)	—	—
Unvested balance at March 31, 2013 (unaudited)	132	$ 0.96

Stock options

The following table summarizes the stock option activity under the Plan:

	Shares	Weighted-average exercise price per share	Weighted-average contractual life (in years)	Aggregate intrinsic value (a)
Outstanding at December 31, 2011	1,529	$ 2.09	9.0	$ 313
Granted	785	2.20		
Exercised	(10)	2.17		
Canceled or forfeited	(103)	2.15		
Outstanding at December 31 2012	2,201	$ 2.09	8.5	$ 7,502
Granted (unaudited)	1,468	5.50		
Exercised (unaudited)	(16)	2.09		
Canceled or forfeited (unaudited)	—	—		
Outstanding at March 31, 2013 (unaudited)	3,653	$ 3.46	8.9	$ 17,146
Exercisable at December 31, 2012	925	$ 2.12	7.8	$ 3,128
Vested and expected to vest at December 31, 2012	2,201	$ 2.09	8.5	$ 7,502
Exercisable at March 31, 2013 (unaudited)	1,057	$ 2.10	7.7	$ 6,405
Vested and expected to vest at March 31, 2013 (unaudited)	3,653	$ 3.46	8.9	$ 17,146

(a) The aggregate intrinsic value is calculated as the difference between the exercise price of the underlying options and the estimated fair value of the Common Stock for the options that were in the money at December 31, 2011 and 2012 and March 31, 2013 (unaudited).

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During the years ended December 31, 2011 and 2012, and the three months ended March 31, 2012 and 2013 (unaudited), current and former employees of the Company exercised a total of 2, 10, 0 and 16 options, respectively, resulting in total proceeds of $1, $21, $0 and $35, respectively. In accordance with Company policy, the shares were issued from a pool of shares reserved for issuance under the stock plans described above.

Warrants

During the year ended December 31, 2011, the Company issued warrants to purchase an aggregate of 50 shares of Common Stock. The awards were granted in exchange for consulting services provided by a non-employee pursuant to standalone award agreements that are independent of an equity incentive plan. The warrants vested immediately and are outstanding for ten years from the date of issuance. The Company determined the fair value of the warrants using the Black-Scholes option pricing model. The aggregate fair value of the warrants was recognized in full on the date of grant. The Company recognized $102 of share-based compensation expense associated with the warrants issued during the year ended December 31, 2011.

Note receivable

In November 2010, the Company received a non-recourse note from its Chief Executive Officer (“CEO”) in exchange for the purchase of 329 shares of restricted stock. Interest accrues on the note on an annual basis at a rate of four percent. The note is payable in cash and due on November 15, 2020, and allowed to be prepaid. As of March 31, 2013, the outstanding principal balance of the note was $312. This note is collateralized by the underlying restricted common stock and has been accounted for similar to a stock option within the accompanying consolidated financial statements. Accordingly, neither the note nor the issuance of the shares has been recorded. The CEO expects to repay the note prior to the conclusion of the proposed initial public offering. The Company recorded stock-based compensation expense of $63 in connection with this restricted stock for each of the years ended December 31, 2011 and 2012 and $16 for each of the three months ended March 31, 2012 and 2013 (unaudited).

13. 401(k) Savings plan

In 1997, the Company established a defined-contribution savings plan under Section 401(k) of the Internal Revenue Code (“the 401(k) Plan”). The 401(k) Plan covers all employees who meet defined minimum age and service requirements, and allows participants to defer a portion of their annual compensation on a pretax basis. The Company has not made any contributions to the 401(k) Plan for the two years ended December 31, 2012 and three months ended March 31, 2013 (unaudited).

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14. Income taxes

For the years ended December 31, 2011 and 2012, the Company did not record a current or deferred income tax expense or benefit.

The components of loss before income taxes were as follows:

	Year ended December 31,	
	2011	2012
U.S.	$ (15,300)	$ (23,700)
Foreign	(298)	30
Total	$ (15,598)	$ (23,670)

Deferred taxes are recognized for temporary differences between the basis of assets and liabilities for financial statement and income tax purposes. The significant components of the Company's deferred tax assets are comprised of the following:

	Year ended December 31,	
	2011	2012
Deferred tax assets:		
U.S. net operating loss carryforwards	$ 16,082	$ 24,044
Foreign net operating loss carryforwards	584	587
Tax credit carryforwards	1,283	1,910
Capitalized research and development expenses, net	2,898	2,334
Accruals and other	867	556
Total deferred tax assets	21,714	29,431
Less valuation allowance	(21,714)	(29,431)
Net deferred tax assets	$ —	$ —

The Company has evaluated the positive and negative evidence bearing upon the realizability of its deferred tax assets. Based on the Company's history of operating losses, the Company has concluded that it is more likely than not that the benefit of its deferred tax assets will not be realized. Accordingly, the Company has provided a full valuation allowance for deferred tax assets as of December 31, 2011 and 2012. The valuation allowance increased approximately $7,717 during the year ended December 31, 2012, due primarily to net operating losses. The valuation allowance increased approximately $6,240 during the year ended December 31, 2011, due primarily to net operating losses generated during the period and research credits.

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A reconciliation of income tax expense computed at the statutory federal income tax rate to income taxes as reflected in the financial statements is as follows:

	Year ended December 31,	
	2011	**2012**
Federal income tax expense at statutory rate	34.0%	34.0%
State income tax, net of federal benefit	5.0%	4.4%
Permanent differences	(1.3%)	(0.8%)
Research and development credit	3.4%	0.8%
Other	(0.6%)	0.6%
Change in valuation allowance	(40.5%)	(39.0%)
Effective income tax rate	0.0%	0.0%

As of December 31, 2011 and 2012, the Company had U.S. federal net operating loss carryforwards of approximately $42,400 and $62,600, respectively, which may be available to offset future income tax liabilities and expire at various dates through 2032. As of December 31, 2011 and 2012, the Company also had U.S. state net operating loss carryforwards of approximately $31,300 and $52,300, respectively, which may be available to offset future income tax liabilities and expire at various dates through 2032. At December 31, 2011 and 2012, the Company also had approximately $1,800 and $1,800, respectively, of foreign net operating loss carryforwards which may be available to offset future income tax liabilities; these carryforwards do not expire. As a result of the up-front payment pursuant to the Company's collaboration agreement with Celgene, the Company expects that it will use a significant portion of its net operating loss carryforwards.

As of December 31, 2011 and 2012, the Company had federal research and development tax credit carryforwards of approximately $1,000 and $1,300, respectively, available to reduce future tax liabilities which expire at various dates through 2032. As of December 31, 2011 and 2012, the Company had state research and development tax credit carryforwards of approximately $400 and $900, respectively, available to reduce future tax liabilities which expire at various dates through 2027.

Under the provisions of the Internal Revenue Code, the net operating loss and tax credit carryforwards are subject to review and possible adjustment by the Internal Revenue Service and state tax authorities. Net operating loss and tax credit carryforwards may become subject to an annual limitation in the event of certain cumulative changes in the ownership interest of significant shareholders over a three-year period in excess of 50 percent, as defined under Sections 382 and 383 of the Internal Revenue Code, respectively, as well as similar state provisions. This could limit the amount of tax attributes that can be utilized annually to offset future taxable income or tax liabilities. The amount of the annual limitation is determined based on the value of the Company immediately prior to the ownership change. Subsequent ownership changes may further affect the limitation in future years. The Company has completed several financings since its inception which may have resulted in a change in control as defined by Sections 382 and 383 of the Internal Revenue Code, or could result in a change in control in the future.

The Company will recognize interest and penalties related to uncertain tax positions in income tax expense. As of December 31, 2011 and 2012, the Company had no accrued interest or

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penalties related to uncertain tax positions and no amounts have been recognized in the Company's consolidated statements of operations and comprehensive loss.

For all years through December 31, 2012, the Company generated research credits but has not conducted a study to document the qualified activities. This study may result in an adjustment to the Company's research and development credit carryforwards; however, until a study is completed and any adjustment is known, no amounts are being presented as an uncertain tax position for these two years. A full valuation allowance has been provided against the Company's research and development credits and, if an adjustment is required, this adjustment would be offset by an adjustment to the deferred tax asset established for the research and development credit carryforwards and the valuation allowance.

The Company or one of its subsidiaries files income tax returns in the United States, and various state and foreign jurisdictions. The federal, state and foreign income tax returns are generally subject to tax examinations for the tax years ended December 31, 2009 through December 31, 2012. To the extent the Company has tax attribute carryforwards, the tax years in which the attribute was generated may still be adjusted upon examination by the Internal Revenue Service, state or foreign tax authorities to the extent utilized in a future period.

15. Net loss per share

The following table reconciles net loss to net loss applicable to common stockholders:

	Year ended December 31,		Three months ended March 31,	
	2011	2012	2012	2013
			(unaudited)	
Numerator:				
Net loss	$ (15,598)	$ (23,670)	$ (5,068)	$ (6,544)
Accretion and dividends on convertible preferred stock	(4,993)	(3,057)	(1,285)	—
Gain on extinguishment of convertible preferred stock	—	23,114	—	—
Net loss applicable to common stockholders	$ (20,591)	$ (3,613)	$ (6,353)	$ (6,544)
Denominator:				
Weighted average common shares outstanding—basic and diluted	120	262	223	328
Net loss per share applicable to common stockholders—basic and diluted	$ (171.59)	$ (13.79)	$ (28.49)	$ (19.94)

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The following common stock equivalents were excluded from the calculation of diluted net loss per share for the periods indicated because including them would have had an anti-dilutive effect:

	Year ended December 31,		Three months ended March 31,	
	2011	2012	2012	2013
			(unaudited)	
Preferred stock	10,041	16,389	10,041	16,389
Warrants	440	440	440	440
Outstanding stock options	1,529	2,201	1,745	3,653
Unvested restricted stock	249	155	222	132
	12,259	19,185	12,448	20,614

16. Subsequent events

The Company has completed an evaluation of all subsequent events through the filing date of this Registration Statement on Form S-1 with the SEC, to ensure that this filing includes appropriate disclosure of events both recognized in the financial statements as of March 31, 2013, and events which occurred subsequently but were not recognized in the financial statements. The Company has concluded that no subsequent event has occurred that requires disclosure, except as noted below:

(A) (unaudited) On June 3, 2013, the Company entered into a new nine-year building lease for approximately 43,600 square feet of space in Cambridge, Massachusetts, commencing on the earlier of the substantial completion of the build-out work or January 1, 2014. The lease has monthly lease payments of $0.2 million the first 12 months with annual rent escalations thereafter and provides a rent abatement of $0.2 million per month for the first six months. The total operating lease obligation of the noncancelable lease term of this agreement is $24.2 million. In addition, the lease provides a contribution from the landlord towards the initial build-out of the space of up to $6.5 million. The Company has the option to extend this lease by an additional five years. In accordance with the lease, the Company entered into a cash-collateralized irrevocable standby letter of credit in the amount of $1.3 million, naming the landlord as beneficiary. The Company's current building lease in Cambridge, Massachusetts, expires on March 31, 2015. The Company plans to relocate to the new space prior to its expiration.

On June 3, 2013, the Company's board of directors adopted its 2013 Employee Stock Purchase Plan ("2013 ESPP"), which was subsequently approved by its stockholders. It will become effective upon closing of this offering. The 2013 ESPP authorizes the initial issuance of up to a total of 238 shares of the Company's common stock to participating employees. Unless otherwise determined by the administrator of the 2013 ESPP, the first offering will begin on January 1st of the year designated by the administrator.

On June 3, 2013, the Company's board of directors adopted its 2013 Stock Option and Incentive Plan ("2013 Plan"), which was subsequently approved by its stockholders. It will become effective immediately prior to this offering. The 2013 Plan will replace the 2010 Plan. The

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Company has initially reserved 955,000 shares of its common stock for the issuance of awards under the 2013 Plan (including the shares reserved for issuance under the 2010 Stock Option and Grant Plan). The 2013 Plan provides that the number of shares reserved and available for issuance under the plan will automatically increase each January 1, beginning on January 1, 2014, by four percent of the outstanding number of shares of common stock on the immediately preceding December 31 or such lesser number of shares as determined by the Company's compensation committee.

(B) On June 3, 2013, the board of directors and the stockholders of the Company approved a one-for-18.967 reverse stock split of the Company's outstanding common stock, which was effected on June 3, 2013. Stockholders entitled to fractional shares as a result of the reverse stock split will receive a cash payment in lieu of receiving fractional shares. The Company's historical share and per share information has been retroactively adjusted to give effect to this reverse stock split. Shares of common stock underlying outstanding stock options and other equity instruments were proportionately reduced and the respective exercise prices, if applicable, were proportionately increased in accordance with the terms of the agreements governing such securities. Shares of common stock reserved for issuance upon the conversion of the Company's Series A-1 Preferred Stock, Series A-2 Preferred Stock, Series B Preferred Stock, Series C Preferred Stock, and Series D Preferred Stock were proportionately reduced and the respective conversion prices were proportionately increased.

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5,000,000 shares

Common stock

Prospectus

J.P. Morgan **BofA Merrill Lynch**

Cowen and Company

Canaccord Genuity **Wedbush PacGrow Life Sciences**

, 2013

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

No action is being taken in any jurisdiction outside the United States to permit a public offering of the common stock or possession or distribution of this prospectus in that jurisdiction. Persons who come into possession of this prospectus in jurisdictions outside the United States are required to inform themselves about and to observe any restrictions as to this offering and the distribution of this prospectus applicable to that jurisdiction.

Until , 2013, all dealers that buy, sell or trade in our common stock, whether or not participating in this offering, may be required to deliver a prospectus. This is in addition to the dealers' obligation to deliver a prospectus when acting as underwriters and with respect to their unsold allotments or subscriptions.

Part II

Information not required in prospectus

Item 13. Other expenses of issuance and distribution

The following table sets forth the costs and expenses, other than the underwriting discounts and commissions, payable by the registrant in connection with the sale of common stock being registered. All amounts are estimates except for the Securities and Exchange Commission, or SEC, registration fee, the FINRA filing fee and The Nasdaq Global Market listing fee.

Item	Amount to be paid
SEC registration fee	$ 12,549
FINRA filing fee	14,300
Nasdaq Global Market listing fee	125,000
Printing and engraving expenses	225,000
Legal fees and expenses	1,550,000
Accounting fees and expenses	900,000
Transfer Agent fees and expenses	10,000
Miscellaneous expenses	163,151
Total	$ 3,000,000

* To be provided by amendment

Item 14. Indemnification of directors and officers

Section 145(a) of the Delaware General Corporation Law provides, in general, that a corporation may indemnify any person who was or is a party or is threatened to be made a party to any threatened, pending or completed action, suit or proceeding, whether civil, criminal, administrative or investigative (other than an action by or in the right of the corporation), because he or she is or was a director, officer, employee or agent of the corporation, or is or was serving at the request of the corporation as a director, officer, employee or agent of another corporation, partnership, joint venture, trust or other enterprise, against expenses (including attorneys' fees), judgments, fines and amounts paid in settlement actually and reasonably incurred by the person in connection with such action, suit or proceeding, if he or she acted in good faith and in a manner he or she reasonably believed to be in or not opposed to the best interests of the corporation and, with respect to any criminal action or proceeding, had no reasonable cause to believe his or her conduct was unlawful.

Section 145(b) of the Delaware General Corporation Law provides, in general, that a corporation may indemnify any person who was or is a party or is threatened to be made a party to any threatened, pending or completed action or suit by or in the right of the corporation to procure a judgment in its favor because the person is or was a director, officer, employee or agent of the corporation, or is or was serving at the request of the corporation as a director, officer, employee or agent of another corporation, partnership, joint venture, trust or other enterprise, against expenses (including attorneys' fees) actually and reasonably incurred by the person in connection with the defense or settlement of such action or suit if he or she acted in good faith and in a manner he or she reasonably believed to be in or not opposed to the best interests of the corporation, except that no indemnification shall be made with respect to any claim, issue or matter as to which he or she shall have been adjudged to be liable to the

corporation unless and only to the extent that the Court of Chancery or other adjudicating court determines that, despite the adjudication of liability but in view of all of the circumstances of the case, he or she is fairly and reasonably entitled to indemnity for such expenses which the Court of Chancery or other adjudicating court shall deem proper.

Section 145(g) of the Delaware General Corporation Law provides, in general, that a corporation may purchase and maintain insurance on behalf of any person who is or was a director, officer, employee or agent of the corporation, or is or was serving at the request of the corporation as a director, officer, employee or agent of another corporation, partnership, joint venture, trust or other enterprise against any liability asserted against such person and incurred by such person in any such capacity, or arising out of his or her status as such, whether or not the corporation would have the power to indemnify the person against such liability under Section 145 of the Delaware General Corporation Law.

Article VII of our amended and restated certificate of incorporation (the “Charter”), provides that no director of our company shall be personally liable to us or our stockholders for monetary damages for any breach of fiduciary duty as a director, except for liability (1) for any breach of the director’s duty of loyalty to us or our stockholders, (2) for acts or omissions not in good faith or which involve intentional misconduct or a knowing violation of law, (3) in respect of unlawful dividend payments or stock redemptions or repurchases, or (4) for any transaction from which the director derived an improper personal benefit. In addition, our Charter provides that if the Delaware General Corporation Law is amended to authorize the further elimination or limitation of the liability of directors, then the liability of a director of our company shall be eliminated or limited to the fullest extent permitted by the Delaware General Corporation Law, as so amended.

Article VII of the Charter further provides that any repeal or modification of such article by our stockholders or amendment to the Delaware General Corporation Law will not adversely affect any right or protection existing at the time of such repeal or modification with respect to any acts or omissions occurring before such repeal or modification of a director serving at the time of such repeal or modification.

Article V of our amended and restated by-laws (the “By-Laws”), provides that we will indemnify each of our directors and officers and, in the discretion of our board of directors, certain employees, to the fullest extent permitted by the Delaware General Corporation Law as the same may be amended (except that in the case of amendment, only to the extent that the amendment permits us to provide broader indemnification rights than the Delaware General Corporation Law permitted us to provide prior to such the amendment) against any and all expenses, judgments, penalties, fines and amounts reasonably paid in settlement that are incurred by the director, officer or such employee or on the director’s, officer’s or employee’s behalf in connection with any threatened, pending or completed proceeding or any claim, issue or matter therein, to which he or she is or is threatened to be made a party because he or she is or was serving as a director, officer or employee of our company, or at our request as a director, partner, trustee, officer, employee or agent of another corporation, partnership, joint venture, trust, employee benefit plan or other enterprise, if he or she acted in good faith and in a manner he or she reasonably believed to be in or not opposed to the best interests of our company and, with respect to any criminal proceeding, had no reasonable cause to believe his or her conduct was unlawful. Article V of the By-Laws further provides for the advancement of expenses to each of our directors and, in the discretion of the board of directors, to certain officers and employees.

In addition, Article V of the By-Laws provides that the right of each of our directors and officers to indemnification and advancement of expenses shall be a contract right and shall not be exclusive of any other right now possessed or hereafter acquired under any statute, provision of the Charter or By-Laws, agreement, vote of stockholders or otherwise. Furthermore, Article V of the By-Laws authorizes us to provide insurance for our directors, officers and employees, against any liability, whether or not we would have the power to indemnify such person against such liability under the Delaware General Corporation Law or the provisions of Article V of the By-Laws.

In connection with the sale of common stock being registered hereby, we have entered into indemnification agreements with each of our directors and our executive officers. These agreements will provide that we will indemnify each of our directors and such officers to the fullest extent permitted by law and the Charter and By-Laws.

We also maintain a general liability insurance policy which covers certain liabilities of directors and officers of our company arising out of claims based on acts or omissions in their capacities as directors or officers.

In any underwriting agreement we enter into in connection with the sale of common stock being registered hereby, the underwriters will agree to indemnify, under certain conditions, us, our directors, our officers and persons who control us within the meaning of the Securities Act of 1933, as amended, against certain liabilities.

Item 15. Recent sales of unregistered securities

In the three years preceding the filing of this registration statement, we have issued the following securities that were not registered under the Securities Act:

Grants and modifications of warrants

In May 2007, December 2007, May 2008, August 2008, December 2008, April 2009, July 2009, October 2009 and December 2009, we issued warrants to purchase 1,133,100, 472,124, 472,124, 472,124, 472,124, 321,044, 321,044, 283,274, and 574,800 shares, respectively, of either (i) our Series A-1 Preferred Stock or (ii) such preferred stock that we may issue in a subsequent qualified financing. In March 2010, in connection with the Series B Preferred Stock financing, the 2007, 2008 and the April, July and October 2009 warrants were amended to provide that such warrants would be exercisable only for shares of our Series A-1 Preferred Stock at a per share price of $0.6619 and the December 2009 warrants were amended to provide that such warrants would be exercisable only for shares of our Series B Preferred Stock at a per share price of $0.3262. The warrant issuances were exempt pursuant to Section 4(2), as transactions by an issuer not involving a public offering. The shares of preferred stock issued upon exercise of warrants and the shares of common stock issued upon conversion of the preferred stock are deemed restricted securities for the purposes of the Securities Act.

Grants and exercises of stock options

Since January 1, 2010, we have granted stock options to purchase an aggregate of 3,904,878 shares of our common stock at exercise prices ranging from $0.95 to $8.16. Since January 1, 2010, we have issued an aggregate of 29,955 shares of our common stock upon exercise of stock options granted pursuant to our 2002 Employee, Director and Consultant Plan and our 2010 Stock Option and Grant Plan for aggregate consideration of $61,394.

The option grants and the issuances of common stock upon exercise of the options were exempt either pursuant to Rule 701, as a transaction pursuant to a compensatory benefit plan, or pursuant to Section 4(2), as a transaction by an issuer not involving a public offering. The shares of common stock issued upon exercise of options are deemed restricted securities for the purposes of the Securities Act.

Issuances of capital stock

Since January 1, 2010, we have granted and issued an aggregate of 386,329 shares of our common stock pursuant to our 2010 Stock Option and Grant Plan. The issuances of common stock were exempt either pursuant to Rule 701, as a transaction pursuant to a compensatory benefit plan, or pursuant to Section 4(2), as a transaction by an issuer not involving a public offering. The shares of common stock issued pursuant to our 2010 Stock Option and Grant Plan are deemed restricted securities for the purposes of the Securities Act.

In March 2010, we issued an aggregate of 61,555,660 shares of our Series B Preferred Stock for aggregate consideration of $16.8 million in cash and $3.3 million in converted bridge notes to five investors. In April 2011, we issued an aggregate of 53,648,066 shares of our Series B Preferred Stock at a price per share of $0.3262 for aggregate consideration of $17.5 million to the same five investors. In April 2011, we issued an aggregate of 39,942,483 shares of our Series C Preferred Stock at a price per share of $0.37554 to five investors for aggregate consideration of $15.0 million to the same five investors. In July 2012, we issued an aggregate of 120,409,385 shares of our Series D Preferred Stock at a price per share of $0.4983 for aggregate consideration of $60.0 million to 17 investors. These preferred stock issuances were exempt under the Securities Act pursuant to Section 4(2) and/or Regulation D promulgated thereunder as transactions not involving a public offering.

Item 16. Exhibits and financial statement schedules

(a) Exhibits

See the Exhibit Index attached to this Registration Statement, which is incorporated by reference herein.

(b) Financial statement schedules

Schedules not listed above have been omitted because the information required to be set forth therein is not applicable or is shown in the financial statements or notes thereto.

Item 17. Undertakings

The undersigned Registrant hereby undertakes to provide to the underwriters at the closing specified in the underwriting agreement certificates in such denominations and registered in such names as required by the underwriters to permit prompt delivery to each purchaser.

Insofar as indemnification for liabilities arising under the Securities Act may be permitted to directors, officers and controlling persons of the Registrant pursuant to the foregoing provisions, or otherwise, the Registrant has been advised that in the opinion of the SEC such indemnification is against public policy as expressed in the Securities Act, and is, therefore, unenforceable. In the event that a claim for indemnification against such liabilities (other than the payment by the

Registrant of expenses incurred or paid by a director, officer, or controlling person of the Registrant in the successful defense of any action, suit or proceeding) is asserted by such director, officer or controlling person in connection with the securities being registered, the Registrant will, unless in the opinion of its counsel the matter has been settled by controlling precedent, submit to a court of appropriate jurisdiction the question of whether such indemnification by it is against public policy as expressed in the Securities Act and will be governed by the final adjudication of such issue.

The undersigned Registrant hereby undertakes that:

1. For purposes of determining any liability under the Securities Act, the information omitted from the form of prospectus filed as part of this Registration Statement in reliance upon Rule 430A and contained in a form of prospectus filed by the Registrant pursuant to Rule 424(b)(1) or (4) or 497(h) under the Securities Act shall be deemed to be part of this Registration Statement as of the time it was declared effective.

2. For the purpose of determining any liability under the Securities Act, each post-effective amendment that contains a form of prospectus shall be deemed to be a new registration statement relating to the securities offered therein, and the offering of such securities at that time shall be deemed to be the initial bona fide offering thereof.

Signatures

Pursuant to the requirements of the Securities Act of 1933, as amended, the Registrant has duly caused this Amendment No. 2 to Registration Statement on Form S-1 to be signed on its behalf by the undersigned, thereunto duly authorized, in the city of Cambridge, Commonwealth of Massachusetts, on the 4th day of June, 2013.

bluebird bio, Inc.

By: /s/ Nick Leschly
Nick Leschly
President and Chief Executive Officer

Pursuant to the requirements of the Securities Act, this Amendment No. 2 to Registration Statement on Form S-1 has been signed by the following persons in the capacities and on the dates indicated.

Signature	Title	Date
/s/ Nick Leschly Nick Leschly	President, Chief Executive Officer and Director (Principal Executive Officer)	June 4, 2013
/s/ Jeffrey T. Walsh Jeffrey T. Walsh	Chief Operating Officer and Secretary (Principal Financial Officer)	June 4, 2013
* Linda C. Bain	Vice President, Finance and Business Operations and Treasurer (Principal Accounting Officer)	June 4, 2013
* Daniel S. Lynch	Chairman of the Board	June 4, 2013
* Wendy L. Dixon, Ph.D.	Director	June 4, 2013
* Steven Gillis, Ph.D.	Director	June 4, 2013
* John M. Maraganore, Ph.D.	Director	June 4, 2013
* Geert-Jan Mulder, M.D.	Director	June 4, 2013
* Dr. Axel Polack	Director	June 4, 2013
* David P. Schenkein, M.D.	Director	June 4, 2013
* Robert I. Tepper, M.D.	Director	June 4, 2013

*By: /s/ Jeffrey T. Walsh
Jeffrey T. Walsh
Attorney-in-fact

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Exhibit index

Exhibit number	Description of exhibit
1.1	Form of Underwriting Agreement.
3.1	Form of Amended and Restated Certificate of Incorporation (to be effective upon pricing of this offering).
3.2	Form of Amended and Restated Certificate of Incorporation (to be effective upon completion of this offering).
3.3**	Form of Amended and Restated By-laws.
4.1	Specimen Common Stock Certificate.
4.2**	Form of Common Stock Warrant.
4.3**	Form of Series A-1 Preferred Stock Warrant.
4.4**	Form of Series B Preferred Stock Warrant.
4.5**	Amended and Restated Investors' Rights Agreement, dated as of July 23, 2012, by and among the Registrant and the Investors listed therein.
5.1	Opinion of Goodwin Procter LLP.
10.1**	Second Amended and Restated 2002 Employee, Director and Consultant Plan, as amended, and forms of award agreement thereunder.
10.2**	2010 Stock Option and Grant Plan, as amended, and forms of award agreement thereunder.
10.3	2013 Stock Option and Incentive Plan and forms of award agreement thereunder.
10.4**	Form of Indemnification Agreement between the Registrant and each of its Executive Officers and Directors.
10.5**	Amended and Restated Lease Agreement, dated May 18, 2007, by and between the Registrant and Rivertech Associates II, LLC, as amended.
10.6†**	Patent License Agreement, dated December 11, 1996, by and between the Registrant (formerly known as Genetix Pharmaceuticals Inc., successor-in-interest to Innogene Pharmaceuticals Inc.) and Massachusetts Institute of Technology, as amended.
10.7†**	Patent and Know-How License Agreement No. 07554F30, dated May 14, 2009, by and between the Registrant (formerly known as Genetix Pharmaceuticals Inc.) and INSERM-TRANSFERT, as amended.
10.8†**	License Agreement, dated September 13, 2011, by and between the Registrant and Institut Pasteur, as amended.
10.9†**	License Agreement, dated December 7, 2011, by and between the Registrant and Research Development Foundation.
10.10†**	Novation Agreement, dated April 2, 2012, by and between the Registrant and The Board of Trustees of the Leland Stanford Junior University.
10.11†**	Master Collaboration Agreement by and between the Registrant and Celgene Corporation, dated March 19, 2013.
10.12	Amended and Restated Employment Agreement by and between the Registrant and Nick Leschly.
10.13	Amended and Restated Employment Agreement by and between the Registrant and Jeffrey T. Walsh.

Exhibit number	Description of exhibit
10.14	Amended and Restated Employment Agreement by and between the Registrant and Mitch Finer.
10.15	Amended and Restated Employment Agreement by and between the Registrant and David M. Davidson, M.D.
10.16	Offer Letter, dated September 27, 2011 by and between the Registrant and Linda Bain.
10.17	2013 Employee Stock Purchase Plan.
10.18**	Executive Cash Incentive Bonus Plan.
10.19	Lease, dated June 3, 2013, by and between the Registrant and 150 Second Street, LLC.
21.1**	Subsidiaries of Registrant.
23.1	Consent of Ernst & Young LLP.
23.2	Consent of McGladrey LLP.
23.3	Consent of Goodwin Procter LLP (included in Exhibit 5.1).
24.1**	Power of Attorney (included on signature page).

** Previously filed.

† Portions of this exhibit (indicated by asterisks) have been omitted pursuant to a request for confidential treatment and this exhibit has been submitted separately to the SEC.

Exhibit 1.1

BLUEBIRD BIO, INC.

[•] Shares of Common Stock, par value $0.01 per share

Underwriting Agreement

[•], 2013

J. P. Morgan Securities LLC
Merrill Lynch, Pierce, Fenner & Smith
Incorporated
As Representatives of
the several Underwriters listed in
Schedule 1 hereto

c/o J. P. Morgan Securities LLC
383 Madison Avenue
New York, New York 10179

c/o Merrill Lynch, Pierce, Fenner & Smith
Incorporated
One Bryant Park
New York, New York, 10036

Ladies and Gentlemen:

bluebird bio, Inc., a Delaware corporation (the "Company"), proposes to issue and sell to the several Underwriters listed in Schedule 1 hereto (the "Underwriters"), for whom you are acting as representatives (the "Representatives"), an aggregate of [•] shares of common stock, par value $0.01 per share ("Common Stock"), of the Company (the "Underwritten Shares") and, at the option of the Underwriters, up to an additional [•] shares of Common Stock of the Company (the "Option Shares"). The Underwritten Shares and the Option Shares are herein referred to as the "Shares". The shares of Common Stock, par value $0.01 per share, of the Company to be outstanding after giving effect to the sale of the Shares are referred to herein as the "Stock".

The Company hereby confirms its agreement with the several Underwriters concerning the purchase and sale of the Shares, as follows:

1. Registration Statement. The Company has prepared and filed with the Securities and Exchange Commission (the "Commission") under the Securities Act of 1933, as amended, and the rules and regulations of the Commission thereunder (collectively, the "Securities Act"), a registration statement (File No. 333-188605), including a prospectus, relating to the Shares. Such registration statement, as amended at the time it became effective, including the information, if any, deemed pursuant to Rule 430A, 430B or 430C under the Securities Act to be part of the registration statement at the time of its effectiveness ("Rule 430 Information"), is referred to herein as the "Registration Statement"; and as used herein, the term "Preliminary Prospectus" means each prospectus included in such registration statement (and any amendments thereto) before effectiveness, any prospectus filed with the Commission pursuant to

Rule 424(a) under the Securities Act and the prospectus included in the Registration Statement at the time of its effectiveness that omits Rule 430 Information, and the term "Prospectus" means the prospectus in the form first used (or made available upon request of purchasers pursuant to Rule 173 under the Securities Act) in connection with confirmation of sales of the Shares. If the Company has filed an abbreviated registration statement pursuant to Rule 462(b) under the Securities Act (the "Rule 462 Registration Statement"), then any reference herein to the term "Registration Statement" shall be deemed to include such Rule 462 Registration Statement. Capitalized terms used but not defined herein shall have the meanings given to such terms in the Registration Statement and the Prospectus.

At or prior to the Applicable Time (as defined below), the Company had prepared the following information (collectively with the pricing information set forth on Annex A, the "Pricing Disclosure Package"): a Preliminary Prospectus dated [●], 2013 and each "free-writing prospectus" (as defined pursuant to Rule 405 under the Securities Act) listed on Annex A hereto.

"Applicable Time" means [●] [A/P].M., New York City time, on [●], 2013.

2. Purchase of the Shares by the Underwriters.

(a) The Company agrees to issue and sell the Underwritten Shares to the several Underwriters as provided in this Agreement, and each Underwriter, on the basis of the representations, warranties and agreements set forth herein and subject to the conditions set forth herein, agrees, severally and not jointly, to purchase from the Company the respective number of Underwritten Shares set forth opposite such Underwriter's name in Schedule 1 hereto at a price per share (the "Purchase Price") of $[●].

In addition, the Company agrees to issue and sell the Option Shares to the several Underwriters as provided in this Agreement, and the Underwriters, on the basis of the representations, warranties and agreements set forth herein and subject to the conditions set forth herein, shall have the option to purchase, severally and not jointly, from the Company the Option Shares at the Purchase Price less an amount per share equal to any dividends or distributions declared by the Company and payable on the Underwritten Shares but not payable on the Option Shares.

If any Option Shares are to be purchased, the number of Option Shares to be purchased by each Underwriter shall be the number of Option Shares which bears the same ratio to the aggregate number of Option Shares being purchased as the number of Underwritten Shares set forth opposite the name of such Underwriter in Schedule 1 hereto (or such number increased as set forth in Section 10 hereof) bears to the aggregate number of Underwritten Shares being purchased from the Company by the several Underwriters, subject, however, to such adjustments to eliminate any fractional Shares as the Representatives in their sole discretion shall make.

The Underwriters may exercise the option to purchase Option Shares at any time in whole, or from time to time in part, on or before the thirtieth day following the date of the Prospectus, by written notice from the Representatives to the Company. Such notice shall set forth the aggregate number of Option Shares as to which the option is being exercised and the date and time when the Option Shares are to be delivered and paid for, which may be the same date and time as the Closing Date (as hereinafter defined) but shall not be earlier than the Closing Date or later than the tenth full business day (as hereinafter defined) after the date of such notice (unless such time and date are postponed in accordance with the provisions of Section 10 hereof). Any such notice shall be given at least two business days prior to the date and time of delivery specified therein, except with respect to Option Shares to be purchased on the Closing Date, in which case such notice shall only be required at least one business day prior to the Closing Date.

(b) The Company understands that the Underwriters intend to make a public offering of the Shares as soon after the effectiveness of this Agreement as in the judgment of the Representatives is advisable, and initially to offer the Shares on the terms set forth in the Prospectus. The Company acknowledges and agrees that the Underwriters may offer and sell Shares to or through any affiliate of an Underwriter.

(c) Payment for the Shares shall be made by wire transfer in immediately available funds to the account specified by the Company to the Representatives in the case of the Underwritten Shares, at the offices of Ropes & Gray LLP, Prudential Tower, 800 Boylston Street, Boston, MA 02199 at 10:00 A.M., New York City time, on [•], 2013, or at such other time or place on the same or such other date, not later than the fifth business day thereafter, as the Representatives and the Company may agree upon in writing or, in the case of the Option Shares, on the date and at the time and place specified by the Representatives in the written notice of the Underwriters' election to purchase such Option Shares. The time and date of such payment for the Underwritten Shares is referred to herein as the "Closing Date", and the time and date for such payment for the Option Shares, if other than the Closing Date, is herein referred to as the "Additional Closing Date".

Payment for the Shares to be purchased on the Closing Date or the Additional Closing Date, as the case may be, shall be made against delivery to the Representatives for the respective accounts of the several Underwriters of the Shares to be purchased on such date or the Additional Closing Date, as the case may be, with any transfer taxes payable in connection with the sale of such Shares duly paid by the Company. Delivery of the Shares shall be made through the facilities of The Depository Trust Company ("DTC") unless the Representatives shall otherwise instruct.

(d) The Company acknowledges and agrees that the Underwriters are acting solely in the capacity of an arm's length contractual counterparty to the Company with respect to the offering of Shares contemplated hereby (including in connection with determining the terms of the offering) and not as a financial advisor or a fiduciary to, or an agent of, the Company or any other person. Additionally, neither the Representatives nor any other Underwriter is advising the Company or any other person as to any legal, tax, investment, accounting or regulatory matters in any jurisdiction. The Company shall consult with its own advisors concerning such matters and shall be responsible for making its own independent investigation and appraisal of the transactions contemplated hereby, and the Underwriters shall have no responsibility or liability to the Company with respect thereto. Any review by the Underwriters of the Company, the transactions contemplated hereby or other matters relating to such transactions will be performed solely for the benefit of the Underwriters and shall not be on behalf of the Company.

3. Representations and Warranties of the Company. The Company represents and warrants to each Underwriter that:

(a) *Preliminary Prospectus.* No order preventing or suspending the use of any Preliminary Prospectus has been issued by the Commission, and each Preliminary Prospectus included in the Pricing Disclosure Package, at the time of filing thereof, complied in all material respects with the Securities Act, and no Preliminary Prospectus, at the time of filing thereof, contained any untrue statement of a material fact or omitted to state a material fact necessary in order to make the statements therein, in the light of the circumstances under which they were made, not misleading; provided that the Company makes no representation and warranty with respect to any statements or omissions made in reliance upon and in conformity with information relating to any Underwriter furnished to the Company in writing by such Underwriter through the Representatives expressly for use in any Preliminary Prospectus, it being understood and agreed that the only such information furnished by any Underwriter consists of the information described as such in Section 7(b) hereof.

(b) *Pricing Disclosure Package*. The Pricing Disclosure Package as of the Applicable Time did not, and as of the Closing Date and as of the Additional Closing Date, as the case may be, will not, contain any untrue statement of a material fact or omit to state a material fact necessary in order to make the statements therein, in the light of the circumstances under which they were made, not misleading; provided that the Company makes no representation and warranty with respect to any statements or omissions made in reliance upon and in conformity with information relating to any Underwriter furnished to the Company in writing by such Underwriter through the Representatives expressly for use in such Pricing Disclosure Package, it being understood and agreed that the only such information furnished by any Underwriter consists of the information described as such in Section 7(b) hereof.

(c) *Issuer Free Writing Prospectus.* Other than the Registration Statement, the Preliminary Prospectus and the Prospectus, the Company (including its agents and representatives, other than the Underwriters in their capacity as such) has not prepared, used, authorized, approved or referred to and will not prepare, use, authorize, approve or refer to any "written communication" (as defined in Rule 405 under the Securities Act) that constitutes an offer to sell or solicitation of an offer to buy the Shares (each such communication by the Company or its agents and representatives (other than a communication referred to in clause (i) below) an "Issuer Free Writing Prospectus") other than (i) any document not constituting a prospectus pursuant to Section 2(a)(10)(a) of the Securities Act or Rule 134 under the Securities Act or (ii) the documents listed on Annex A hereto, each electronic road show and any other written communications approved in writing in advance by the Representatives. Each such Issuer Free Writing Prospectus complied in all material respects with the Securities Act, has been or will be (within the time period specified in Rule 433) filed in accordance with the Securities Act (to the extent required thereby) and, when taken together with the Preliminary Prospectus accompanying, or delivered prior to delivery of, such Issuer Free Writing Prospectus, did not, and as of the Closing Date and as of the Additional Closing Date, as the case may be, will not, contain any untrue statement of a material fact or omit to state a material fact necessary in order to make the statements therein, in the light of the circumstances under which they were made, not misleading; provided that the Company makes no representation and warranty with respect to any statements or omissions made in each such Issuer Free Writing Prospectus or Preliminary Prospectus in reliance upon and in conformity with information relating to any Underwriter furnished to the Company in writing by such Underwriter through the Representatives expressly for use in such Issuer Free Writing Prospectus or Preliminary Prospectus, it being understood and agreed that the only such information furnished by any Underwriter consists of the information described as such in Section 7(b) hereof.

(d) *Emerging Growth Company*. From the time of initial confidential submission of the Registration Statement to the Commission (or, if earlier, the first date on which the Company engaged directly or through any person authorized to act on its behalf in any Testing-the-Waters Communication) through the date hereof, the Company has been and is an "emerging growth company," as defined in Section 2(a) of the Securities Act (an "Emerging Growth Company"). "Testing-the-Waters Communication" means any oral or written communication with potential investors undertaken in reliance on Section 5(d) of the Securities Act.

(e) *Testing-the-Waters Materials*. The Company (i) has not alone engaged in any Testing-the-Waters Communications other than Testing-the-Waters Communications with the prior consent of the Representatives with entities that are qualified institutional buyers within the

meaning of Rule 144A under the Securities Act or institutions that are accredited investors within the meaning of Rule 501 under the Securities Act and (ii) has not authorized anyone other than the Representatives to engage in Testing-the-Waters Communications. The Company reconfirms that the Representatives have been authorized to act on its behalf in undertaking Testing-the-Waters Communications. The Company has not distributed or approved for distribution any Written Testing-the-Waters Communications other than those listed on Annex B hereto. "Written Testing-the-Waters Communication" means any Testing-the-Waters Communication that is a written communication within the meaning of Rule 405 under the Securities Act. Any individual Written Testing-the-Waters Communication does not conflict with the information contained in the Registration Statement or the Pricing Disclosure Package, complied in all material respects with the Securities Act, and when taken together with the Pricing Disclosure Package as of the Applicable Time, did not, and as of the Closing Date and as of the Additional Closing Date, as the case may be, will not, contain any untrue statement of a material fact or omit to state a material fact necessary in order to make the statements therein, in the light of the circumstances under which they were made, not misleading.

(f) *Registration Statement and Prospectus.* The Registration Statement has been declared effective by the Commission. No order suspending the effectiveness of the Registration Statement has been issued by the Commission, and no proceeding for that purpose or pursuant to Section 8A of the Securities Act against the Company or related to the offering of the Shares has been initiated or, to the knowledge of the Company, threatened by the Commission; as of the applicable effective date of the Registration Statement and any post-effective amendment thereto, the Registration Statement and any such post-effective amendment complied and will comply in all material respects with the Securities Act, and did not and will not contain any untrue statement of a material fact or omit to state a material fact required to be stated therein or necessary in order to make the statements therein not misleading; and as of the date of the Prospectus and any amendment or supplement thereto and as of the Closing Date and as of the Additional Closing Date, as the case may be, the Prospectus will not contain any untrue statement of a material fact or omit to state a material fact necessary in order to make the statements therein, in the light of the circumstances under which they were made, not misleading; provided that the Company makes no representation and warranty with respect to any statements or omissions made in reliance upon and in conformity with information relating to any Underwriter furnished to the Company in writing by such Underwriter through the Representatives expressly for use in the Registration Statement and the Prospectus and any amendment or supplement thereto, it being understood and agreed that the only such information furnished by any Underwriter consists of the information described as such in Section 7(b) hereof.

(g) *Financial Statements.* The financial statements (including the related notes thereto) of the Company and its consolidated subsidiaries included in the Registration Statement, the Pricing Disclosure Package and the Prospectus comply in all material respects with the applicable requirements of the Securities Act and present fairly in all material respects the financial position of the Company and its consolidated subsidiaries as of the dates indicated and the results of their operations and the changes in their cash flows for the periods specified; such financial statements have been prepared in conformity with generally accepted accounting principles in the United States applied on a consistent basis throughout the periods covered thereby, except in the case of unaudited, interim financial statements, which are subject to normal year-end adjustments and do not contain certain footnotes as permitted by the applicable rules of the Commission, and any supporting schedules included in the Registration Statement present fairly in all material respects the information required to be stated therein; and the other financial information included in the Registration Statement, the Pricing Disclosure Package and the Prospectus has been derived from the accounting records of the Company and its consolidated subsidiaries and presents fairly in all material respects the information shown thereby.

(h) *No Material Adverse Change.* Since the date of the most recent financial statements of the Company included in the Registration Statement, the Pricing Disclosure Package and the Prospectus, (i) there has not been any change in the capital stock (other than the issuance of shares of Common Stock upon exercise of stock options and warrants described as outstanding in, and the grant of options and awards under existing equity incentive plans described in, the Registration Statement, the Pricing Disclosure Package and the Prospectus), short-term debt or long-term debt of the Company or any of its subsidiaries, or any dividend or distribution of any kind declared, set aside for payment, paid or made by the Company on any class of capital stock, or any material adverse change, or any development that would reasonably be expected to result in material adverse change, in or affecting the business, properties, management, financial position, stockholders' equity, results of operations or prospects of the Company and its subsidiaries taken as a whole; (ii) neither the Company nor any of its subsidiaries has entered into any transaction or agreement (whether or not in the ordinary course of business) that is material to the Company and its subsidiaries taken as a whole or incurred any liability or obligation, direct or contingent, that is material to the Company and its subsidiaries taken as a whole; and (iii) neither the Company nor any of its subsidiaries has sustained any loss or interference with its business that is material to the Company and its subsidiaries taken as a whole and that is either from fire, explosion, flood or other calamity, whether or not covered by insurance, or from any labor disturbance or dispute or any action, order or decree of any court or arbitrator or governmental or regulatory authority, except in each case as otherwise disclosed in the Registration Statement, the Pricing Disclosure Package and the Prospectus.

(i) *Organization and Good Standing.* The Company and each of its subsidiaries have been duly organized and are validly existing and in good standing under the laws of their respective jurisdictions of organization, are duly qualified to do business and are in good standing in each jurisdiction in which their respective ownership or lease of property or the conduct of their respective businesses requires such qualification, and have all power and authority necessary to own or hold their respective properties and to conduct the businesses in which they are engaged, except where the failure to be so qualified or in good standing or have such power or authority would not, individually or in the aggregate, have a material adverse effect on the business, properties, management, financial position, stockholders' equity, results of operations or prospects of the Company and its subsidiaries taken as a whole or on the performance by the Company of its obligations under this Agreement (a "Material Adverse Effect"). The Company does not own or control, directly or indirectly, any corporation, association or other entity other than the subsidiaries listed in Exhibit 21 to the Registration Statement. Other than bluebird bio Securities Corporation, none of the subsidiaries of the Company is a Significant Subsidiary as defined by Rule 1-02(w) of Regulation S-X promulgated by the Commission.

(j) *Capitalization.* The Company has an authorized capitalization as set forth in the Registration Statement, the Pricing Disclosure Package and the Prospectus under the heading "Capitalization"; all the outstanding shares of capital stock of the Company have been duly and validly authorized and issued and are fully paid and non-assessable and are not subject to any pre-emptive or similar rights that have not been duly waived or satisfied; except as described in or expressly contemplated by the Pricing Disclosure Package and the Prospectus, there are no outstanding rights (including, without limitation, pre-emptive rights), warrants or options to acquire, or instruments convertible into or exchangeable for, any shares of capital stock or other equity interest in the Company or any of its subsidiaries, or any contract, commitment, agreement, understanding or arrangement of any kind relating to the issuance of any capital stock

of the Company or any such subsidiary, any such convertible or exchangeable securities or any such rights, warrants or options; the capital stock of the Company conforms in all material respects to the description thereof contained in the Registration Statement, the Pricing Disclosure Package and the Prospectus; and all the outstanding shares of capital stock or other equity interests of each subsidiary owned, directly or indirectly, by the Company have been duly and validly authorized and issued, are fully paid and non-assessable and are owned directly or indirectly by the Company, free and clear of any lien, charge, encumbrance, security interest, restriction on voting or transfer or any other claim of any third party. There are no debt securities or preferred stock of, or guaranteed by, the Company or any of its subsidiaries that are rated by a "nationally recognized statistical rating organization," as such term is defined in Section 3(a)(62) of the Securities Exchange Act of 1934, as amended, and the rules and regulations of the Commission thereunder (collectively, the "Exchange Act").

(k) *Stock Options.* With respect to the stock options (the "Stock Options") granted pursuant to the stock-based compensation plans of the Company and its subsidiaries (the "Company Stock Plans"), (i) to the Company's knowledge, each Stock Option intended to qualify as an "incentive stock option" under Section 422 of the United States Internal Revenue Code of 1986, as amended (the "Code") so qualifies, (ii) each grant of a Stock Option was duly authorized no later than the date on which the grant of such Stock Option was by its terms to be effective by all necessary corporate action, including, as applicable, approval by the board of directors of the Company (or a duly constituted and authorized committee thereof) and any required stockholder approval by the necessary number of votes or written consents, and the award agreement governing such grant (if any) was duly executed and delivered by each party thereto, (iii) each such grant was made in accordance with the terms of the Company Stock Plans, and (iv) each such grant was properly accounted for in accordance with generally accepted accounting principles in the United States in the financial statements (including the related notes) of the Company. Since January 1, 2010, the Company has not knowingly granted, and there is no and has been no policy or practice of the Company of granting, Stock Options prior to, or otherwise coordinating the grant of Stock Options with, the release or other public announcement of material information regarding the Company or its subsidiaries or their results of operations or prospects.

(l) *Due Authorization.* The Company has full right, power and authority to execute and deliver this Agreement and to perform its obligations hereunder; and all action required to be taken for the due and proper authorization, execution and delivery by it of this Agreement and the consummation by it of the transactions contemplated hereby has been duly and validly taken.

(m) *Underwriting Agreement.* This Agreement has been duly authorized, executed and delivered by the Company.

(n) *The Shares.* The Shares to be issued and sold by the Company hereunder have been duly authorized and, when issued and delivered and paid for as provided herein, will be duly and validly issued, will be fully paid and nonassessable and will conform in all material respects to the descriptions thereof in the Registration Statement, the Pricing Disclosure Package and the Prospectus; and the issuance of the Shares is not subject to any preemptive or similar rights that have not been duly waived.

(o) *Descriptions of the Underwriting Agreement.* This Agreement conforms in all material respects to the description thereof contained in the Registration Statement, the Pricing Disclosure Package and the Prospectus.

(p) *No Violation or Default.* Neither the Company nor any of its subsidiaries is (i) in violation of its charter or by-laws or similar organizational documents; (ii) in default, and no event has occurred that, with notice or lapse of time or both, would constitute such a default, in the due performance or observance of any term, covenant or condition contained in any indenture, mortgage, deed of trust, loan agreement or other agreement or instrument to which the Company or any of its subsidiaries is a party or by which the Company or any of its subsidiaries is bound or to which any of the property or assets of the Company or any of its subsidiaries is subject; or (iii) in violation of any law or statute or any judgment, order, rule or regulation of any court or arbitrator or governmental or regulatory authority, except, in the case of clauses (ii) and (iii) above, for any such default or violation that would not, individually or in the aggregate, have a Material Adverse Effect.

(q) *No Conflicts.* The execution, delivery and performance by the Company of this Agreement, the issuance and sale of the Shares and the consummation by the Company of the transactions contemplated by this Agreement will not (i) conflict with or result in a breach or violation of any of the terms or provisions of, or constitute a default under, or result in the creation or imposition of any lien, charge or encumbrance upon any property or assets of the Company or any of its subsidiaries pursuant to, any indenture, mortgage, deed of trust, loan agreement or other agreement or instrument to which the Company or any of its subsidiaries is a party or by which the Company or any of its subsidiaries is bound or to which any of the property or assets of the Company or any of its subsidiaries is subject, (ii) result in any violation of the provisions of the charter or by-laws or similar organizational documents of the Company or any of its subsidiaries or (iii) result in the violation of any law or statute or any judgment, order, rule or regulation of any court or arbitrator or governmental or regulatory authority, except, in the case of clauses (i) and (iii) above, for any such conflict, breach, violation or default that would not, individually or in the aggregate, have a Material Adverse Effect.

(r) *No Consents Required.* No consent, approval, authorization, order, license, registration or qualification of or with any court or arbitrator or governmental or regulatory authority is required for the execution, delivery and performance by the Company of this Agreement, the issuance and sale of the Shares and the consummation of the transactions contemplated by this Agreement, except for the registration of the Shares under the Securities Act and such consents, approvals, authorizations, orders and registrations or qualifications as may be required by the Financial Industry Regulatory Authority, Inc. ("FINRA"), for official listing on the Nasdaq Stock Exchange and under applicable state securities laws in connection with the purchase and distribution of the Shares by the Underwriters.

(s) *Legal Proceedings.* Except as described in the Registration Statement, the Pricing Disclosure Package and the Prospectus, there are no legal, governmental or regulatory investigations, actions, suits or proceedings pending to which the Company or any of its subsidiaries is a party or to which any property of the Company or any of its subsidiaries is the subject that, individually or in the aggregate, if determined adversely to the Company or any of its subsidiaries, would reasonably be expected to have a Material Adverse Effect; to the knowledge of the Company, no such investigations, actions, suits or proceedings are threatened or contemplated by any governmental or regulatory authority or threatened by others; and (i) there are no current or pending legal, governmental or regulatory actions, suits or proceedings that are required under the Securities Act to be described in the Registration Statement, the Pricing Disclosure Package or the Prospectus that are not so described in the Registration Statement, the Pricing Disclosure Package and the Prospectus and (ii) there are no statutes, regulations or contracts or other documents that are required under the Securities Act to be filed as exhibits to the Registration Statement or described in the Registration Statement, the Pricing Disclosure Package or the Prospectus that are not so filed as exhibits to the Registration Statement or described in the Registration Statement, the Pricing Disclosure Package and the Prospectus.

(t) *Independent Accountants*. Ernst & Young LLP and McGladrey & Pullen, LLP, who have certified certain financial statements of the Company and its subsidiaries are each independent registered public accounting firms with respect to the Company and its subsidiaries within the applicable rules and regulations adopted by the Commission and the Public Company Accounting Oversight Board (United States) and as required by the Securities Act.

(u) *Title to Real and Personal Property*. The Company and its subsidiaries have good and marketable title in fee simple (in the case of real property) to, or have valid rights to lease or otherwise use, all items of real and personal property and assets that are material to the business of the Company and its subsidiaries taken as a whole, in each case free and clear of all liens, encumbrances, claims and defects and imperfections of title except those that (i) do not materially interfere with the use made and proposed to be made of such property by the Company and its subsidiaries or (ii) would not reasonably be expected, individually or in the aggregate, to have a Material Adverse Effect.

(v) *Intellectual Property Rights*. Except as expressly contemplated by the Registration Statement, the Pricing Disclosure Package and the Prospectus, the Company owns or has valid, binding and enforceable licenses or other rights under the patents and patent applications, copyrights, trademarks, trademark registrations, service marks, service mark registrations, trade names, service names and know-how (including trade secrets and other unpatented and/or unpatentable proprietary or confidential information, systems or procedures) necessary for, or used in the conduct, or the proposed conduct, of the business of the Company in the manner described in the Registration Statement, the Pricing Disclosure Package and the Prospectus (collectively, the "Company Intellectual Property"); to the knowledge of the Company, the patents, trademarks, and copyrights included within the Company Intellectual Property are valid, enforceable, and subsisting; other than as disclosed in the Registration Statement, the Pricing Disclosure Package and the Prospectus, (i) the Company is not obligated to pay a material royalty, grant a license to any material portion of the Company Intellectual Property, or provide other material consideration to any third party in connection with the Company Intellectual Property, (ii) the Company has not received any notice of any claim of infringement, misappropriation or conflict with any asserted rights of others with respect to any of the Company's products, proposed products, processes or Company Intellectual Property, (iii) to the knowledge of the Company, neither the sale nor use of any of the discoveries, inventions, products, proposed products or processes of the Company referred to in the Registration Statement, the Pricing Disclosure Package or the Prospectus do or will, to the knowledge of the Company, infringe, interfere or conflict with any right or valid patent claim of any third party, and (iv) to the knowledge of the Company, no third party has any ownership right in or to any Company Intellectual Property that is owned by the Company, other than any co-owner of any patent constituting Company Intellectual Property who is listed on the records of the U.S. Patent and Trademark Office (the "USPTO") and any co-owner of any patent application constituting Company Intellectual Property who is named in such patent application, and, to the knowledge of the Company, no third party has any ownership right in or to any Company Intellectual Property in any field of use that is exclusively licensed to the Company, other than any licensor to the Company of such Company Intellectual Property.

(w) *Patents and Patent Applications*. All patents and patent applications owned by or licensed to the Company or under which the Company has rights have, to the knowledge of the Company, been duly and properly filed and maintained; to the knowledge of the Company, the

parties prosecuting such applications have complied with their duty of candor and disclosure to the USPTO in connection with such applications; and the Company is not aware of any facts required to be disclosed to the USPTO that were not disclosed to the USPTO and which would preclude the grant of a patent in connection with any such application or could form the basis of a finding of invalidity with respect to any patents that have issued with respect to such applications.

(x) *No Undisclosed Relationships*. No relationship, direct or indirect, exists between or among the Company or any of its subsidiaries, on the one hand, and the directors, officers, stockholders, customers or suppliers of the Company or any of its subsidiaries, on the other, that is required by the Securities Act to be described in the Registration Statement and the Prospectus and that is not so described in such documents and in the Pricing Disclosure Package.

(y) *Investment Company Act*. The Company is not and, after giving effect to the offering and sale of the Shares and the application of the proceeds thereof as described in the Registration Statement, the Pricing Disclosure Package and the Prospectus, will not be required to register as an "investment company" or an entity "controlled" by an "investment company" within the meaning of the Investment Company Act of 1940, as amended, and the rules and regulations of the Commission thereunder (collectively, the "Investment Company Act").

(z) *Taxes.* The Company and its subsidiaries have paid all federal, state, local and foreign taxes and filed all tax returns required to be paid or filed through the date hereof except for taxes being contested in good faith and for which reserves in accordance with generally accepted accounting principles in the United States have been taken; and except as otherwise disclosed in the Registration Statement, the Pricing Disclosure Package and the Prospectus, there is no material tax deficiency that has been, or would reasonably be expected to be, asserted against the Company or any of its subsidiaries or any of their respective properties or assets.

(aa) *Licenses and Permits.* The Company and its subsidiaries possess all licenses, certificates, permits and other authorizations issued by, and have made all declarations and filings with, the appropriate federal, state, local or foreign governmental or regulatory authorities that are necessary for the ownership or lease of their respective properties or the conduct of their respective businesses as described in the Registration Statement, the Pricing Disclosure Package and the Prospectus, except where the failure to possess or make the same would not, individually or in the aggregate, have a Material Adverse Effect; and except as described in the Registration Statement, the Pricing Disclosure Package and the Prospectus, neither the Company nor any of its subsidiaries has received notice of any revocation or modification of any such license, certificate, permit or authorization or has any reason to believe that any such license, certificate, permit or authorization will not be renewed in the ordinary course.

(bb) *No Labor Disputes.* No labor disturbance by or dispute with employees of the Company or any of its subsidiaries exists or, to the knowledge of the Company, is contemplated or threatened, and the Company is not aware of any existing or imminent labor disturbance by, or dispute with, the employees of any of its or its subsidiaries' principal suppliers, contractors or customers, except as would not have a Material Adverse Effect.

(cc) *Compliance with and Liability under Environmental Laws.* (i) The Company and its subsidiaries (a) are in compliance with any and all applicable federal, state, local and foreign laws, rules, regulations, requirements, decisions, judgments, decrees, orders and the common law relating to pollution or the protection of the environment, natural resources or human health or safety, including those relating to the generation, storage, treatment, use, handling, transportation, Release or threat of Release of Hazardous Materials (collectively, "Environmental Laws"), (b)

have received and are in compliance with all permits, licenses, certificates or other authorizations or approvals required of them under applicable Environmental Laws to conduct their respective businesses, (c) have not received notice of any actual or potential liability under or relating to, or actual or potential violation of, any Environmental Laws, including for the investigation or remediation of any Release or threat of Release of Hazardous Materials, and have no knowledge of any event or condition that would reasonably be expected to result in any such notice, (d) are not conducting or paying for, in whole or in part, any investigation, remediation or other corrective action pursuant to any Environmental Law at any location, and (e) are not a party to any order, decree or agreement that imposes any obligation or liability under any Environmental Law, and (ii) there are no costs or liabilities associated with Environmental Laws of or relating to the Company or its subsidiaries, except in the case of each of (i) and (ii) above, for any such matter, as would not, individually or in the aggregate, reasonably be expected to have a Material Adverse Effect; and (iii) except as described in the Registration Statement, the Pricing Disclosure Package and the Prospectus, (a) there are no proceedings that are pending, or to the knowledge of the Company, contemplated, against the Company or any of its subsidiaries under any Environmental Laws in which a governmental entity is also a party, other than such proceedings regarding which it is reasonably believed no monetary sanctions of $100,000 or more will be imposed, (b) the Company and its subsidiaries are not aware of any facts or issues regarding compliance with Environmental Laws, or liabilities or other obligations under Environmental Laws, including the Release or threat of Release of Hazardous Materials, that, individually or in the aggregate, would reasonably be expected to have a Material Adverse Effect, and (c) none of the Company and its subsidiaries anticipates material capital expenditures relating to any Environmental Laws.

(dd) *Hazardous Materials*. There has been no storage, generation, transportation, use, handling, treatment, Release or threat of Release of Hazardous Materials by, relating to or caused by the Company or any of its subsidiaries (or, to the knowledge of the Company and its subsidiaries, any other entity (including any predecessor) for whose acts or omissions the Company or any of its subsidiaries is or would reasonably be expected to be liable) at, on, under or from any property or facility now or previously owned, operated or leased by the Company or any of its subsidiaries, or at, on, under or from any other property or facility, in violation of any Environmental Laws or in a manner or amount or to a location that would reasonably be expected to result in any liability under any Environmental Law, except for any violation or liability which would not, individually or in the aggregate, reasonably be expected to have a Material Adverse Effect. “Hazardous Materials” means any material, chemical, substance ,waste, pollutant, contaminant, compound, mixture, or constituent thereof, in any form or amount, including petroleum (including crude oil or any fraction thereof) and petroleum products, natural gas liquids, asbestos and asbestos containing materials, naturally occurring radioactive materials, brine, and drilling mud, regulated or which can give rise to liability under any Environmental Law. “Release” means any spilling, leaking, seepage, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, disposing, depositing, dispersing, or migrating in, into or through the environment, or in, into from or through any building or structure.

(ee) *Compliance with ERISA.* (i) Each employee benefit plan, within the meaning of Section 3(3) of the Employee Retirement Income Security Act of 1974, as amended (“ERISA”), for which the Company or any member of its “Controlled Group” (defined as any organization which is a member of a controlled group of corporations within the meaning of Section 414 of the Internal Revenue Code of 1986, as amended (the “Code”)) would have any liability (each, a “Plan”) has been maintained in compliance with its terms and the requirements of any applicable statutes, orders, rules and regulations, including but not limited to ERISA and the Code, except

for noncompliance that could not reasonably be expected to result in material liability to the Company or its subsidiaries; (ii) no prohibited transaction, within the meaning of Section 406 of ERISA or Section 4975 of the Code, has occurred with respect to any Plan, excluding transactions effected pursuant to a statutory or administrative exemption, that would reasonably be expected to result in a material liability to the Company or its subsidiaries; (iii) for each Plan that is subject to the funding rules of Section 412 of the Code or Section 302 of ERISA, the minimum funding standard of Section 412 of the Code or Section 302 of ERISA, as applicable, has been satisfied (without taking into account any waiver thereof or extension of any amortization period) and is reasonably expected to be satisfied in the future (without taking into account any waiver thereof or extension of any amortization period); (iv) to the extent applicable to a Plan, the fair market value of the assets of each Plan exceeds the present value of all benefits accrued under such Plan (determined based on those assumptions used to fund such Plan); (v) no "reportable event" (within the meaning of Section 4043(c) of ERISA) has occurred or is reasonably expected to occur that either has resulted, or would reasonably be expected to result, in material liability to the Company or its subsidiaries; (vi) neither the Company nor any member of the Controlled Group has incurred, nor reasonably expects to incur, any liability under Title IV of ERISA (other than contributions to the Plan or premiums to the PBGC, in the ordinary course and without default) in respect of a Plan (including a "multiemployer plan", within the meaning of Section 4001(a)(3) of ERISA); and (vii) there is no pending audit or investigation by the Internal Revenue Service, the U.S. Department of Labor, the Pension Benefit Guaranty Corporation or any other governmental agency or any foreign regulatory agency with respect to any Plan that would reasonably be expected to result in material liability to the Company or its subsidiaries. None of the following events has occurred or is reasonably likely to occur: (x) a material increase in the aggregate amount of contributions required to be made to all Plans by the Company or its subsidiaries in the current fiscal year of the Company and its subsidiaries compared to the amount of such contributions made in the Company and its subsidiaries' most recently completed fiscal year; or (y) a material increase in the Company and its subsidiaries' "accumulated post-retirement benefit obligations" (within the meaning of Statement of Financial Accounting Standards 106) compared to the amount of such obligations in the Company and its subsidiaries' most recently completed fiscal year.

(ff) *Disclosure Controls*. The Company and its subsidiaries maintain an effective system of "disclosure controls and procedures" (as defined in Rule 13a-15(e) of the Exchange Act) that complies with the requirements of the Exchange Act and that has been designed to ensure that information required to be disclosed by the Company in reports that it files or submits under the Exchange Act is recorded, processed, summarized and reported within the time periods specified in the Commission's rules and forms, including controls and procedures designed to ensure that such information is accumulated and communicated to the Company's management as appropriate to allow timely decisions regarding required disclosure.

(gg) *Accounting Controls.* The Company and its subsidiaries maintain systems of "internal control over financial reporting" (as defined in Rule 13a-15(f) of the Exchange Act) that are designed to comply with the requirements of the Exchange Act and have been designed by, or under the supervision of, the Company's principal executive and principal financial officers, or persons performing similar functions, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles in the United States, including, but not limited to, internal accounting controls sufficient to provide reasonable assurance that (i) transactions are executed in accordance with management's general or specific authorizations; (ii) transactions are recorded as necessary to permit preparation of financial statements in conformity with generally accepted accounting principles and to maintain asset accountability; (iii) access to assets is

permitted only in accordance with management's general or specific authorization; and (iv) the recorded accountability for assets is compared with the existing assets at reasonable intervals and appropriate action is taken with respect to any differences. Except as disclosed in the Registration Statement, the Pricing Disclosure Package and the Prospectus, there are no material weaknesses in the Company's internal controls. The Company's auditors and the Audit Committee of the Board of Directors of the Company have been advised of: (i) all significant deficiencies and material weaknesses, if any, in the design or operation of internal controls over financial reporting which have adversely affected or are reasonably likely to adversely affect the Company's ability to record, process, summarize and report financial information; and (ii) to the knowledge of the Company, any fraud, whether or not material, that involves management or other employees who have a significant role in the Company's internal controls over financial reporting.

(hh) *Insurance.* The Company and its subsidiaries have insurance covering their respective properties, operations, personnel and businesses, including business interruption insurance, which insurance is in amounts and insures against such losses and risks as are generally maintained by companies engaged in the same or similar business and which the Company reasonably believes are adequate to protect the Company and its subsidiaries and their respective businesses; and neither the Company nor any of its subsidiaries has (i) received notice from any insurer or agent of such insurer that capital improvements or other expenditures are required or necessary to be made in order to continue such insurance or (ii) any reason to believe that it will not be able to renew its existing insurance coverage as and when such coverage expires or to obtain similar coverage at reasonable cost from similar insurers as may be necessary to continue its business.

(ii) *No Unlawful Payments.* Neither the Company nor any of its subsidiaries nor, to the knowledge of the Company, any director, officer, agent, employee or other person associated with or authorized to act on behalf of the Company or any of its subsidiaries has (i) used any corporate funds for any unlawful contribution, gift, entertainment or other unlawful expense relating to political activity; (ii) made any direct or indirect unlawful payment to any foreign or domestic government official or employee from corporate funds; (iii) violated or is in violation of any provision of the Foreign Corrupt Practices Act of 1977; or (iv) made any bribe, rebate, payoff, influence payment, kickback or other unlawful payment.

(jj) *Compliance with Money Laundering Laws*. The operations of the Company and its subsidiaries are and have been conducted at all times in compliance with applicable financial recordkeeping and reporting requirements of the Currency and Foreign Transactions Reporting Act of 1970, as amended, the money laundering statutes of all jurisdictions, the rules and regulations thereunder and any related or similar rules, regulations or guidelines, issued, administered or enforced by any governmental agency (collectively, the "Money Laundering Laws") and no action, suit or proceeding by or before any court or governmental agency, authority or body or any arbitrator involving the Company or any of its subsidiaries with respect to the Money Laundering Laws is pending or, to the knowledge of the Company, threatened.

(kk) *Compliance with OFAC.* None of the Company, any of its subsidiaries or, to the knowledge of the Company, any director, officer, agent, employee or affiliate of the Company or any of its subsidiaries is currently subject to any U.S. sanctions administered by the Office of Foreign Assets Control of the U.S. Department of the Treasury ("OFAC"); and the Company will not, directly or indirectly, use the proceeds of the offering of the Shares hereunder, or lend, contribute or otherwise make available such proceeds to any subsidiary, joint venture partner or other person or entity, for the purpose of financing the activities of any person currently subject to any U.S. sanctions administered by OFAC.

(ll) *No Restrictions on Subsidiaries*. No subsidiary of the Company is currently prohibited, directly or indirectly, under any agreement or other instrument to which it is a party or is subject, from paying any dividends to the Company, from making any other distribution on such subsidiary's capital stock, from repaying to the Company any loans or advances to such subsidiary from the Company or from transferring any of such subsidiary's properties or assets to the Company or any other subsidiary of the Company.

(mm) *No Broker's Fees.* Neither the Company nor any of its subsidiaries is a party to any contract, agreement or understanding with any person (other than this Agreement) that would give rise to a valid claim against the Company or any of its subsidiaries or any Underwriter for a brokerage commission, finder's fee or like payment in connection with the offering and sale of the Shares.

(nn) *No Registration Rights*. Except as described in the Registration Statement, the Pricing Disclosure Package and the Prospectus, no person has the right to require the Company or any of its subsidiaries to register any securities for sale under the Securities Act by reason of the filing of the Registration Statement with the Commission or the issuance and sale of the Shares.

(oo) *No Stabilization.* The Company has not taken, directly or indirectly, any action designed to or that would reasonably be expected to cause or result in any stabilization or manipulation of the price of the Shares.

(pp) *Margin Rules*. The application of the proceeds received by the Company from the issuance, sale and delivery of the Shares as described in the Registration Statement, the Pricing Disclosure Package and the Prospectus will not violate Regulation T, U or X of the Board of Governors of the Federal Reserve System or any other regulation of such Board of Governors.

(qq) *Forward-Looking Statements.* No forward-looking statement (within the meaning of Section 27A of the Securities Act and Section 21E of the Exchange Act) contained in the Registration Statement, the Pricing Disclosure Package or the Prospectus has been made or reaffirmed without a reasonable basis or has been disclosed other than in good faith.

(rr) *Statistical and Market Data*. Nothing has come to the attention of the Company that has caused the Company to believe that the statistical and market-related data included in the Registration Statement, the Pricing Disclosure Package and the Prospectus is not based on or derived from sources that are reliable and accurate in all material respects.

(ss) *Tests and Clinical and Nonclinical Studies*. To the Company's knowledge, the tests and nonclinical and clinical studies that are described in the Registration Statement, the Pricing Disclosure Package and the Prospectus were and, if still pending, are being, conducted in all material respects in accordance with the protocols submitted to the U.S. Food and Drug Administration (the "FDA") or any foreign governmental body exercising comparable authority, procedures and controls pursuant to, where applicable, accepted professional and scientific standards, and all applicable laws and regulations; the descriptions of the tests and nonclinical and clinical studies conducted by or, to the Company's knowledge, on behalf of the Company, and, to the Company's knowledge, the results thereof, contained in the Registration Statement, the Pricing Disclosure Package and the Prospectus are accurate and complete in all material respects; the Company is not aware of any other tests or nonclinical or clinical studies, the results

of which reasonably call into question the results described in the Registration Statement, the Pricing Disclosure Package and the Prospectus; and the Company has not received any notices or correspondence from the FDA, any foreign, state or local governmental body exercising comparable authority or any Institutional Review Board requiring the termination, suspension, material modification or clinical hold of any tests or nonclinical or clinical studies conducted by or on behalf of the Company.

(tt) *Sarbanes-Oxley Act*. There is and has been no failure on the part of the Company or, to the knowledge of the Company, any of the Company's directors or officers, in their capacities as such, to comply with any provision of the Sarbanes-Oxley Act of 2002 and the rules and regulations promulgated in connection therewith (the "Sarbanes-Oxley Act"), including Section 402 related to loans.

(uu) *Status under the Securities Act*. At the time of filing the Registration Statement and any post-effective amendment thereto, at the earliest time thereafter that the Company or any offering participant made a *bona fide* offer (within the meaning of Rule 164(h)(2) under the Securities Act) of the Shares and at the date hereof, the Company was not and is not an "ineligible issuer," as defined in Rule 405 under the Securities Act.

4. Further Agreements of the Company. The Company covenants and agrees with each Underwriter that:

(a) *Required Filings.* The Company will file the final Prospectus with the Commission within the time periods specified by Rule 424(b) and Rule 430A, 430B or 430C under the Securities Act, will file any Issuer Free Writing Prospectus to the extent required by Rule 433 under the Securities Act, and will furnish copies of the Prospectus and each Issuer Free Writing Prospectus (to the extent not previously delivered) to the Underwriters in New York City prior to 10:00 A.M., New York City time, on the business day next succeeding the date of this Agreement in such quantities as the Representatives may reasonably request.

(b) *Delivery of Copies.* The Company will deliver, without charge, (i) to the Representatives, three signed copies of the Registration Statement as originally filed and each amendment thereto, in each case including all exhibits and consents filed therewith; and (ii) to each Underwriter (A) a conformed copy of the Registration Statement as originally filed and each amendment thereto (without exhibits) and (B) during the Prospectus Delivery Period (as defined below), as many copies of the Prospectus (including all amendments and supplements thereto and each Issuer Free Writing Prospectus) as the Representatives may reasonably request. As used herein, the term "Prospectus Delivery Period" means such period of time after the first date of the public offering of the Shares as in the opinion of counsel for the Underwriters a prospectus relating to the Shares is required by law to be delivered (or required to be delivered but for Rule 172 under the Securities Act) in connection with sales of the Shares by any Underwriter or dealer.

(c) *Amendments or Supplements, Issuer Free Writing Prospectuses.* Before preparing, using, authorizing, approving, referring to or filing any Issuer Free Writing Prospectus, and before filing any amendment or supplement to the Registration Statement or the Prospectus, the Company will furnish to the Representatives and counsel for the Underwriters a copy of the proposed Issuer Free Writing Prospectus, amendment or supplement for review and will not prepare, use, authorize, approve, refer to or file any such Issuer Free Writing Prospectus or file any such proposed amendment or supplement to which the Representatives reasonably object.

(d) *Notice to the Representatives.* The Company will advise the Representatives promptly, and confirm such advice in writing, (i) when the Registration Statement has become effective; (ii) when any amendment to the Registration Statement has been filed or becomes effective; (iii) when any supplement to the Prospectus, any Issuer Free Writing Prospectus or any Written Testing-the-Waters Communication or any amendment to the Prospectus has been filed or distributed; (iv) of any request by the Commission for any amendment to the Registration Statement or any amendment or supplement to the Prospectus or the receipt of any comments from the Commission relating to the Registration Statement or any other request by the Commission for any additional information including, but not limited to, any request for information concerning any Testing-the-Waters Communication; (v) of the issuance by the Commission of any order suspending the effectiveness of the Registration Statement or preventing or suspending the use of any Preliminary Prospectus, any of the Pricing Disclosure Package, the Prospectus or any Written Testing-the-Waters Communication or the initiation or threatening of any proceeding for that purpose or pursuant to Section 8A of the Securities Act; (vi) of the occurrence of any event or development within the Prospectus Delivery Period as a result of which the Prospectus, the Pricing Disclosure Package, any Issuer Free Writing Prospectus or any Written Testing-the-Waters Communication as then amended or supplemented would include any untrue statement of a material fact or omit to state a material fact necessary in order to make the statements therein, in the light of the circumstances existing when the Prospectus, the Pricing Disclosure Package, any such Issuer Free Writing Prospectus or Written Testing-the-Waters Communication is delivered to a purchaser, not misleading; and (vii) of the receipt by the Company of any notice with respect to any suspension of the qualification of the Shares for offer and sale in any jurisdiction or the initiation or threatening of any proceeding for such purpose; and the Company will use its best efforts to prevent the issuance of any such order suspending the effectiveness of the Registration Statement, preventing or suspending the use of any Preliminary Prospectus, any of the Pricing Disclosure Package or the Prospectus or any Written Testing-the-Waters Communication or suspending any such qualification of the Shares and, if any such order is issued, will obtain as soon as possible the withdrawal thereof.

(e) *Ongoing Compliance.* (1) If during the Prospectus Delivery Period (i) any event or development shall occur or condition shall exist as a result of which the Prospectus as then amended or supplemented would include any untrue statement of a material fact or omit to state any material fact necessary in order to make the statements therein, in the light of the circumstances existing when the Prospectus is delivered to a purchaser, not misleading or (ii) it is necessary to amend or supplement the Prospectus to comply with law, the Company will immediately notify the Underwriters thereof and forthwith prepare and, subject to paragraph (c) above, file with the Commission and furnish to the Underwriters and to such dealers as the Representatives may designate such amendments or supplements to the Prospectus as may be necessary so that the statements in the Prospectus as so amended or supplemented will not, in the light of the circumstances existing when the Prospectus is delivered to a purchaser, be misleading or so that the Prospectus will comply with law and (2) if at any time prior to the Closing Date (i) any event or development shall occur or condition shall exist as a result of which the Pricing Disclosure Package as then amended or supplemented would include any untrue statement of a material fact or omit to state any material fact necessary in order to make the statements therein, in the light of the circumstances existing when the Pricing Disclosure Package is delivered to a purchaser, not misleading or (ii) it is necessary to amend or supplement the Pricing Disclosure Package to comply with law, the Company will immediately notify the Underwriters thereof and forthwith prepare and, subject to paragraph (c) above, file with the Commission (to the extent required) and furnish to the Underwriters and to such dealers as the Representatives may designate such amendments or supplements to the Pricing Disclosure Package as may be necessary so that the statements in the Pricing Disclosure Package as so amended or

supplemented will not, in the light of the circumstances existing when the Pricing Disclosure Package is delivered to a purchaser, be misleading or so that the Pricing Disclosure Package will comply with law.

(f) *Blue Sky Compliance.* The Company will qualify the Shares for offer and sale under the securities or Blue Sky laws of such jurisdictions as the Representatives shall reasonably request and will continue such qualifications in effect so long as required for distribution of the Shares; provided that the Company shall not be required to (i) qualify as a foreign corporation or other entity or as a dealer in securities in any such jurisdiction where it would not otherwise be required to so qualify, (ii) file any general consent to service of process in any such jurisdiction or (iii) subject itself to taxation in any such jurisdiction if it is not otherwise so subject.

(g) *Earning Statement.* The Company will make generally available to its security holders and the Representatives as soon as practicable an earning statement that satisfies the provisions of Section 11(a) of the Securities Act and Rule 158 of the Commission promulgated thereunder covering a period of at least twelve months beginning with the first fiscal quarter of the Company occurring after the "effective date" (as defined in Rule 158) of the Registration Statement; provided that the Company will be deemed to have furnished such statements to its security holders and the Representatives to the extent they are filed on the Commisson's Electronic Data Gathering, Analysis and Retrieval system.

(h) *Clear Market.* For a period of 180 days after the date of the Prospectus, the Company will not (i) offer, pledge, sell, contract to sell, sell any option or contract to purchase, purchase any option or contract to sell, grant any option, right or warrant to purchase, or otherwise transfer or dispose of, directly or indirectly, or file with the Commission a registration statement under the Securities Act relating to, any shares of Stock or any securities convertible into or exercisable or exchangeable for Stock, or publicly disclose the intention to make any offer, sale, pledge, disposition or filing, or (ii) enter into any swap or other agreement that transfers, in whole or in part, any of the economic consequences of ownership of the Stock or any such other securities, whether any such transaction described in clause (i) or (ii) above is to be settled by delivery of Stock or such other securities, in cash or otherwise, without the prior written consent of the Representatives, other than (A) the Shares to be sold hereunder, (B) any shares of Stock issued upon the exercise of options granted under Company Stock Plans or warrants described as outstanding in the Registration Statement, the Pricing Disclosure Package and the Prospectus, (C) any options and other awards granted under a Company Stock Plan described in the Registration Statement, the Pricing Disclosure Package and the Prospectus, (D) the filing by the Company of any registration statement on Form S-8 or a successor form thereto relating to a Company Stock Plan described in the Registration Statement, the Pricing Disclosure Package and the Prospectus and (E) shares of Stock or other securities issued in connection with a transaction with an unaffiliated third party that includes a bona fide commercial relationship (including joint ventures, marketing or distribution arrangements, collaboration agreements or intellectual property license agreements) or any acquisition of assets or not less than a majority or controlling portion of the equity of another entity, provided that (x) the aggregate number of shares issued pursuant to this clause (E) shall not exceed five percent of the total number of outstanding shares of Stock immediately following the issuance and sale of the Underwritten Shares pursuant hereto and (y) the recipient of any such shares of Stock and securities issued pursuant to this clause (E) during the 180-day restricted period described above shall enter into an agreement substantially in the form of Exhibit A hereto.

If the Representatives, in their sole discretion, agree to release or waive the restrictions set forth in a lock-up letter described in Section 6(n) hereof for an officer or director

of the Company and provide the Company with notice of the impending release or waiver at least three business days before the effective date of the release or waiver, the Company agrees to announce the impending release or waiver by a press release substantially in the form of Exhibit C hereto through a major news service at least two business days before the effective date of the release or waiver.

(i) *Use of Proceeds.* The Company will apply the net proceeds from the sale of the Shares in all material respects as described in the Registration Statement, the Pricing Disclosure Package and the Prospectus under the heading "Use of proceeds".

(j) *No Stabilization.* The Company will not take, directly or indirectly, without giving effect to activities by the Underwriters, any action designed to or that would reasonably be expected to cause or result in any stabilization or manipulation of the price of the Stock.

(k) *Exchange Listing.* The Company will use its best efforts to list for quotation the Shares on the Nasdaq Global Market (the "Nasdaq Market").

(l) *Reports.* During a period of three years from the date of this Agreement, the Company will furnish to the Representatives, as soon as they are available, copies of all reports or other communications (financial or other) furnished to holders of the Shares, and copies of any reports and financial statements furnished to or filed with the Commission or any national securities exchange or automatic quotation system; provided the Company will be deemed to have furnished such reports and financial statements to the Representatives to the extent they are filed on the Commission's Electronic Data Gathering, Analysis, and Retrieval system.

(m) *Record Retention*. The Company will, pursuant to reasonable procedures developed in good faith, retain copies of each Issuer Free Writing Prospectus that is not filed with the Commission in accordance with Rule 433 under the Securities Act.

(n) *Filings.* The Company will file with the Commission such reports as may be required by Rule 463 under the Securities Act.

(o) *Emerging Growth Company*. The Company will promptly notify the Representatives if the Company ceases to be an Emerging Growth Company at any time prior to the later of (i) completion of the distribution of Shares within the meaning of the Securities Act and (ii) completion of the 180-day restricted period referred to in Section 4(h) hereof.

5. Certain Agreements of the Underwriters . Each Underwriter hereby represents and agrees that:

(a) It has not used, authorized use of, referred to or participated in the planning for use of, and will not use, authorize use of, refer to or participate in the planning for use of, any "free writing prospectus", as defined in Rule 405 under the Securities Act (which term includes use of any written information furnished to the Commission by the Company and not incorporated by reference into the Registration Statement and any press release issued by the Company) other than (i) a free writing prospectus that contains no "issuer information" (as defined in Rule 433(h)(2) under the Securities Act) that was not included (including through incorporation by reference) in the Preliminary Prospectus or a previously filed Issuer Free Writing Prospectus, (ii) any Issuer Free Writing Prospectus listed on Annex A or prepared pursuant to Section 3(c) or Section 4(c) above (including any electronic road show), or (iii) any free writing prospectus prepared by such underwriter and approved by the Company in advance in writing (each such free writing prospectus referred to in clauses (i) or (iii), an "Underwriter Free Writing Prospectus").

(b) It has not and will not, without the prior written consent of the Company, use any free writing prospectus that contains the final terms of the Shares unless such terms have previously been included in a free writing prospectus filed with the Commission.

(c) It is not subject to any pending proceeding under Section 8A of the Securities Act with respect to the offering (and will promptly notify the Company if any such proceeding against it is initiated during the Prospectus Delivery Period).

6. Conditions of Underwriters' Obligations. The obligation of each Underwriter to purchase the Underwritten Shares on the Closing Date or the Option Shares on the Additional Closing Date, as the case may be, as provided herein is subject to the performance by the Company of its covenants and other obligations hereunder and to the following additional conditions:

(a) *Registration Compliance; No Stop Order.* No order suspending the effectiveness of the Registration Statement shall be in effect, and no proceeding for such purpose or pursuant to Section 8A under the Securities Act shall be pending before or threatened by the Commission; the Prospectus and each Issuer Free Writing Prospectus shall have been timely filed with the Commission under the Securities Act (in the case of an Issuer Free Writing Prospectus, to the extent required by Rule 433 under the Securities Act) and in accordance with Section 4(a) hereof; and all requests by the Commission for additional information shall have been complied with to the reasonable satisfaction of the Representatives.

(b) *Representations and Warranties.* The representations and warranties of the Company contained herein shall be true and correct on the date hereof and on and as of the Closing Date or the Additional Closing Date, as the case may be; and the statements of the Company and its officers made in any certificates delivered pursuant to this Agreement shall be true and correct on and as of the Closing Date or the Additional Closing Date, as the case may be.

(c) *No Material Adverse Change.* No event or condition of a type described in Section 3(h) hereof shall have occurred or shall exist, which event or condition is not described in the Pricing Disclosure Package (excluding any amendment or supplement thereto) and the Prospectus (excluding any amendment or supplement thereto) and the effect of which in the judgment of the Representatives makes it impracticable or inadvisable to proceed with the offering, sale or delivery of the Shares on the Closing Date or the Additional Closing Date, as the case may be, on the terms and in the manner contemplated by this Agreement, the Pricing Disclosure Package and the Prospectus.

(d) *Officer's Certificate.* The Representatives shall have received on and as of the Closing Date or the Additional Closing Date, as the case may be, a certificate of the chief financial officer or chief accounting officer of the Company and one additional senior executive officer of the Company who is satisfactory to the Representatives (i) confirming that such officers have carefully reviewed the Registration Statement, the Pricing Disclosure Package and the Prospectus and, to the knowledge of such officers, the representations set forth in Sections 3(b) and 3(f) hereof are true and correct, (ii) confirming that the other representations and warranties of the Company in this Agreement are true and correct and that the Company has in all material respects complied with all agreements and satisfied all conditions on its part to be performed or satisfied hereunder at or prior to the Closing Date or the Additional Closing Date, as the case may be, and (iii) to the effect set forth in paragraphs (a) and (c) above.

(e) *Comfort Letters.* On the date of this Agreement and on the Closing Date or the Additional Closing Date, as the case may be, Ernst & Young LLP and McGladrey & Pullen, LLP shall have furnished to the Representatives, at the request of the Company, letters, dated the respective dates of delivery thereof and addressed to the Underwriters, in form and substance reasonably satisfactory to the Representatives, containing statements and information of the type customarily included in accountants' "comfort letters" to underwriters with respect to the financial statements and certain financial information contained in the Registration Statement, the Pricing Disclosure Package and the Prospectus; provided, that the letter delivered on the Closing Date or the Additional Closing Date, as the case may be, shall use a "cut-off" date no more than three business days prior to such Closing Date or such Additional Closing Date, as the case may be.

(f) *Opinion and 10b-5 Statement of Counsel for the Company.* Goodwin Procter LLP, counsel for the Company, shall have furnished to the Representatives, at the request of the Company, their written opinion and 10b-5 statement, dated the Closing Date or the Additional Closing Date, as the case may be, and addressed to the Underwriters, in form and substance reasonably satisfactory to the Representatives.

(g) *Opinion of Intellectual Property Counsel for the Company.* Cooley LLP, special counsel for the Company with respect to intellectual property matters, shall have furnished to the Representatives, at the request of the Company, their written opinion, dated the Closing Date or the Additional Closing Date, as the case may be, and addressed to the Underwriters, in form and substance reasonably satisfactory to the Representatives.

(h) *Opinion and 10b-5 Statement of Counsel for the Underwriters.* The Representatives shall have received on and as of the Closing Date or the Additional Closing Date, as the case may be, an opinion and 10b-5 statement of Ropes & Gray LLP, counsel for the Underwriters, with respect to such matters as the Representatives may reasonably request, and such counsel shall have received such documents and information as they may reasonably request to enable them to pass upon such matters.

(i) *No Legal Impediment to Issuance.* No action shall have been taken and no statute, rule, regulation or order shall have been enacted, adopted or issued by any federal, state or foreign governmental or regulatory authority that would, as of the Closing Date or the Additional Closing Date, as the case may be, prevent the issuance or sale of the Shares; and no injunction or order of any federal, state or foreign court shall have been issued that would, as of the Closing Date or the Additional Closing Date, as the case may be, prevent the issuance or sale of the Shares.

(j) *Good Standing*. The Representatives shall have received on and as of the Closing Date or the Additional Closing Date, as the case may be, satisfactory evidence of the good standing of the Company and its subsidiaries in their respective jurisdictions of organization and their good standing as foreign entities in such other jurisdictions as the Representatives may reasonably request, in each case in writing or any standard form of telecommunication from the appropriate governmental authorities of such jurisdictions.

(k) *Exchange Listing.* The Shares to be delivered on the Closing Date or Additional Closing Date, as the case may be, shall have been approved for listing on the Nasdaq Global Market, subject to official notice of issuance.

(l) *Lock-up Agreements*. The "lock-up" agreements, each substantially in the form of Exhibit A hereto, between you and certain shareholders, officers and directors of the Company relating to sales and certain other dispositions of shares of Stock or certain other securities, delivered to you on or before the date hereof, shall be in full force and effect on the Closing Date or Additional Closing Date, as the case may be.

(m) *Additional Documents.* On or prior to the Closing Date or the Additional Closing Date, as the case may be, the Company shall have furnished to the Representatives such further certificates and documents as the Representatives may reasonably request.

All opinions, letters, certificates and evidence mentioned above or elsewhere in this Agreement shall be deemed to be in compliance with the provisions hereof only if they are in form and substance reasonably satisfactory to counsel for the Underwriters.

7. Indemnification and Contribution.

(a) *Indemnification of the Underwriters.* The Company agrees to indemnify and hold harmless each Underwriter, its affiliates, directors and officers and each person, if any, who controls such Underwriter within the meaning of Section 15 of the Securities Act or Section 20 of the Exchange Act, from and against any and all losses, claims, damages and liabilities (including, without limitation, legal fees and other expenses incurred in connection with any suit, action or proceeding or any claim asserted, as such fees and expenses are incurred), joint or several, that arise out of, or are based upon, (i) any untrue statement or alleged untrue statement of a material fact contained in the Registration Statement or caused by any omission or alleged omission to state therein a material fact required to be stated therein or necessary in order to make the statements therein, not misleading, (ii) or any untrue statement or alleged untrue statement of a material fact contained in the Prospectus (or any amendment or supplement thereto), any Issuer Free Writing Prospectus, any "issuer information" filed or required to be filed pursuant to Rule 433(d) under the Securities Act, any Written Testing-the-Waters Communication, any road show as defined in Rule 433(h) under the Securities Act (a "road show") or any Pricing Disclosure Package (including any Pricing Disclosure Package that has subsequently been amended), or caused by any omission or alleged omission to state therein a material fact necessary in order to make the statements therein, in light of the circumstances under which they were made, not misleading, in each case except insofar as such losses, claims, damages or liabilities arise out of, or are based upon, any untrue statement or omission or alleged untrue statement or omission made in reliance upon and in conformity with any information relating to any Underwriter furnished to the Company in writing by such Underwriter through the Representatives expressly for use therein, it being understood and agreed that the only such information furnished by any Underwriter consists of the information described as such in subsection (b) below.

(b) *Indemnification of the Company.* Each Underwriter agrees, severally and not jointly, to indemnify and hold harmless the Company, its directors, its officers who signed the Registration Statement and each person, if any, who controls the Company within the meaning of Section 15 of the Securities Act or Section 20 of the Exchange Act to the same extent as the indemnity set forth in paragraph (a) above, but only with respect to any losses, claims, damages or liabilities that arise out of, or are based upon, any untrue statement or omission or alleged untrue statement or omission made in reliance upon and in conformity with any information relating to such Underwriter furnished to the Company in writing by such Underwriter through the Representatives expressly for use in the Registration Statement, the Prospectus (or any amendment or supplement thereto), any Issuer Free Writing Prospectus, any Written Testing-the-Waters Communication, any road show or any Pricing Disclosure Package (including any Pricing Disclosure Package that has subsequently been amended), it being understood and agreed upon that the only such information furnished by any Underwriter consists

of the following information in the Prospectus furnished on behalf of each Underwriter: the concession and reallowance figures appearing in the [•] paragraph under the caption "Underwriting", the information contained in the [•] paragraph [•], in each case under the caption "Underwriting".

(c) *Notice and Procedures.* If any suit, action, proceeding (including any governmental or regulatory investigation), claim or demand shall be brought or asserted against any person in respect of which indemnification may be sought pursuant to either paragraph (a) or (b) above, such person (the "Indemnified Person") shall promptly notify the person against whom such indemnification may be sought (the "Indemnifying Person") in writing; provided that the failure to notify the Indemnifying Person shall not relieve it from any liability that it may have under paragraph (a) or (b) above except to the extent that it has been materially prejudiced (through the forfeiture of substantive rights or defenses) by such failure; and provided, further, that the failure to notify the Indemnifying Person shall not relieve it from any liability that it may have to an Indemnified Person otherwise than under paragraph (a) or (b) above. If any such proceeding shall be brought or asserted against an Indemnified Person and it shall have notified the Indemnifying Person thereof, the Indemnifying Person shall retain counsel reasonably satisfactory to the Indemnified Person (who shall not, without the consent of the Indemnified Person, be counsel to the Indemnifying Person) to represent the Indemnified Person in such proceeding and shall pay the fees and expenses of such counsel related to such proceeding, as incurred. In any such proceeding, any Indemnified Person shall have the right to retain its own counsel, but the fees and expenses of such counsel shall be at the expense of such Indemnified Person unless (i) the Indemnifying Person and the Indemnified Person shall have mutually agreed to the contrary; (ii) the Indemnifying Person has failed within a reasonable time to retain counsel reasonably satisfactory to the Indemnified Person; (iii) the Indemnified Person shall have reasonably concluded that there may be legal defenses available to it that are different from or in addition to those available to the Indemnifying Person; or (iv) the named parties in any such proceeding (including any impleaded parties) include both the Indemnifying Person and the Indemnified Person and representation of both parties by the same counsel would be inappropriate due to actual or potential differing interest between them. It is understood and agreed that the Indemnifying Person shall not, in connection with any proceeding or related proceedings in the same jurisdiction, be liable for the fees and expenses of more than one separate firm (in addition to any local counsel) for all Indemnified Persons, and that all such fees and expenses shall be paid or reimbursed as they are incurred. Any such separate firm for any Underwriter, its affiliates, directors and officers and any control persons of such Underwriter shall be designated in writing by the Representatives and any such separate firm for the Company, its directors, its officers who signed the Registration Statement and any control persons of the Company shall be designated in writing by the Company. The Indemnifying Person shall not be liable for any settlement of any proceeding effected without its written consent, but if settled with such consent or if there be a final judgment for the plaintiff, the Indemnifying Person agrees to indemnify each Indemnified Person from and against any loss or liability by reason of such settlement or judgment. Notwithstanding the foregoing sentence, if at any time an Indemnified Person shall have requested that an Indemnifying Person reimburse the Indemnified Person for fees and expenses of counsel as contemplated by this paragraph, the Indemnifying Person shall be liable for any settlement of any proceeding effected without its written consent if (i) such settlement is entered into more than 30 days after receipt by the Indemnifying Person of such request and (ii) the Indemnifying Person shall not have reimbursed the Indemnified Person in accordance with such request prior to the date of such settlement. No Indemnifying Person shall, without the written consent of the Indemnified Person, effect any settlement of any pending or threatened proceeding in respect of which any Indemnified Person is or could have been a party and indemnification could have been sought hereunder by such Indemnified Person, unless such settlement (x) includes an unconditional release of such Indemnified Person, in form and substance reasonably satisfactory to such Indemnified Person, from all liability on claims that are the subject matter of such proceeding and (y) does not include any statement as to or any admission of fault, culpability or a failure to act by or on behalf of any Indemnified Person.

(d) *Contribution.* If the indemnification provided for in paragraphs (a) and (b) above is unavailable to an Indemnified Person or insufficient in respect of any losses, claims, damages or liabilities referred to therein, then each Indemnifying Person under such paragraph, in lieu of indemnifying such Indemnified Person thereunder, shall contribute to the amount paid or payable by such Indemnified Person as a result of such losses, claims, damages or liabilities (i) in such proportion as is appropriate to reflect the relative benefits received by the Company, on the one hand, and the Underwriters on the other, from the offering of the Shares or (ii) if the allocation provided by clause (i) is not permitted by applicable law, in such proportion as is appropriate to reflect not only the relative benefits referred to in clause (i) but also the relative fault of the Company, on the one hand, and the Underwriters on the other, in connection with the statements or omissions that resulted in such losses, claims, damages or liabilities, as well as any other relevant equitable considerations. The relative benefits received by the Company, on the one hand, and the Underwriters on the other, shall be deemed to be in the same respective proportions as the net proceeds (before deducting expenses) received by the Company from the sale of the Shares and the total underwriting discounts and commissions received by the Underwriters in connection therewith, in each case as set forth in the table on the cover of the Prospectus, bear to the aggregate offering price of the Shares. The relative fault of the Company, on the one hand, and the Underwriters on the other, shall be determined by reference to, among other things, whether the untrue or alleged untrue statement of a material fact or the omission or alleged omission to state a material fact relates to information supplied by the Company or by the Underwriters and the parties' relative intent, knowledge, access to information and opportunity to correct or prevent such statement or omission.

(e) *Limitation on Liability.* The Company and the Underwriters agree that it would not be just and equitable if contribution pursuant to paragraph (d) above were determined by pro rata allocation (even if the Underwriters were treated as one entity for such purpose) or by any other method of allocation that does not take account of the equitable considerations referred to in paragraph (d) above. The amount paid or payable by an Indemnified Person as a result of the losses, claims, damages and liabilities referred to in paragraph (d) above shall be deemed to include, subject to the limitations set forth above, any legal or other expenses incurred by such Indemnified Person in connection with any such action or claim. Notwithstanding the provisions of paragraphs (d) and (e), in no event shall an Underwriter be required to contribute any amount in excess of the amount by which the total underwriting discounts and commissions received by such Underwriter with respect to the offering of the Shares exceeds the amount of any damages that such Underwriter has otherwise been required to pay by reason of such untrue or alleged untrue statement or omission or alleged omission. No person guilty of fraudulent misrepresentation (within the meaning of Section 11(f) of the Securities Act) shall be entitled to contribution from any person who was not guilty of such fraudulent misrepresentation. The Underwriters' obligations to contribute pursuant to paragraphs (d) and (e) are several in proportion to their respective purchase obligations hereunder and not joint.

(f) *Non-Exclusive Remedies.* The remedies provided for in this Section 7 are not exclusive and shall not limit any rights or remedies which may otherwise be available to any Indemnified Person at law or in equity.

8. Effectiveness of Agreement. This Agreement shall become effective upon the execution and delivery hereof by the parties hereto.

9. Termination. This Agreement may be terminated in the absolute discretion of the Representatives, by notice to the Company, if after the execution and delivery of this Agreement and prior to the Closing Date or, in the case of the Option Shares, prior to the Additional Closing Date (i) trading generally shall have been suspended or materially limited on or by any of the New York Stock Exchange, NYSE MKT, the Nasdaq Stock Market, the Chicago Board Options Exchange, the Chicago Mercantile Exchange or the Chicago Board of Trade; (ii) trading of any securities issued or guaranteed by the

Company shall have been suspended on any exchange or in any over-the-counter market; (iii) a general moratorium on commercial banking activities shall have been declared by federal or New York State authorities; or (iv) there shall have occurred any outbreak or escalation of hostilities or any change in financial markets or any calamity or crisis, either within or outside the United States, that, in the judgment of the Representatives, is material and adverse and makes it impracticable or inadvisable to proceed with the offering, sale or delivery of the Shares on the Closing Date or the Additional Closing Date, as the case may be, on the terms and in the manner contemplated by this Agreement, the Pricing Disclosure Package and the Prospectus.

10. Defaulting Underwriter.

(a) If, on the Closing Date or the Additional Closing Date, as the case may be, any Underwriter defaults on its obligation to purchase the Shares that it has agreed to purchase hereunder on such date, the non-defaulting Underwriters may in their discretion arrange for the purchase of such Shares by other persons satisfactory to the Company on the terms contained in this Agreement. If, within 36 hours after any such default by any Underwriter, the non-defaulting Underwriters do not arrange for the purchase of such Shares, then the Company shall be entitled to a further period of 36 hours within which to procure other persons satisfactory to the non-defaulting Underwriters to purchase such Shares on such terms. If other persons become obligated or agree to purchase the Shares of a defaulting Underwriter, either the non-defaulting Underwriters or the Company may postpone the Closing Date or the Additional Closing Date, as the case may be, for up to five full business days in order to effect any changes that in the opinion of counsel for the Company or counsel for the Underwriters may be necessary in the Registration Statement and the Prospectus or in any other document or arrangement, and the Company agrees to promptly prepare any amendment or supplement to the Registration Statement and the Prospectus that effects any such changes. As used in this Agreement, the term "Underwriter" includes, for all purposes of this Agreement unless the context otherwise requires, any person not listed in Schedule 1 hereto that, pursuant to this Section 10, purchases Shares that a defaulting Underwriter agreed but failed to purchase.

(b) If, after giving effect to any arrangements for the purchase of the Shares of a defaulting Underwriter or Underwriters by the non-defaulting Underwriters and the Company as provided in paragraph (a) above, the aggregate number of Shares that remain unpurchased on the Closing Date or the Additional Closing Date, as the case may be, does not exceed one-eleventh of the aggregate number of Shares to be purchased on such date, then the Company shall have the right to require each non-defaulting Underwriter to purchase the number of Shares that such Underwriter agreed to purchase hereunder on such date plus such Underwriter's pro rata share (based on the number of Shares that such Underwriter agreed to purchase on such date) of the Shares of such defaulting Underwriter or Underwriters for which such arrangements have not been made.

(c) If, after giving effect to any arrangements for the purchase of the Shares of a defaulting Underwriter or Underwriters by the non-defaulting Underwriters and the Company as provided in paragraph (a) above, the aggregate number of Shares that remain unpurchased on the Closing Date or the Additional Closing Date, as the case may be, exceeds one-eleventh of the aggregate amount of Shares to be purchased on such date, or if the Company shall not exercise the right described in paragraph (b) above, then this Agreement or, with respect to any Additional Closing Date, the obligation of the Underwriters to purchase Shares on the Additional Closing Date shall terminate without liability on the part of the non-defaulting Underwriters. Any termination of this Agreement pursuant to this Section 10 shall be without liability on the part of the Company, except that the Company will continue to be liable for the payment of expenses as set forth in Section 11 hereof and except that the provisions of Section 7 hereof shall not terminate and shall remain in effect.

(d) Nothing contained herein shall relieve a defaulting Underwriter of any liability it may have to the Company or any non-defaulting Underwriter for damages caused by its default.

11. Payment of Expenses.

(a) Whether or not the transactions contemplated by this Agreement are consummated or this Agreement is terminated, the Company will pay or cause to be paid all costs and expenses incident to the performance of its obligations hereunder, including without limitation, (i) the costs incident to the authorization, issuance, sale, preparation and delivery of the Shares and any taxes payable in that connection; (ii) the costs incident to the preparation, printing and filing under the Securities Act of the Registration Statement, the Preliminary Prospectus, any Issuer Free Writing Prospectus, any Pricing Disclosure Package and the Prospectus (including all exhibits, amendments and supplements thereto) and the distribution thereof; (iii) the fees and expenses of the Company's counsel and independent accountants; (iv) the fees and expenses incurred in connection with the registration or qualification of the Shares under the state or foreign securities or blue sky laws of such jurisdictions as the Representatives may designate and the preparation, printing and distribution of a Blue Sky Memorandum (including the related fees and expenses of counsel for the Underwriters in an amount not to exceed $15,000); (v) the cost of preparing stock certificates; (vi) the costs and charges of any transfer agent and any registrar; (vii) all expenses and application fees incurred in connection with any filing with, and clearance of the offering by, FINRA (in an amount not to exceed $20,000); (ix) all expenses incurred by the Company in connection with any "road show" presentation to potential investors, it being understood and agreed that except as provided in this Section 11 or Section 7 hereof, the Underwriters will pay all of the travel, lodging and other expenses of the Underwriters or any of their employees incurred by them in connection with the "road show" (provided that the Underwriters and the Company shall each pay 50% of the cost of any aircraft or other transportation chartered in connection with the "road show"); and (x) all expenses and application fees related to the listing of the Shares on the Nasdaq Global Market.

(b) If (i) this Agreement is terminated pursuant to clause (i) or (ii) of Section 9, (ii) the Company for any reason fails to tender the Shares for delivery to the Underwriters or (iii) the Underwriters decline to purchase the Shares for any reason permitted under this Agreement (other than following termination of this Agreement pursuant to clause (iii) or (iv) of Section 9), the Company agrees to reimburse the Underwriters for all out-of-pocket costs and expenses (including the fees and expenses of their counsel) reasonably incurred by the Underwriters in connection with this Agreement and the offering contemplated hereby. For the avoidance of doubt, it is understood that the Company shall not pay or reimburse any costs, fees or expenses incurred by an Underwriter that defaults on its obligations to purchase the Shares.

12. Persons Entitled to Benefit of Agreement. This Agreement shall inure to the benefit of and be binding upon the parties hereto and their respective successors and the officers and directors and any controlling persons referred to in Section 7 hereof. Nothing in this Agreement is intended or shall be construed to give any other person any legal or equitable right, remedy or claim under or in respect of this Agreement or any provision contained herein. No purchaser of Shares from any Underwriter shall be deemed to be a successor merely by reason of such purchase.

13. Survival. The respective indemnities, rights of contribution, representations, warranties and agreements of the Company and the Underwriters contained in this Agreement or made by or on behalf of the Company or the Underwriters pursuant to this Agreement or any certificate delivered pursuant hereto shall survive the delivery of and payment for the Shares and shall remain in full force and effect, regardless of any termination of this Agreement or any investigation made by or on behalf of the Company or the Underwriters.

14. Certain Defined Terms. For purposes of this Agreement, (a) except where otherwise expressly provided, the term "affiliate" has the meaning set forth in Rule 405 under the Securities Act; (b) the term "business day" means any day other than a day on which banks are permitted or required to be closed in New York City; and (c) the term "subsidiary" has the meaning set forth in Rule 405 under the Securities Act.

15. Miscellaneous.

(a) *Authority of J.P. Morgan Securities LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated*. Any action by the Underwriters hereunder may be taken by J.P. Morgan Securities LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated on behalf of the Underwriters, and any such action taken by J.P. Morgan Securities LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated shall be binding upon the Underwriters.

(b) *Notices.* All notices and other communications hereunder shall be in writing and shall be deemed to have been duly given if mailed or transmitted and confirmed by any standard form of telecommunication. Notices to the Underwriters shall be given to the Representatives c/o J. P. Morgan Securities LLC, 383 Madison Avenue, New York, New York 10179 (fax: (212) 622-8358), Attention Equity Syndicate Desk and c/o Merrill Lynch, Pierce, Fenner & Smith Incorporated, One Bryant Park, New York, New York 10036 (fax: (646) 855-3073); Attention: Syndicate Department, with a copy to ECM Legal (facsimile: (212) 230-8730) and, in each case, with a copy (which copy shall not constitute notice) to Ropes & Gray LLP, Prudential Tower, 800 Boylston Street, Boston, Massachusetts 02199 (fax: (617) 235-0392), Attention: Patrick O'Brien, Esq. Notices to the Company shall be given to it at bluebird bio, Inc., 840 Memorial Drive, Cambridge, Massachusetts 02139, (fax: (617) 576-2421); Attention: Chief Executive Officer, with a copy (which copy shall not constitute notice) to Goodwin Procter LLP, 53 State Street, Boston, Massachusetts 02109 (fax: (617) 523-1231), Attention: Michael H. Bison, Esq.

(c) *Governing Law.* This Agreement and any claim, controversy or dispute arising under or related to this Agreement shall be governed by and construed in accordance with the laws of the State of New York applicable to agreements made and to be performed in such state.

(d) *Counterparts.* This Agreement may be signed in counterparts (which may include counterparts delivered by any standard form of telecommunication), each of which shall be an original and all of which together shall constitute one and the same instrument.

(e) *Amendments or Waivers.* No amendment or waiver of any provision of this Agreement, nor any consent or approval to any departure therefrom, shall in any event be effective unless the same shall be in writing and signed by the parties hereto.

(f) *Headings.* The headings herein are included for convenience of reference only and are not intended to be part of, or to affect the meaning or interpretation of, this Agreement.

If the foregoing is in accordance with your understanding, please indicate your acceptance of this Agreement by signing in the space provided below.

Very truly yours,

BLUEBIRD BIO, INC.

By: _____
Name:
Title:

Accepted: , 2013

J. P. MORGAN SECURITIES LLC
MERRILL LYNCH, PIERCE, FENNER & SMITH
INCORPORATED

For themselves and on behalf of the
several Underwriters listed
in Schedule 1 hereto.

J. P. MORGAN SECURITIES LLC

By: _____
Authorized Signatory

MERRILL LYNCH, PIERCE, FENNER & SMITH
INCORPORATED

By: _____
Authorized Signatory

Schedule 1

Underwriter	Number of Shares
J. P. Morgan Securities LLC	
Merrill Lynch, Pierce, Fenner & Smith Incorporated	
Cowen & Company, LLC	
Cannacord Genuity Inc.	
Wedbush Securities Inc.	
Total	

a. **Pricing Disclosure Package**

[*list each Issuer Free Writing Prospectus to be included in the Pricing Disclosure Package*]

b. **Pricing Information Provided Orally by Underwriters**

[*set out key information included in script that will be used by Underwriters to confirm sales*]

ANNEX B

Written Testing-the-Waters Communications

[None.]

Exhibit A

FORM OF LOCK-UP AGREEMENT

, 2013

J. P. MORGAN SECURITIES LLC
Merrill Lynch, Pierce, Fenner & Smith
Incorporated
As Representatives of
the several Underwriters listed in
Schedule 1 to the Underwriting
Agreement referred to below

c/o J. P. Morgan Securities LLC
383 Madison Avenue
New York, NY 10179

c/o Merrill Lynch, Pierce, Fenner & Smith
Incorporated
One Bryant Park
New York, New York, 10036

Re: bluebird bio, Inc. — Public Offering

Ladies and Gentlemen:

The undersigned understands that you, as Representatives of the several Underwriters, propose to enter into an Underwriting Agreement (the "Underwriting Agreement") with bluebird bio, Inc., a Delaware corporation (the "Company"), providing for the public offering (the "Public Offering") by the several Underwriters named in Schedule 1 to the Underwriting Agreement (the "Underwriters"), of Common Stock, par value $0.01 per share, of the Company (the "Common Stock"). Capitalized terms used herein and not otherwise defined shall have the meanings set forth in the Underwriting Agreement.

In consideration of the Underwriters' agreement to purchase and make the Public Offering of the Common Stock, and for other good and valuable consideration receipt of which is hereby acknowledged, the undersigned hereby agrees that, without the prior written consent of J. P. Morgan Securities LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated on behalf of the Underwriters, the undersigned will not, during the period ending 180 days after the date of the prospectus relating to the Public Offering (the "Prospectus"), (1) offer, pledge, sell, contract to sell, sell any option or contract to purchase, purchase any option or contract to sell, grant any option, right or warrant to purchase, or otherwise transfer or dispose of, directly or indirectly, any shares of Common Stock or any securities convertible into or exercisable or exchangeable for Common Stock (including without limitation, Common Stock or such other securities which may

be deemed to be beneficially owned by the undersigned in accordance with the rules and regulations of the Securities and Exchange Commission and securities which may be issued upon exercise of a stock option or warrant), or publicly disclose the intention to make any offer, sale, pledge or disposition, (2) enter into any swap or other agreement that transfers, in whole or in part, any of the economic consequences of ownership of the Common Stock or such other securities, whether any such transaction described in clause (1) or (2) above is to be settled by delivery of Common Stock or such other securities, in cash or otherwise or (3) make any demand for or exercise any right with respect to the registration of any shares of Common Stock or any security convertible into or exercisable or exchangeable for Common Stock, in each case other than (A) transfers of shares of Common Stock as a bona fide gift or gifts and (B) distributions of shares of Common Stock to members or stockholders of the undersigned; provided that in the case of any transfer or distribution pursuant to clause (A) or (B), each donee or distributee shall execute and deliver to the Representatives a lock-up letter in the form of this paragraph; and provided, further, that in the case of any transfer or distribution pursuant to clause (A) or (B), no filing by any party (donor, donee, transferor or transferee) under the Securities Exchange Act of 1934, as amended, or other public announcement shall be required or shall be made voluntarily in connection with such transfer or distribution (other than a filing on a Form 5 made after the expiration of the 180-day period referred to above). If the undersigned is an officer or director of the Company, the undersigned further agrees that the foregoing provisions shall be equally applicable to any Company-directed Securities the undersigned may purchase in the Public Offering.

If the undersigned is an officer or director of the Company, (i) J.P. Morgan Securities LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated on behalf of the Underwriters agree that, at least three business days before the effective date of any release or waiver of the foregoing restrictions in connection with a transfer of shares of Common Stock, J.P. Morgan Securities LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated on behalf of the Underwriters will notify the Company of the impending release or waiver, and (ii) the Company has agreed in the Underwriting Agreement to announce the impending release or waiver by press release through a major news service at least two business days before the effective date of the release or waiver. Any release or waiver granted by J.P. Morgan Securities LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated on behalf of the Underwriters hereunder to any such officer or director shall only be effective two business days after the publication date of such press release. The provisions of this paragraph will not apply if (a) the release or waiver is effected solely to permit a transfer not for consideration and (b) the transferee has agreed in writing to be bound by the same terms described in this letter to the extent and for the duration that such terms remain in effect at the time of the transfer.

In furtherance of the foregoing, the Company, and any duly appointed transfer agent for the registration or transfer of the securities described herein, are hereby authorized to decline to make any transfer of securities if such transfer would constitute a violation or breach of this Letter Agreement.

The undersigned hereby represents and warrants that the undersigned has full power and authority to enter into this Letter Agreement. All authority herein conferred or agreed to be conferred and any obligations of the undersigned shall be binding upon the successors, assigns, heirs or personal representatives of the undersigned.

The undersigned understands that, if the Underwriting Agreement does not become effective, or if the Underwriting Agreement (other than the provisions thereof which survive termination) shall terminate or be terminated prior to payment for and delivery of the Common Stock to be sold thereunder, the undersigned shall be released from, all obligations under this Letter Agreement. The undersigned understands that the Underwriters are entering into the Underwriting Agreement and proceeding with the Public Offering in reliance upon this Letter Agreement.

This Letter Agreement and any claim, controversy or dispute arising under or related to this Letter Agreement shall be governed by and construed in accordance with the laws of the State of New York, without regard to the conflict of laws principles thereof.

Very truly yours,

[*NAME OF STOCKHOLDER*]

By: _____

Name:
Title:

Exhibit B

[Form of Waiver of Lock-up]

J.P. MORGAN SECURITIES LLC
MERRILL LYNCH, PIERCE, FENNER & SMITH INCORPORATED

bluebird bio, Inc.
Public Offering of Common Stock

, 2013

[Name and Address of
Officer or Director
Requesting Waiver]

Dear Mr./Ms. [Name]:

This letter is being delivered to you in connection with the offering by bluebird bio, Inc. (the "Company") of shares of common stock, $ par value (the "Common Stock"), of the Company and the lock-up letter dated , 2013 (the "Lock-up Letter"), executed by you in connection with such offering, and your request for a [waiver] [release] dated , 20[ ], with respect to shares of Common Stock (the "Shares").

J.P. Morgan Securities LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated hereby agree to [waive] [release] the transfer restrictions set forth in the Lock-up Letter, but only with respect to the Shares, effective , 20[ ]; provided, however, that such [waiver] [release] is conditioned on the Company announcing the impending [waiver] [release] by press release through a major news service at least two business days before effectiveness of such [waiver] [release]. This letter will serve as notice to the Company of the impending [waiver] [release].

Except as expressly [waived] [released] hereby, the Lock-up Letter shall remain in full force and effect.

Yours very truly,

J.P. MORGAN SECURITIES LLC

By: _____
Name:
Title:

MERRILL LYNCH, PIERCE, FENNER & SMITH
INCORPORATED

By: _____
Name:
Title:

cc: The Company

Exhibit C

[Form of Press Release]

bluebird bio, Inc.
[Date]

bluebird bio, Inc. (the "Company") announced today that J.P. Morgan Securities LLC and Merrill Lynch, Pierce, Fenner & Smith Incorporated, the book-runners in the Company's recent public sale of shares of common stock, are [waiving] [releasing] a lock-up restriction with respect to shares of the Company's common stock held by [certain officers or directors] [an officer or director] of the Company. The [waiver] [release] will take effect on , 20 , and the shares may be sold on or after such date.

This press release is not an offer for sale of the securities in the United States or in any other jurisdiction where such offer is prohibited, and such securities may not be offered or sold in the United States absent registration or an exemption from registration under the United States Securities Act of 1933, as amended.

Exhibit 3.1

AMENDED AND RESTATED CERTIFICATE OF INCORPORATION OF BLUEBIRD BIO, INC.

bluebird bio, Inc., a corporation organized and existing under the laws of the State of Delaware (the " **Corporation**"), hereby certifies as follows

1. The name of the Corporation is bluebird bio, Inc. The date of the filing of its original Certificate of Incorporation with the Secretary of State of the State of Delaware was April 16, 1992 (the "**Original Certificate**"). The name under which the Corporation filed the Original Certificate was Genetix Pharmaceuticals Inc.

2. This Amended and Restated Certificate of Incorporation (the " **Certificate**") amends, restates and integrates the provisions of the Amended and Restated Certificate of Incorporation that was filed with the Secretary of State of the State of Delaware on July 23, 2012, as amended (the " **Existing Certificate**"), and was duly adopted in accordance with the provisions of Sections 228, 242 and 245 of the General Corporation Law of the State of Delaware (the "**DGCL**").

3. The text of the Existing Certificate is hereby amended and restated in its entirety to provide as herein set forth in full.

ARTICLE I

The name of the Corporation is bluebird bio, Inc.

ARTICLE II

The address of the Corporation's registered office in the State of Delaware is 2711 Centerville Road, Suite 400, City of Wilmington, County of New Castle, 19808. The name of its registered agent at that address is Corporation Service Company.

ARTICLE III

The purpose of the Corporation is to engage in any lawful act or activity for which corporations may be organized under the DGCL.

ARTICLE IV

The total number of shares of capital stock which the Corporation shall have authority to issue is four hundred forty-seven million, two hundred fifty-one thousand, four hundred and sixty (447,251,460) shares, of which (i) one hundred twenty-five million (125,000,000) shares shall be a class designated as common stock, par value $0.01 per share (the "**Common Stock**"), (ii) three hundred seventeen million, two hundred fifty-one thousand, four hundred and sixty (317,251,460) shares shall be a class designated as convertible preferred stock, par value $0.01 per share (the " **Pre-IPO Preferred Stock**") and (iii) five million (5,000,000) shares shall be a class designated as undesignated preferred stock, par value $0.01 per share (the " **Undesignated Preferred Stock**").

Except as otherwise provided in any certificate of designations of any series of Undesignated Preferred Stock, the number of authorized shares of the class of Common Stock or Undesignated Preferred Stock may from time to time be increased or decreased (but not below the number of shares of such class outstanding) by the affirmative vote of the holders of a majority in voting power of the outstanding shares of capital stock of the Corporation irrespective of the provisions of Section 242(b)(2) of the DGCL.

The powers, preferences and rights of, and the qualifications, limitations and restrictions upon, each class or series of stock shall be determined in accordance with, or as set forth below in, this Article IV.

A. COMMON STOCK

Subject to all the rights, powers and preferences of the Undesignated Preferred Stock and except as provided by law or in this Certificate (or in any certificate of designations of any series of Undesignated Preferred Stock):

(a) the holders of the Common Stock shall have the exclusive right to vote for the election of directors of the Corporation (the " **Directors**") and on all other matters requiring stockholder action, each outstanding share entitling the holder thereof to one vote on each matter properly submitted to the stockholders of the Corporation for their vote; provided, however, that, except as otherwise required by law, holders of Common Stock, as such, shall not be entitled to vote on any amendment to this Certificate (or on any amendment to a certificate of designations of any series of Undesignated Preferred Stock) that alters or changes the powers, preferences, rights or other terms of one or more outstanding series of Undesignated Preferred Stock if the holders of such affected series of Undesignated Preferred Stock are entitled to vote, either separately or together with the holders of one or more other such series, on such amendment pursuant to this Certificate (or pursuant to a certificate of designations of any series of Undesignated Preferred Stock) or pursuant to the DGCL;

(b) dividends may be declared and paid or set apart for payment upon the Common Stock out of any assets or funds of the Corporation legally available for the payment of dividends, but only when and as declared by the Board of Directors or any authorized committee thereof; and

(c) upon the voluntary or involuntary liquidation, dissolution or winding up of the Corporation, the net assets of the Corporation shall be distributed pro rata to the holders of the Common Stock.

B. PRE-IPO PREFERRED STOCK

Designation. 18,816,742 shares of Pre-IPO Preferred Stock are designated as Series A-1 Convertible Preferred Stock (the " **Series A-1 Preferred Stock**"), 22,304,324 shares of Pre-IPO Preferred Stock are designated Series A-2 Convertible Preferred Stock (the " **Series A-2 Preferred Stock**", and together with the Series A-1 Preferred Stock, the "**Series A Preferred Stock**"), 115,778,526 shares of Pre-IPO Preferred Stock are designated Series B Convertible Preferred Stock (the "**Series B Preferred Stock**"), 39,942,483 shares of Pre-IPO Preferred Stock are designated Series C Convertible Preferred Stock (the "**Series C Preferred Stock**") and 120,409,385 shares of Pre-IPO Preferred Stock are designated Series D Convertible Preferred Stock (the " **Series D Preferred Stock**").

Unless otherwise indicated, references to "Sections" in this Part B of this Article IV refer to sections in this Part B of this Article IV.

1. [RESERVED].

2. Dividends.

The Corporation shall not declare, pay or set aside any dividends on shares of any other class or series of capital stock of the Corporation (other than dividends on shares of Common Stock payable in shares of Common Stock) unless (in addition to the obtaining of any consents required elsewhere in this Certificate of Incorporation) the holders of the Preferred Stock then outstanding shall first receive, or simultaneously receive, a dividend on each outstanding share of Preferred Stock in an amount at least equal to (A) in the case of a dividend on Common Stock or any class or series that is convertible into Common Stock, that dividend per share of Preferred Stock as would equal the product of (i) the dividend payable on each share of such class or series determined, if applicable, as if all shares of such class or series had been converted into Common Stock and (ii) the number of shares of Common Stock issuable upon conversion of a share of Preferred Stock, in each case calculated on the record date for determination of holders entitled to receive such dividend or (B) in the case of a dividend on any class or series that is not convertible into Common Stock, at a rate per share of Preferred Stock determined by (i) dividing the amount of the dividend payable on each share of such class or series of capital stock by the original issuance price of such class or series of capital stock (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization affecting such shares) and (ii) multiplying such fraction by an amount equal to the Applicable Original Issue Price; provided that, if the Corporation declares, pays or sets aside, on the same date, a dividend on shares of more than one class or series of capital stock of the Corporation, the dividend payable to the holders of Preferred Stock pursuant to this Section 2 shall be calculated based upon the dividend on the class or series of capital stock that would result in the highest Preferred Stock dividend. The "**Series A Original Issue Price**" shall mean $0.6619 per share, subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series A Preferred Stock. The "**Series B Original Issue Price**" shall mean $0.3262 per share, subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series B Preferred Stock. The "**Series C Original Issue Price**" shall mean $0.37554 per share, subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series C Preferred Stock. The " **Series D Original Issue Price**" shall mean $0.4983 per share, subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series D Preferred Stock. The term "**Applicable Original Issue Price**" shall mean the then current Series D Original Issue Price, Series C Original Issue Price, Series B Original Issue Price or Series A Original Issue Price, as applicable.

3. Liquidation, Dissolution or Winding Up; Certain Mergers, Consolidations and Asset Sales .

3.1 Preferential Payments to Holders of Series D Preferred Stock . In the event of any voluntary or involuntary liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event (as defined below), the holders of shares of Series D Preferred Stock then outstanding shall be entitled to be paid out of the assets of the Corporation available for distribution to its stockholders, before any payment shall be made to the holders of Series C Preferred Stock, Series B Preferred Stock, Series A Preferred Stock or Common Stock by reason of their ownership thereof, an amount per share equal to $0.4983 (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series D Preferred Stock), plus any dividends declared but unpaid thereon. If upon any such liquidation, dissolution or winding up of the Corporation, the assets of the Corporation available for distribution to its stockholders shall be insufficient to pay the holders of shares of Series D Preferred Stock the full amount to which they shall be entitled under this Subsection 3.1, the holders of shares of Series D Preferred Stock shall share ratably in any distribution of the assets available for distribution in proportion to the respective amounts which would otherwise be payable in respect of the shares held by them upon such distribution if all amounts payable on or with respect to such shares were paid in full.

3.2 Preferential Payments to Holders of Series C Preferred Stock and Series B Preferred Stock . In the event of any voluntary or involuntary liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event, the holders of shares of Series C Preferred Stock and Series B Preferred Stock then outstanding shall be entitled to be paid out of the assets of the Corporation available for distribution to its stockholders, before any payment shall be made to the holders of Series A Preferred Stock or Common Stock by reason of their ownership thereof, and on a *pari passu* basis, an amount per share equal to (i) with respect to the Series C Preferred Stock, $0.37554 (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series C Preferred Stock), plus any dividends declared but unpaid thereon and (ii) with respect to the Series B Preferred Stock, $0.4893 (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series B Preferred Stock), plus any dividends declared but unpaid thereon. If upon any such liquidation, dissolution or winding up of the Corporation, the assets of the Corporation available for distribution to its stockholders shall be insufficient to pay the holders of shares of Series C Preferred Stock and Series B Preferred Stock the full amount to which they shall be entitled under this Subsection 3.2, the holders of shares of Series C Preferred Stock and Series B Preferred Stock shall share ratably in any distribution of the assets available for distribution in proportion to the respective amounts which would otherwise be payable in respect of the shares held by them upon such distribution if all amounts payable on or with respect to such shares were paid in full.

3.3 Preferential Payments to Holders of Series A-2 Preferred Stock . In the event of any voluntary or involuntary liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event, the holders of shares of Series A-2 Preferred Stock then outstanding shall be entitled to be paid out of the assets of the Corporation available for distribution to its stockholders, before any payment shall be made to the holders of Series A-1 Preferred Stock or Common Stock by reason of their ownership thereof, an amount per share

equal to $0.5758 (subject to appropriate adjustment in the event of any stock dividend, stock split, combination or other similar recapitalization with respect to the Series A-2 Preferred Stock), plus any dividends declared but unpaid thereon. If upon any such liquidation, dissolution or winding up of the Corporation, the assets of the Corporation available for distribution to its stockholders shall be insufficient to pay the holders of shares of Series A-2 Preferred Stock the full amount to which they shall be entitled under this Subsection 3.3, the holders of shares of Series A-2 Preferred Stock shall share ratably in any distribution of the assets available for distribution in proportion to the respective amounts which would otherwise be payable in respect of the shares held by them upon such distribution if all amounts payable on or with respect to such shares were paid in full.

3.4 Distribution of Remaining Assets.

3.4.1 In the event of any voluntary or involuntary liquidation, dissolution or winding up of the Corporation or Deemed Liquidation Event, after the payment of all preferential amounts required to be paid to the holders of shares of Series D Preferred Stock, Series C Preferred Stock, Series B Preferred Stock and Series A-2 Preferred Stock under Subsections 3.1, 3.2 and 3.3, respectively, the remaining assets of the Corporation available for distribution to its stockholders shall be distributed among the holders of shares of Preferred Stock and Common Stock, pro rata based on the number of shares held by each such holder, treating for this purpose all such securities as if they had been converted to Common Stock pursuant to the terms of the Certificate of Incorporation immediately prior to such dissolution, liquidation or winding up of the Corporation.

3.4.2 Notwithstanding anything to the contrary contained in this Certificate of Incorporation, in the event of a Deemed Liquidation Event in which any holder of Series A-2 Preferred Stock that is also a party to that certain letter agreement by and between the Corporation and Philippe Leboulch dated March 5, 2010 (the "**Leboulch Letter**"), would, in the absence of this Section 3.4.2, be entitled to receive under Subsections 3.1, 3.2, 3.3 and 3.4.1 an amount that exceeds three times (3x) the aggregate original issuance price of all of the outstanding shares of capital stock then held by such holder (for clarity, including any shares of Preferred Stock acquired after the filing of this Certificate of Incorporation) (the amount of such excess being referred to herein as such holder's "**Excess Aggregate Preference Amount**"), then the amount that each such holder of Series A-2 Preferred Stock would be otherwise entitled to receive under Subsections 3.1, 3.2, 3.3 and 3.4.1 (with respect to all of the shares of capital stock then held by such holder) shall be reduced by an amount equal to five percent (5%) of such Excess Aggregate Preference Amount (the "**5% Amount**"), and the 5% Amount shall be payable to Philippe Leboulch (collectively, the "**Leboulch Bonus Payments**") in accordance with this Subsection 3.4.2 to the extent and as otherwise described in the Leboulch Letter. It is the intention that the Leboulch Bonus Payments shall be funded solely by those amounts that would otherwise be distributable to a holder of Series A-2 Preferred Stock under Subsections 3.1, 3.2, 3.3 and 3.4.1 (with respect to all of the shares of capital stock then held by such holder) in the absence of the Leboulch Letter and this Subsection 3.4.2 and shall not otherwise reduce the total assets of the Corporation available for distribution to its stockholders hereunder or the amounts distributable to any stockholder of the Corporation that does not hold shares of Series A-2 Preferred Stock and is not a party to the Leboulch Letter. This Subsection 3.4.2 shall have no force and effect with respect to any distributions made upon a Deemed Liquidation Event to any transferee of any shares of capital stock received from any holder of Series A-2 Preferred Stock that is also party to the Leboulch Letter.

3.5 Deemed Liquidation Events.

3.5.1 Definition. Each of the following events shall be considered a "**Deemed Liquidation Event**" unless the holders of a majority of the then outstanding shares of Preferred Stock, voting together as a single class and on an as-converted basis (the "**Requisite Holders**") elect otherwise by written notice sent to the Corporation at least five (5) days prior to the effective date of any such event:

(a) a merger or consolidation in which

(i) the Corporation is a constituent party or

(ii) a subsidiary of the Corporation is a constituent party and the Corporation issues shares of its capital stock pursuant to such merger or consolidation,

except any such merger or consolidation involving the Corporation or a subsidiary in which the shares of capital stock of the Corporation outstanding immediately prior to such merger or consolidation continue to represent, or are converted into or exchanged for shares of capital stock that represent, immediately following such merger or consolidation, at least a majority, by voting power, of the capital stock of (1) the surviving or resulting corporation or (2) if the surviving or resulting corporation is a wholly owned subsidiary of another corporation immediately following such merger or consolidation, the parent corporation of such surviving or resulting corporation (provided that, for the purpose of this Subsection 3.5.1, all shares of Common Stock issuable upon exercise of Options (as defined below) outstanding immediately prior to such merger or consolidation or upon conversion of Convertible Securities (as defined below) outstanding immediately prior to such merger or consolidation shall be deemed to be outstanding immediately prior to such merger or consolidation and, if applicable, converted or exchanged in such merger or consolidation on the same terms as the actual outstanding shares of Common Stock are converted or exchanged);

(b) the sale, conveyance, lease, transfer, exclusive license or other disposition, in a single transaction or series of related transactions, by the Corporation or any subsidiary of the Corporation of all or substantially all the assets or intellectual property rights of the Corporation and its subsidiaries taken as a whole (including any transaction in which all or substantially all of the assets or intellectual property rights related to one of the Corporation's product candidates are sold or exclusively licensed to a third party), or the sale or disposition (whether by merger or otherwise) of one or more subsidiaries of the Corporation if substantially all of the assets of the Corporation and its subsidiaries taken as a whole are held by such subsidiary or subsidiaries, except where such sale, conveyance, lease, transfer, exclusive license or other disposition is to a wholly owned subsidiary of the Corporation; or

(c) the closing of the sale, exchange or transfer (whether by merger, consolidation or otherwise), in one transaction or a series of related transactions, to a person or group of affiliated persons (other than an underwriter of the Corporation's securities), of the Corporation's securities if, after such closing, such person or group of affiliated persons would hold 50% or more of the outstanding voting stock of this Corporation (or the surviving or acquiring entity).

3.5.2 Amount Deemed Paid or Distributed. In any Deemed Liquidation Event, if Proceeds received by the Corporation or its stockholders is other than cash, its value will be deemed its fair market value. Any securities shall be valued as follows:

(a) Securities not subject to investment letter or other similar restrictions on free marketability covered by subsection (b) below:

(i) If traded on a securities exchange, the value shall be deemed to be the average of the closing prices of the securities on such exchange over the twenty (20) trading day period ending three (3) trading days prior to the closing of the Deemed Liquidation Event;

(ii) If actively traded over-the-counter, the value shall be deemed to be the average of the closing bid or sale prices (whichever is applicable) over the twenty (20) trading day period ending three (3) trading days prior to the closing of the Deemed Liquidation Event; and

(iii) If there is no active public market, the value shall be the fair market value thereof, as mutually determined by the Board of Directors of the Corporation, including at least a majority of the Preferred Directors (as defined below).

(b) The method of valuation of securities subject to investment letter or other restrictions on free marketability (other than restrictions arising solely by virtue of a stockholder's status as an affiliate or former affiliate) shall be to make an appropriate discount from the market value determined as above in (a) (i), (ii) or (iii) to reflect the approximate fair market value thereof, as mutually determined by the corporation and the Requisite Holders.

(c) The foregoing methods for valuing non-cash consideration to be distributed in connection with a Deemed Liquidation Event shall, with the appropriate approval of the definitive agreements governing such Deemed Liquidation Event by the stockholders under the DGCL and Subsection 4.3 below, be superseded by the determination of such value set forth in the definitive agreements governing such Deemed Liquidation Event.

3.5.3 Effect of Non-Compliance. In the event the requirements of this Section 3 are not complied with, the Corporation shall forthwith either:

(a) cause the closing of such Deemed Liquidation Event to be postponed until such time as the requirements of this Section 3 have been complied with; or

(b) cancel such transaction, in which event the rights, preferences and privileges of the holders of the Preferred Stock shall revert to and be the same as such rights, preferences and privileges existing immediately prior to the date of the first notice referred to in Section 5.10 below.

3.5.4 Allocation of Escrow or Contingent Payments. In the event of a Deemed Liquidation Event, if any portion of the consideration payable to the stockholders of the Corporation is placed into escrow and/or is payable to the stockholders of the Corporation subject to contingencies, notwithstanding the operation of this Section 3 the definitive agreement with respect to such transaction shall provide that (a) the portion of such consideration that is not placed in escrow and not subject to any contingencies (the **"Initial Consideration"**) shall be allocated among the holders of capital stock of the Corporation in accordance with Subsections 3.1, 3.2, 3.3 and 3.4 as if the Initial Consideration were the only consideration payable in connection with such Deemed Liquidation Event and (b) any additional consideration which becomes payable to the stockholders of the Corporation upon release from escrow or satisfaction of contingencies shall be allocated among the holders of capital stock of the Corporation in accordance with Subsections 3.1, 3.2, 3.3 and 3.4 after taking into account the previous payment of the Initial Consideration as part of the same transaction.

4. Voting.

4.1 General. On any matter presented to the stockholders of the Corporation for their action or consideration at any meeting of stockholders of the Corporation (or by written consent of stockholders in lieu of meeting), each holder of outstanding shares of Preferred Stock shall be entitled to cast the number of votes equal to the number of whole shares of Common Stock into which the shares of the applicable series of Preferred Stock held by such holder are convertible as of the record date for determining stockholders entitled to vote on such matter. Except as provided by law or by the other provisions of the Certificate of Incorporation, holders of Preferred Stock shall vote together with the holders of Common Stock as a single class.

4.2 Election of Directors. The holders of record of the shares of Series C Preferred Stock, exclusively and as a separate class, shall be entitled to elect one (1) director of the Corporation (the "**Series C Director**"), the holders of record of the shares of Series B Preferred Stock, exclusively and as a separate class, shall be entitled to elect two (2) directors of the Corporation (the " **Series B Directors**") and the holders of record of the shares of Series A Preferred Stock, exclusively and as a separate class, shall be entitled to elect one (1) director of the Corporation (the " **Series A Director**", and together with the Series C Director and the Series B Directors, the " **Preferred Directors**"). Any director elected as provided in the preceding sentence may be removed without cause by, and only by, the affirmative vote of the holders of the shares of the class or series of capital stock entitled to elect such director or directors, given either at a special meeting of such stockholders duly called for that purpose or pursuant to a written consent of stockholders. The holders of record of the shares of Common Stock and of any other class or series of voting stock (including the Preferred Stock), exclusively and voting together as a single class on an as-converted basis, shall be entitled to elect the balance of the total number of directors of the Corporation. At any meeting held for the purpose of electing a director, the presence in person or by proxy of the holders of a majority of the outstanding shares of the class or series entitled to elect such director shall constitute a quorum for the purpose of electing such director. A vacancy in any directorship filled by the holders of any class or series shall be filled only by vote or written consent in lieu of a meeting of the holders of such class or series or by any remaining director or directors elected by the holders of such class or series pursuant to this Subsection 4.2.

4.3 Preferred Stock Protective Provisions. At any time when shares of Preferred Stock are outstanding, the Corporation shall not, either directly or indirectly by amendment, merger, consolidation or otherwise, do any of the following without (in addition to any other vote required by law or the Certificate of Incorporation) the written consent or affirmative vote of the Requisite Holders, given in writing or by vote at a meeting, consenting or voting (as the case may be) together as a single class on an as converted basis:

(a) liquidate, dissolve or wind-up the business and affairs of the Corporation, effect any reclassification, reorganization or recapitalization of the Corporation's outstanding shares of capital stock or effect any Deemed Liquidation Event, or consent to any of the foregoing;

(b) amend, alter or repeal any provision of the Certificate of Incorporation or Bylaws of the Corporation;

(c) (1) create, or authorize the creation of, or issue or obligate itself to issue shares of, any additional class or series of capital stock unless the same ranks junior to the Preferred Stock with respect to the distribution of assets on the liquidation, dissolution or winding up of the Corporation, the payment of dividends and rights of redemption, or (2) increase or decrease the authorized number of shares of Preferred Stock or any series thereof, increase or decrease the par value of the Preferred Stock, alter or change the powers, preferences or special rights of the Preferred Stock or any series thereof, amend the terms of the Preferred Stock or any series thereof, or authorize, create or issue any class of capital stock having rights, preferences or privileges senior to or on parity with the Preferred Stock or any series thereof;

(d) (1) reclassify, alter or amend any existing security of the Corporation that is pari passu with the Preferred Stock in respect of the distribution of assets on the liquidation, dissolution or winding up of the Corporation, the payment of dividends or rights of redemption, if such reclassification, alteration or amendment would render such other security senior to the Preferred Stock in respect of any such right, preference or privilege, or (2) reclassify, alter or amend any existing security of the Corporation that is junior to the Preferred Stock in respect of the distribution of assets on the liquidation, dissolution or winding up of the Corporation, the payment of dividends or rights of redemption, if such reclassification, alteration or amendment would render such other security senior to or pari passu with the Preferred Stock in respect of any such right, preference or privilege;

(e) purchase, redeem or retire (or permit any subsidiary to purchase, redeem or retire) or make any distribution on, any shares of capital stock of the Corporation other than (1) redemptions of or distributions on the Preferred Stock as expressly authorized herein and (2) repurchases and retirements of stock from former employees, officers, directors, consultants or other persons who performed services for the Corporation or any subsidiary in connection with the cessation of such employment or service at the lower of the original purchase price or the then-current fair market value thereof;

(f) sell, abandon, transfer, lease, pledge, subject to a lien, encumber, grant a security interest in or otherwise dispose of all or any material portion of the properties or assets of the Corporation (including any exclusive license of intellectual property, but not including any non-exclusive license of intellectual property made in the ordinary course of business);

(g) create, or authorize the creation of, or issue, or authorize the issuance of any debt security, or permit any subsidiary to take any such action with respect to any debt security;

(h) create, or hold capital stock in, any subsidiary that is not wholly owned (either directly or through one or more other subsidiaries) by the Corporation, or sell, transfer or otherwise dispose of any capital stock of any direct or indirect subsidiary of the Corporation, or permit any direct or indirect subsidiary to sell, lease, transfer, exclusively license or otherwise dispose (in a single transaction or series of related transactions) of all or substantially all of the assets of such subsidiary;

(i) declare or pay any dividends;

(j) effect any change to the principal business of the Corporation, or enter or exit any line of business; or

(k) increase or decrease the authorized number of directors constituting the Board of Directors.

4.4 Series D Preferred Stock Protective Provisions. At any time when shares of Series D Preferred Stock are outstanding, the Corporation shall not, either directly or indirectly by amendment, merger, consolidation or otherwise, do any of the following without (in addition to any other vote required by law or the Restated Certificate of Incorporation) the written consent or affirmative vote of the holders of a majority of the then outstanding shares of Series D Preferred Stock (the "**Requisite Series D Holders**"), given in writing or by vote at a meeting, consenting or voting (as the case may be) exclusively as a separate class:

(a) alter or change the powers, preferences or special rights of the Series D Preferred Stock; or

(b) declare or pay any dividend on any series or class of capital stock (other than dividends payable to the holders of Common Stock solely in the form of additional shares of Common Stock) unless and until the holders of Series D Preferred have first received via dividend or distribution an amount per share of Series D Preferred equal to the Series D Original Issue Price.

For clarity, the issuance and sale by the Corporation in connection with a *bona fide* capital raising transaction of a new series of capital stock with powers, preferences or rights senior to or on parity with the Series D Preferred Stock shall not be deemed to be such an alteration or change requiring the consent of the Requisite Series D Holders pursuant to Subsection 4.4(a).

5. Optional Conversion.

The holders of the Preferred Stock shall have conversion rights as follows (the **"Conversion Rights"**):

5.1 Right to Convert.

5.1.1 Series D Conversion Ratio. Each share of Series D Preferred Stock shall be convertible, at the option of the holder thereof, at any time and from time to time, and without the payment of additional consideration by the holder thereof, into such number of fully paid and nonassessable shares of Common Stock as is determined by dividing the Series D Original Issue Price by the Series D Conversion Price (as defined below) in effect at the time of conversion. The "**Series D Conversion Price**" shall initially be equal to $9.4513. Such initial Series D Conversion Price, and the rate at which shares of Series D Preferred Stock may be converted into shares of Common Stock, shall be subject to adjustment as provided below.

5.1.2 Series C Conversion Ratio. Each share of Series C Preferred Stock shall be convertible, at the option of the holder thereof, at any time and from time to time, and without the payment of additional consideration by the holder thereof, into such number of fully paid and nonassessable shares of Common Stock as is determined by dividing the Series C Original Issue Price by the Series C Conversion Price (as defined below) in effect at the time of conversion. The "**Series C Conversion Price**" shall initially be equal to $7.1229. Such initial Series C Conversion Price, and the rate at which shares of Series C Preferred Stock may be converted into shares of Common Stock, shall be subject to adjustment as provided below.

5.1.3 Series B Conversion Ratio. Each share of Series B Preferred Stock shall be convertible, at the option of the holder thereof, at any time and from time to time, and without the payment of additional consideration by the holder thereof, into such number of fully paid and nonassessable shares of Common Stock as is determined by dividing the Series B Original Issue Price by the Series B Conversion Price (as defined below) in effect at the time of conversion. The "**Series B Conversion Price**" shall initially be equal to $6.1870. Such initial Series B Conversion Price, and the rate at which shares of Series B Preferred Stock may be converted into shares of Common Stock, shall be subject to adjustment as provided below.

5.1.4 Series A Conversion Ratio. Each share of Series A Preferred Stock shall be convertible, at the option of the holder thereof, at any time and from time to time, and without the payment of additional consideration by the holder thereof, into such number of fully paid and nonassessable shares of Common Stock as is determined by dividing the Series A Original Issue Price by the Series A Conversion Price (as defined below) in effect at the time of conversion. The "**Series A Conversion Price**" shall initially be equal to $12.5543. Such initial Series A Conversion Price, and the rate at which shares of Series A Preferred Stock may be converted into shares of Common Stock, shall be subject to adjustment as provided below. The term " **Applicable Conversion Price**" shall mean the then current Series D Conversion Price, Series C Conversion Price, Series B Conversion Price or Series A Conversion Price, as applicable.

5.1.5 Termination of Conversion Rights. In the event of a liquidation, dissolution or winding up of the Corporation or a Deemed Liquidation Event, the Conversion Rights shall terminate at the close of business on the last full day preceding the date fixed for the payment of any such amounts distributable on such event to the holders of Preferred Stock.

5.2 Fractional Shares. No fractional shares of Common Stock shall be issued upon conversion of the Preferred Stock. In lieu of any fractional shares to which the holder would otherwise be entitled, the Corporation shall pay cash equal to such fraction multiplied by the fair market value of a share of Common Stock as determined in good faith by the Board of Directors of the Corporation. Whether or not fractional shares would be issuable upon such conversion shall be determined on the basis of the total number of shares of Preferred Stock the holder is at the time converting into Common Stock and the aggregate number of shares of Common Stock issuable upon such conversion.

5.3 Mechanics of Conversion.

5.3.1 Notice of Conversion. In order for a holder of Preferred Stock to voluntarily convert shares of Preferred Stock into shares of Common Stock, such holder shall surrender the certificate or certificates for such shares of Preferred Stock (or, if such registered holder alleges that such certificate has been lost, stolen or destroyed, a lost certificate affidavit and agreement reasonably acceptable to the Corporation to indemnify the Corporation against any claim that may be made against the Corporation on account of the alleged loss, theft or destruction of such certificate), at the office of the transfer agent for the Preferred Stock (or at the principal office of the Corporation if the Corporation serves as its own transfer agent), together with written notice that such holder elects to convert all or any number of the shares of Preferred Stock represented by such certificate or certificates and, if applicable, any event on which such conversion is contingent. Such notice shall state such holder's name or the names of the nominees in which such holder wishes the certificate or certificates for shares of Common Stock to be issued. If required by the Corporation, certificates surrendered for conversion shall be endorsed or accompanied by a written instrument or instruments of transfer, in form satisfactory to the Corporation, duly executed by the registered holder or his, her or its attorney duly authorized in writing. The close of business on the date of receipt by the transfer agent (or by the Corporation if the Corporation serves as its own transfer agent) of such certificates (or lost certificate affidavit and agreement) and notice shall be the time of conversion (the " **Conversion Time**"), and the shares of Common Stock issuable upon conversion of the shares represented by such certificate shall be deemed to be outstanding of record as of such date. The Corporation shall, as soon as practicable after the Conversion Time, (1) issue and deliver to such holder of Preferred Stock, or to his, her or its nominees, a certificate or certificates for the number of full shares of Common Stock issuable upon such conversion in accordance with the provisions hereof and a certificate for the number (if any) of the shares of Preferred Stock represented by the surrendered certificate that were not converted into Common Stock, (2) pay in cash such amount as provided in Subsection 5.2 in lieu of any fraction of a share of Common Stock otherwise issuable upon such conversion and (3) pay all declared but unpaid dividends on the shares of Preferred Stock converted.

5.3.2 Reservation of Shares. The Corporation shall at all times when the Preferred Stock shall be outstanding, reserve and keep available out of its authorized but unissued capital stock, for the purpose of effecting the conversion of the Preferred Stock, such number of its duly authorized shares of Common Stock as shall from time to time be sufficient to

effect the conversion of all outstanding Preferred Stock; and if at any time the number of authorized but unissued shares of Common Stock shall not be sufficient to effect the conversion of all then outstanding shares of the Preferred Stock, the Corporation shall take such corporate action as may be necessary to increase its authorized but unissued shares of Common Stock to such number of shares as shall be sufficient for such purposes, including, without limitation, engaging in best efforts to obtain the requisite stockholder approval of any necessary amendment to the Certificate of Incorporation. Before taking any action which would cause an adjustment reducing the Applicable Conversion Price below the then par value of the shares of Common Stock issuable upon conversion of the Preferred Stock, the Corporation will take any corporate action which may, in the opinion of its counsel, be necessary in order that the Corporation may validly and legally issue fully paid and nonassessable shares of Common Stock at such adjusted Applicable Conversion Price.

5.3.3 Effect of Conversion. All shares of Preferred Stock which shall have been surrendered for conversion as herein provided shall no longer be deemed to be outstanding and all rights with respect to such shares shall immediately cease and terminate at the Conversion Time, except only the right of the holders thereof to receive shares of Common Stock in exchange therefor, to receive payment in lieu of any fraction of a share otherwise issuable upon such conversion as provided in Subsection 5.2 and to receive payment of any dividends declared but unpaid thereon. Any shares of Preferred Stock so converted shall be retired and cancelled and may not be reissued as shares of such series, and the Corporation may thereafter take such appropriate action (without the need for stockholder action) as may be necessary to reduce the authorized number of shares of Preferred Stock accordingly.

5.3.4 No Further Adjustment. Upon any such conversion, no adjustment to the Applicable Conversion Price shall be made for any declared but unpaid dividends on the Preferred Stock surrendered for conversion or on the Common Stock delivered upon conversion.

5.3.5 Taxes. The Corporation shall pay any and all issue and other similar taxes that may be payable in respect of any issuance or delivery of shares of Common Stock upon conversion of shares of Preferred Stock pursuant to this Section 5. The Corporation shall not, however, be required to pay any tax which may be payable in respect of any transfer involved in the issuance and delivery of shares of Common Stock in a name other than that in which the shares of Preferred Stock so converted were registered, and no such issuance or delivery shall be made unless and until the person or entity requesting such issuance has paid to the Corporation the amount of any such tax or has established, to the satisfaction of the Corporation, that such tax has been paid.

5.4 Adjustments to Conversion Price for Diluting Issues .

5.4.1 Special Definitions. For purposes of this Article Fourth, the following definitions shall apply:

(a) **"Option"** shall mean rights, options or warrants to subscribe for, purchase or otherwise acquire Common Stock or Convertible Securities.

(b) "**Series D Original Issue Date**" shall mean the date on which the first share of Series D Preferred Stock was issued.

(c) "**Convertible Securities**" shall mean any evidences of indebtedness, shares or other securities directly or indirectly convertible into or exchangeable for Common Stock, but excluding Options.

(d) "**Additional Shares of Common Stock**" shall mean all shares of Common Stock issued (or, pursuant to Subsection 5.4.3 below, deemed to be issued) by the Corporation after the Series D Original Issue Date, other than (1) the following shares of Common Stock and (2) shares of Common Stock deemed issued pursuant to the following Options and Convertible Securities (clauses (1) and (2), collectively, **"Exempted Securities"**):

(i) shares of Common Stock, Options or Convertible Securities issued as a dividend or distribution on Preferred Stock;

(ii) shares of Common Stock, Options or Convertible Securities issued by reason of a dividend, stock split, split-up or other distribution on shares of Common Stock that is covered by Subsection 5.5, 5.6, 5.7 or 5.8;

(iii) shares of Common Stock or Options issued to employees or directors of, or consultants or advisors to, the Corporation or any of its subsidiaries pursuant to a plan, agreement or arrangement approved by the Board of Directors of the Corporation, including at least a majority of the Preferred Directors;

(iv) shares of Common Stock or Convertible Securities actually issued upon the exercise of Options or shares of Common Stock actually issued upon the conversion or exchange of Convertible Securities, in each case provided such issuance is pursuant to the terms of such Option or Convertible Security;

(v) shares of Common Stock, Options or Convertible Securities issued to banks, equipment lessors or other financial institutions, or to real property lessors, pursuant to a debt financing, equipment leasing or real property leasing transaction approved by the Board of Directors of the Corporation, including at least a majority of the Preferred Directors; or

(vi) shares of Common Stock, Options or Convertible Securities issued to suppliers or third party service providers in connection with the provision of goods or services pursuant to transactions approved by the Board of Directors of the Corporation, including at least a majority of the Preferred Directors.

5.4.2 No Adjustment of Applicable Conversion Prices . No adjustment in the Series A Conversion Price shall be made as the result of the issuance or deemed issuance of Additional Shares of Common Stock if the Corporation receives written notice from the holders of at least 66 2/3% of the then outstanding shares of Series A Preferred Stock agreeing that no such adjustment shall be made as the result of the issuance or deemed issuance of such Additional Shares of Common Stock. No adjustment in the Series B Conversion Price shall be made as the result of the issuance or deemed issuance of Additional Shares of Common Stock if the Corporation receives written notice from the holders of at least 60% of the then outstanding shares of Series B Preferred Stock agreeing that no such adjustment shall be made as the result of the issuance or deemed issuance of such Additional Shares of Common Stock. No adjustment in the Series C Conversion Price shall be made as the result of the issuance or deemed issuance of Additional Shares of Common Stock if the Corporation receives written notice from the holders of at least a majority of the then outstanding shares of Series C Preferred Stock agreeing that no such adjustment shall be made as the result of the issuance or deemed issuance of such Additional Shares of Common Stock. No adjustment in the Series D Conversion Price shall be made as the result of the issuance or deemed issuance of Additional Shares of Common Stock if the Corporation receives written notice from the Requisite Series D Holders agreeing that no such adjustment shall be made as the result of the issuance or deemed issuance of such Additional Shares of Common Stock.

5.4.3 Deemed Issue of Additional Shares of Common Stock .

(a) If the Corporation at any time or from time to time after the Series D Original Issue Date shall issue any Options or Convertible Securities (excluding Options or Convertible Securities which are themselves Exempted Securities) or shall fix a record date for the determination of holders of any class of securities entitled to receive any such Options or Convertible Securities, then the maximum number of shares of Common Stock (as set forth in the instrument relating thereto, assuming the satisfaction of any conditions to exercisability, convertibility or exchangeability but without regard to any provision contained therein for a subsequent adjustment of such number) issuable upon the exercise of such Options or, in the case of Convertible Securities and Options therefor, the conversion or exchange of such Convertible Securities, shall be deemed to be Additional Shares of Common Stock issued as of the time of such issue or, in case such a record date shall have been fixed, as of the close of business on such record date.

(b) If the terms of any Option or Convertible Security, the issuance of which resulted in an adjustment to the Applicable Conversion Price pursuant to the terms of Subsection 5.4.4, are revised as a result of an amendment to such terms or any other adjustment pursuant to the provisions of such Option or Convertible Security (but excluding automatic adjustments to such terms pursuant to anti-dilution or similar provisions of such Option or Convertible Security) to provide for either (1) any increase or decrease in the number of shares of Common Stock issuable upon the exercise, conversion and/or exchange of any such Option or Convertible Security or (2) any increase or decrease in the consideration payable to the Corporation upon such exercise, conversion and/or exchange, then, effective upon such increase

or decrease becoming effective, the Applicable Conversion Price computed upon the original issue of such Option or Convertible Security (or upon the occurrence of a record date with respect thereto) shall be readjusted to such Applicable Conversion Price as would have obtained had such revised terms been in effect upon the original date of issuance of such Option or Convertible Security. Notwithstanding the foregoing, no readjustment pursuant to this clause (b) shall have the effect of increasing the Applicable Conversion Price to an amount which exceeds the lower of (1) the Applicable Conversion Price in effect immediately prior to the original adjustment made as a result of the issuance of such Option or Convertible Security, or (2) the Applicable Conversion Price that would have resulted from any issuances of Additional Shares of Common Stock (other than deemed issuances of Additional Shares of Common Stock as a result of the issuance of such Option or Convertible Security) between the original adjustment date and such readjustment date.

(c) If the terms of any Option or Convertible Security (excluding Options or Convertible Securities which are themselves Exempted Securities), the issuance of which did not result in an adjustment to the Applicable Conversion Price pursuant to the terms of Subsection 5.4.4 (either because the consideration per share (determined pursuant to Subsection 5.4.5) of the Additional Shares of Common Stock subject thereto was equal to or greater than the Applicable Conversion Price then in effect, or because such Option or Convertible Security was issued before the Series D Original Issue Date), are revised after the Series D Original Issue Date as a result of an amendment to such terms or any other adjustment pursuant to the provisions of such Option or Convertible Security (but excluding automatic adjustments to such terms pursuant to anti-dilution or similar provisions of such Option or Convertible Security) to provide for either (1) any increase in the number of shares of Common Stock issuable upon the exercise, conversion or exchange of any such Option or Convertible Security or (2) any increase or decrease in the consideration payable to the Corporation upon such exercise, conversion or exchange, then such Option or Convertible Security, as so amended or adjusted, and the Additional Shares of Common Stock subject thereto (determined in the manner provided in Subsection 5.4.3(a)) shall be deemed to have been issued effective upon such increase or decrease becoming effective.

(d) Upon the expiration or termination of any unexercised Option or unconverted or unexchanged Convertible Security (or portion thereof) which resulted (either upon its original issuance or upon a revision of its terms) in an adjustment to the Applicable Conversion Price pursuant to the terms of Subsection 5.4.4, the Applicable Conversion Price shall be readjusted to such Applicable Conversion Price as would have obtained had such Option or Convertible Security (or portion thereof) never been issued.

(e) If the number of shares of Common Stock issuable upon the exercise, conversion and/or exchange of any Option or Convertible Security, or the consideration payable to the Corporation upon such exercise, conversion and/or exchange, is calculable at the time such Option or Convertible Security is issued or amended but is subject to adjustment based upon subsequent events, any adjustment to the Applicable Conversion Price provided for in this Subsection 5.4.3 shall be effected at the time of such issuance or amendment based on such number of shares or amount of consideration without regard to any provisions for subsequent adjustments (and any subsequent adjustments shall be treated as provided in clauses (b) and (c) of this Subsection 5.4.3). If the number of shares of Common Stock issuable upon the exercise,

conversion and/or exchange of any Option or Convertible Security, or the consideration payable to the Corporation upon such exercise, conversion and/or exchange, cannot be calculated at all at the time such Option or Convertible Security is issued or amended, any adjustment to the Applicable Conversion Price that would result under the terms of this Subsection 5.4.3 at the time of such issuance or amendment shall instead be effected at the time such number of shares and/or amount of consideration is first calculable (even if subject to subsequent adjustments), assuming for purposes of calculating such adjustment to the Applicable Conversion Price that such issuance or amendment took place at the time such calculation can first be made.

5.4.4 Adjustment of Applicable Conversion Price Upon Issuance of Additional Shares of Common Stock . In the event the Corporation shall (i) with respect to the Series D Preferred Stock and the Series C Preferred Stock, at any time after the Series D Original Issue Date issue Additional Shares of Common Stock (including Additional Shares of Common Stock deemed to be issued pursuant to Subsection 5.4.3), without consideration or for a consideration per share less than the Applicable Conversion Price in effect immediately prior to such issuance or (ii) with respect to the Series B Preferred Stock and the Series A Preferred Stock, at any time after the Series D Original Issue Date issue Additional Shares of Common Stock (including Additional Shares of Common Stock deemed to be issued pursuant to Subsection 5.4.3), without consideration or for a consideration per share less than the Series B Conversion Price in effect immediately prior to such issuance, then, in each case, the Applicable Conversion Price shall be reduced, concurrently with such issue, to a price (calculated to the nearest one-hundredth of a cent) determined in accordance with the following formula:

$$CP_2 = CP_1 * (A + B) \div (A + C).$$

For purposes of the foregoing formula, the following definitions shall apply:

(a) "**CP_2**" shall mean the new Applicable Conversion Price in effect immediately after such issue of Additional Shares of Common Stock

(b) "**CP_1**" shall mean the Applicable Conversion Price in effect immediately prior to such issue of Additional Shares of Common Stock;

(c) "**A**" shall mean the number of shares of Common Stock outstanding immediately prior to such issue of Additional Shares of Common Stock (treating for this purpose as outstanding all shares of Common Stock issuable upon exercise of Options outstanding immediately prior to such issue or upon conversion or exchange of Convertible Securities (including the Preferred Stock) outstanding (assuming exercise of any outstanding Options therefor) immediately prior to such issue);

(d) "**B**" shall mean the number of shares of Common Stock that would have been issued if such Additional Shares of Common Stock had been issued at a price per share equal to (i) with respect to the Series B Preferred Stock and the Series A Preferred Stock, the Series B Conversion Price in effect immediately prior to such issue of Additional Shares of Common Stock (determined by dividing the aggregate consideration received by the Corporation in respect of such issue by the Series B Conversion Price in effect immediately prior to such issue of Additional Shares of Common Stock) or (ii) with respect to

the Series D Preferred Stock and the Series C Preferred Stock, the Applicable Conversion Price in effect immediately prior to such issue of Additional Shares of Common Stock (determined by dividing the aggregate consideration received by the Corporation in respect of such issue by the Applicable Conversion Price in effect immediately prior to such issue of Additional Shares of Common Stock); and

(e) "**C**" shall mean the number of such Additional Shares of Common Stock issued in such transaction.

5.4.5 Determination of Consideration. For purposes of this Subsection 5.4, the consideration received by the Corporation for the issue of any Additional Shares of Common Stock shall be computed as follows:

(a) Cash and Property: Such consideration shall:

(i) insofar as it consists of cash, be computed at the aggregate amount of cash received by the Corporation, excluding amounts paid or payable for accrued interest;

(ii) insofar as it consists of property other than cash, be computed at the fair market value thereof at the time of such issue, as determined in good faith by the Board of Directors of the Corporation; and

(iii) in the event Additional Shares of Common Stock are issued together with other shares or securities or other assets of the Corporation for consideration which covers both, be the proportion of such consideration so received, computed as provided in clauses (i) and (ii) above, as determined in good faith by the Board of Directors of the Corporation.

(b) Options and Convertible Securities. The consideration per share received by the Corporation for Additional Shares of Common Stock deemed to have been issued pursuant to Subsection 5.4.3, relating to Options and Convertible Securities, shall be determined by dividing

(i) the total amount, if any, received or receivable by the Corporation as consideration for the issue of such Options or Convertible Securities, plus the minimum aggregate amount of additional consideration (as set forth in the instruments relating thereto, without regard to any provision contained therein for a subsequent adjustment of such consideration) payable to the Corporation upon the exercise of such Options or the conversion or exchange of such Convertible Securities, or in the case of Options for Convertible Securities, the exercise of such Options for Convertible Securities and the conversion or exchange of such Convertible Securities, by

(ii) the maximum number of shares of Common Stock (as set forth in the instruments relating thereto, without regard to any provision contained therein for a subsequent adjustment of such number) issuable upon the exercise of such Options or the conversion or exchange of such Convertible Securities, or in the case of Options for Convertible Securities, the exercise of such Options for Convertible Securities and the conversion or exchange of such Convertible Securities.

5.4.6 Multiple Closing Dates. In the event the Corporation shall issue on more than one date Additional Shares of Common Stock that are a part of one transaction or a series of related transactions and that would result in an adjustment to the Applicable Conversion Price pursuant to the terms of Subsection 5.4.4, and such issuance dates occur within a period of no more than 90 days from the first such issuance to the final such issuance, then, upon the final such issuance, the Applicable Conversion Price shall be readjusted to give effect to all such issuances as if they occurred on the date of the first such issuance (and without giving effect to any additional adjustments as a result of any such subsequent issuances within such period).

5.5 Adjustment for Stock Splits and Combinations. If the Corporation shall at any time or from time to time after the Series D Original Issue Date effect a subdivision of the outstanding Common Stock, the Applicable Conversion Price in effect immediately before that subdivision shall be proportionately decreased so that the number of shares of Common Stock issuable on conversion of each share of such series shall be increased in proportion to such increase in the aggregate number of shares of Common Stock outstanding. If the Corporation shall at any time or from time to time after the Series D Original Issue Date combine the outstanding shares of Common Stock, the Applicable Conversion Price in effect immediately before the combination shall be proportionately increased so that the number of shares of Common Stock issuable on conversion of each share of such series shall be decreased in proportion to such decrease in the aggregate number of shares of Common Stock outstanding. Any adjustment under this Subsection 5.5 shall become effective at the close of business on the date the subdivision or combination becomes effective.

5.6 Adjustment for Certain Dividends and Distributions. In the event the Corporation at any time or from time to time after the Series D Original Issue Date shall make or issue, or fix a record date for the determination of holders of Common Stock entitled to receive, a dividend or other distribution payable on the Common Stock in additional shares of Common Stock, then and in each such event the Applicable Conversion Price in effect immediately before such event shall be decreased as of the time of such issuance or, in the event such a record date shall have been fixed, as of the close of business on such record date, by multiplying the Applicable Conversion Price then in effect by a fraction:

(1) the numerator of which shall be the total number of shares of Common Stock issued and outstanding immediately prior to the time of such issuance or the close of business on such record date, and

(2) the denominator of which shall be the total number of shares of Common Stock issued and outstanding immediately prior to the time of such issuance or the close of business on such record date plus the number of shares of Common Stock issuable in payment of such dividend or distribution.

Notwithstanding the foregoing, (a) if such record date shall have been fixed and such dividend is not fully paid or if such distribution is not fully made on the date fixed therefor, the Applicable Conversion Price shall be recomputed accordingly as of the close of business on such record date and thereafter the Applicable Conversion Price shall be adjusted pursuant to this Subsection 5.6 as of the time of actual payment of such dividends or distributions; and (b) that no such adjustment shall be made if the holders of Preferred Stock simultaneously receive a dividend or other distribution of shares of Common Stock in a number equal to the number of shares of Common Stock as they would have received if all outstanding shares of Preferred Stock had been converted into Common Stock on the date of such event.

5.7 Adjustments for Other Dividends and Distributions. In the event the Corporation at any time or from time to time after the Series D Original Issue Date shall make or issue, or fix a record date for the determination of holders of Common Stock entitled to receive, a dividend or other distribution payable in securities of the Corporation (other than a distribution of shares of Common Stock in respect of outstanding shares of Common Stock) or in other property and the provisions of Section 2 do not apply to such dividend or distribution, then and in each such event the holders of Preferred Stock shall receive, simultaneously with the distribution to the holders of Common Stock, a dividend or other distribution of such securities or other property in an amount equal to the amount of such securities or other property as they would have received if all outstanding shares of Preferred Stock, as the case may be, had been converted into Common Stock on the date of such event.

5.8 Adjustment for Merger or Reorganization, etc. Subject to the provisions of Subsection 5.3.4, if there shall occur any reorganization, recapitalization, reclassification, consolidation or merger involving the Corporation in which the Common Stock (but not either the Preferred Stock) is converted into or exchanged for securities, cash or other property (other than a transaction covered by Subsections 5.4, 5.6 or 5.7), then, following any such reorganization, recapitalization, reclassification, consolidation or merger, each share of Preferred Stock shall thereafter be convertible in lieu of the Common Stock into which it was convertible prior to such event into the kind and amount of securities, cash or other property which a holder of the number of shares of Common Stock of the Corporation issuable upon conversion of one share of Preferred Stock immediately prior to such reorganization, recapitalization, reclassification, consolidation or merger would have been entitled to receive pursuant to such transaction; and, in such case, appropriate adjustment (as determined in good faith by the Board of Directors of the Corporation) shall be made in the application of the provisions in this Section 5 with respect to the rights and interests thereafter of the holders of Preferred Stock to the end that the provisions set forth in this Section 5 (including provisions with respect to changes in and other adjustments of the Applicable Conversion Price) shall thereafter be applicable, as nearly as reasonably may be, in relation to any securities or other property thereafter deliverable upon the conversion of the Preferred Stock.

5.9 Certificate as to Adjustments. Upon the occurrence of each adjustment or readjustment of the Applicable Conversion Price pursuant to this Section 5, the Corporation at its expense shall, as promptly as reasonably practicable but in any event not later than 10 days thereafter, compute such adjustment or readjustment in accordance with the terms hereof and furnish to each holder of Preferred Stock a certificate setting forth such adjustment or readjustment (including the kind and amount of securities, cash or other property into which the Preferred Stock is convertible) and showing in detail the facts upon which such adjustment or readjustment is based. The Corporation shall, as promptly as reasonably practicable after the written request at any time of any holder of Preferred Stock (but in any event not later than 10 days thereafter), furnish or cause to be furnished to such holder a certificate setting forth (1) the Applicable Conversion Price then in effect, and (2) the number of shares of Common Stock and the amount, if any, of other securities, cash or property which then would be received upon the conversion of the Preferred Stock.

5.10 Notice of Record Date. In the event:

(a) the Corporation shall take a record of the holders of its Common Stock (or other capital stock or securities at the time issuable upon conversion of the Preferred Stock) for the purpose of entitling or enabling them to receive any dividend or other distribution, or to receive any right to subscribe for or purchase any shares of capital stock of any class or any other securities, or to receive any other security; or

(b) of any capital reorganization of the Corporation, any reclassification of the Common Stock of the Corporation, or any Deemed Liquidation Event; or

(c) of the voluntary or involuntary dissolution, liquidation or winding-up of the Corporation,

then, and in each such case, the Corporation will send or cause to be sent to the holders of Preferred Stock a notice specifying, as the case may be, (i) the record date for such dividend, distribution or right, and the amount and character of such dividend, distribution or right, or (ii) the effective date on which such reorganization, reclassification, consolidation, merger, transfer, dissolution, liquidation or winding-up is proposed to take place, and the time, if any is to be fixed, as of which the holders of record of Common Stock (or such other capital stock or securities at the time issuable upon the conversion of the Preferred Stock) shall be entitled to exchange their shares of Common Stock (or such other capital stock or securities) for securities or other property deliverable upon such reorganization, reclassification, consolidation, merger, transfer, dissolution, liquidation or winding-up, and the amount per share and character of such exchange applicable to the Preferred Stock and the Common Stock. Such notice shall be sent at least 10 days prior to the record date or effective date for the event specified in such notice.

6. Mandatory Conversion.

6.1 Trigger Events. Upon either (1) the closing of the sale of shares of Common Stock to the public in a underwritten public offering pursuant to an effective registration statement under the Securities Act of 1933, as amended, resulting in at least $30,000,000 of gross proceeds to the Corporation and a listing of the Common Stock on a

nationally recognized securities exchange or trading system (a **"Qualified Public Offering**") or (2) the date and time, or the occurrence of an event, specified by vote or written consent of the Requisite Holders and the Requisite Series D Holders (the time of such closing or the date and time specified or the time of the event specified in such vote or written consent is referred to herein as the " **Mandatory Conversion Time**"), (A) all outstanding shares of Preferred Stock shall automatically be converted into shares of Common Stock, at the then effective conversion rate and (B) such shares may not be reissued by the Corporation.

6.2 Procedural Requirements. All holders of record of shares of Preferred Stock shall be sent written notice of the Mandatory Conversion Time and the place designated for mandatory conversion of all such shares of Preferred Stock pursuant to this Section 6. Such notice need not be sent in advance of the occurrence of the Mandatory Conversion Time. Upon receipt of such notice, each holder of shares of Preferred Stock shall surrender his, her or its certificate or certificates for all such shares (or, if such holder alleges that such certificate has been lost, stolen or destroyed, a lost certificate affidavit and agreement reasonably acceptable to the Corporation to indemnify the Corporation against any claim that may be made against the Corporation on account of the alleged loss, theft or destruction of such certificate) to the Corporation at the place designated in such notice, and shall thereafter receive certificates for the number of shares of Common Stock to which such holder is entitled pursuant to this Section 6. At the Mandatory Conversion Time, all outstanding shares of Preferred Stock shall be deemed to have been converted into shares of Common Stock, which shall be deemed to be outstanding of record, and all rights with respect to the Preferred Stock so converted, including the rights, if any, to receive notices and vote (other than as a holder of Common Stock), will terminate, except only the rights of the holders thereof, upon surrender of their certificate or certificates (or lost certificate affidavit and agreement) therefor, to receive the items provided for in the last sentence of this Subsection 6.2. If so required by the Corporation, certificates surrendered for conversion shall be endorsed or accompanied by written instrument or instruments of transfer, in form satisfactory to the Corporation, duly executed by the registered holder or by his, her or its attorney duly authorized in writing. As soon as practicable after the Mandatory Conversion Time and the surrender of the certificate or certificates (or lost certificate affidavit and agreement) for Preferred Stock, the Corporation shall issue and deliver to such holder, or to his, her or its nominees, a certificate or certificates for the number of full shares of Common Stock issuable on such conversion in accordance with the provisions hereof, together with cash as provided in Subsection 5.2 in lieu of any fraction of a share of Common Stock otherwise issuable upon such conversion and the payment of any declared but unpaid dividends on the shares of Preferred Stock converted.

6.2.1 Effect of Mandatory Conversion. All shares of Preferred Stock shall, from and after the Mandatory Conversion Time, no longer be deemed to be outstanding and, notwithstanding the failure of the holder or holders thereof to surrender the certificates for such shares on or prior to such time, all rights with respect to such shares shall immediately cease and terminate at the Mandatory Conversion Time, except only the right of the holders thereof to receive shares of Common Stock in exchange therefor and to receive payment of any dividends declared but unpaid thereon (but not any undeclared Accruing Dividends). Such converted Preferred Stock shall be retired and cancelled and may not be reissued as shares of such series, and the Corporation may thereafter take such appropriate action (without the need for stockholder action) as may be necessary to reduce the authorized number of shares of Preferred Stock accordingly.

7. [RESERVED]

8. Redeemed or Otherwise Acquired Shares. Any shares of Preferred Stock which are redeemed or otherwise acquired by the Corporation or any of its subsidiaries shall be automatically and immediately cancelled and retired and shall not be reissued, sold or transferred. Neither the Corporation nor any of its subsidiaries may exercise any voting or other rights granted to the holders of Preferred Stock following redemption.

9. Waiver. Any of the rights, powers, preferences and other terms of the Preferred Stock set forth herein may be waived on behalf of all holders of Preferred Stock by the affirmative written consent or vote of the Requisite Holders; provided that any such waiver of the rights, powers, preferences and other terms of the Series D Preferred Stock must include the affirmative written consent or vote of the Requisite Series D Holders.

10. Notices. Any notice required or permitted by the provisions of this Article Fourth to be given to a holder of shares of Preferred Stock shall be mailed, postage prepaid, to the post office address last shown on the records of the Corporation, or given by electronic communication in compliance with the provisions of the DGCL, and shall be deemed sent upon such mailing or electronic transmission.

C. UNDESIGNATED PREFERRED STOCK

The Board of Directors or any authorized committee thereof is expressly authorized, to the fullest extent permitted by law, to provide by resolution or resolutions for, out of the unissued shares of Undesignated Preferred Stock, the issuance of the shares of Undesignated Preferred Stock in one or more series of such stock, and by filing a certificate of designations pursuant to applicable law of the State of Delaware, to establish or change from time to time the number of shares of each such series, and to fix the designations, powers, including voting powers, full or limited, or no voting powers, preferences and the relative, participating, optional or other special rights of the shares of each series and any qualifications, limitations and restrictions thereof.

ARTICLE V

STOCKHOLDER ACTION

Effective from and after the mandatory conversion of all outstanding shares of Pre-IPO Preferred Stock pursuant to Section 6 of Part B of Article IV of this Certificate of Incorporation (the time at which such mandatory conversion occurs being referred to herein as the " **Mandatory Conversion Time**"):

1. Action without Meeting. Any action required or permitted to be taken by the stockholders of the Corporation at any annual or special meeting of stockholders of the Corporation must be effected at a duly called annual or special meeting of stockholders and may not be taken or effected by a written consent of stockholders in lieu thereof.

2. Special Meetings. Except as otherwise required by statute and subject to the rights, if any, of the holders of any series of Undesignated Preferred Stock, special meetings of the stockholders of the Corporation may be called only by the Board of Directors acting pursuant to a resolution approved by the affirmative vote of a majority of the Directors then in office, and special meetings of stockholders may not be called by any other person or persons. Only those matters set forth in the notice of the special meeting may be considered or acted upon at a special meeting of stockholders of the Corporation.

ARTICLE VI

DIRECTORS

A. Before and after the Mandatory Conversion Time:

1. General. The business and affairs of the Corporation shall be managed by or under the direction of the Board of Directors except as otherwise provided herein or required by law.

B. Effective from and after the Mandatory Conversion Time:

2. Election of Directors. Election of Directors need not be by written ballot unless the By-laws of the Corporation (the " **By-laws**") shall so provide.

3. Number of Directors; Term of Office. The number of Directors of the Corporation shall be fixed solely and exclusively by resolution duly adopted from time to time by the Board of Directors. The Directors, other than those who may be elected by the holders of any series of Undesignated Preferred Stock, shall be classified, with respect to the term for which they severally hold office, into three classes. The initial Class I Directors of the Corporation shall be Nick Leschly, Steven Gillis and Axel Polack; the initial Class II Directors of the Corporation shall be Robert I. Tepper, Daniel S. Lynch and John M. Maraganore; and the initial Class III Directors of the Corporation shall be Wendy L. Dixon and David P. Schenkein. The initial Class I Directors shall serve for a term expiring at the annual meeting of stockholders to be held in 2014, the initial Class II Directors shall serve for a term expiring at the annual meeting of stockholders to be held in 2015, and the initial Class III Directors shall serve for a term expiring at the annual meeting of stockholders to be held in 2016. At each annual meeting of stockholders, Directors elected to succeed those Directors whose terms expire shall be elected for a term of office to expire at the third succeeding annual meeting of stockholders after their election. Notwithstanding the foregoing, the Directors elected to each class shall hold office until their successors are duly elected and qualified or until their earlier resignation, death or removal.

Notwithstanding the foregoing, whenever, pursuant to the provisions of Article IV of this Certificate, the holders of any one or more series of Undesignated Preferred Stock shall have the right, voting separately as a series or together with holders of other such series, to elect Directors at an annual or special meeting of stockholders, the election, term of office, filling of vacancies and other features of such directorships shall be governed by the terms of this Certificate and any certificate of designations applicable to such series.

4. Vacancies. Subject to the rights, if any, of the holders of any series of Undesignated Preferred Stock to elect Directors and to fill vacancies in the Board of Directors

relating thereto, any and all vacancies in the Board of Directors, however occurring, including, without limitation, by reason of an increase in the size of the Board of Directors, or the death, resignation, disqualification or removal of a Director, shall be filled solely and exclusively by the affirmative vote of a majority of the remaining Directors then in office, even if less than a quorum of the Board of Directors, and not by the stockholders. Any Director appointed in accordance with the preceding sentence shall hold office for the remainder of the full term of the class of Directors in which the new directorship was created or the vacancy occurred and until such Director's successor shall have been duly elected and qualified or until his or her earlier resignation, death or removal. Subject to the rights, if any, of the holders of any series of Undesignated Preferred Stock to elect Directors, when the number of Directors is increased or decreased, the Board of Directors shall, subject to Article VI.3 hereof, determine the class or classes to which the increased or decreased number of Directors shall be apportioned; provided, however, that no decrease in the number of Directors shall shorten the term of any incumbent Director. In the event of a vacancy in the Board of Directors, the remaining Directors, except as otherwise provided by law, shall exercise the powers of the full Board of Directors until the vacancy is filled.

5. Removal. Subject to the rights, if any, of any series of Undesignated Preferred Stock to elect Directors and to remove any Director whom the holders of any such series have the right to elect, any Director (including persons elected by Directors to fill vacancies in the Board of Directors) may be removed from office (i) only with cause and (ii) only by the affirmative vote of the holders of 75% or more of the outstanding shares of capital stock then entitled to vote at an election of Directors. At least forty-five (45) days prior to any annual or special meeting of stockholders at which it is proposed that any Director be removed from office, written notice of such proposed removal and the alleged grounds thereof shall be sent to the Director whose removal will be considered at the meeting.

ARTICLE VII

LIMITATION OF LIABILITY

A Director of the Corporation shall not be personally liable to the Corporation or its stockholders for monetary damages for breach of fiduciary duty as a Director, except for liability (a) for any breach of the Director's duty of loyalty to the Corporation or its stockholders, (b) for acts or omissions not in good faith or which involve intentional misconduct or a knowing violation of law, (c) under Section 174 of the DGCL or (d) for any transaction from which the Director derived an improper personal benefit. If the DGCL is amended after the effective date of this Certificate to authorize corporate action further eliminating or limiting the personal liability of Directors, then the liability of a Director of the Corporation shall be eliminated or limited to the fullest extent permitted by the DGCL, as so amended.

Any amendment, repeal or modification of this Article VII by either of (i) the stockholders of the Corporation or (ii) an amendment to the DGCL, shall not adversely affect any right or protection existing at the time of such amendment, repeal or modification with respect to any acts or omissions occurring before such amendment, repeal or modification of a person serving as a Director at the time of such amendment, repeal or modification.

ARTICLE VIII

EXCLUSIVE JURISDICTION OF DELAWARE COURTS

Unless the Corporation consents in writing to the selection of an alternative forum, the Court of Chancery of the State of Delaware shall be the sole and exclusive forum for (i) any derivative action or proceeding brought on behalf of the Corporation, (ii) any action asserting a claim of breach of a fiduciary duty owed by any director, officer or other employee of the Corporation to the Corporation or the Corporation's stockholders, (iii) any action asserting a claim arising pursuant to any provision of the DGCL or the Corporation's Certificate of Incorporation or By-laws, or (iv) any action asserting a claim against the Corporation governed by the internal affairs doctrine. Any person or entity purchasing or otherwise acquiring any interest in shares of capital stock of the Corporation shall be deemed to have notice of and consented to the provisions of this Article VIII.

ARTICLE IX

AMENDMENT OF BY-LAWS

1. Amendment by Directors. Except as otherwise provided by law, the By-laws of the Corporation may be amended or repealed by the Board of Directors by the affirmative vote of a majority of the Directors then in office.

2. Amendment by Stockholders. The By-laws of the Corporation may be amended or repealed at any annual meeting of stockholders, or special meeting of stockholders called for such purpose, by the affirmative vote of at least 75% of the outstanding shares of capital stock entitled to vote on such amendment or repeal, voting together as a single class; provided, however, that if the Board of Directors recommends that stockholders approve such amendment or repeal at such meeting of stockholders, such amendment or repeal shall only require the affirmative vote of the majority of the outstanding shares of capital stock entitled to vote on such amendment or repeal, voting together as a single class.

ARTICLE X

AMENDMENT OF CERTIFICATE OF INCORPORATION

The Corporation reserves the right to amend or repeal this Certificate in the manner now or hereafter prescribed by statute and this Certificate, and all rights conferred upon stockholders herein are granted subject to this reservation. Whenever any vote of the holders of capital stock of the Corporation is required to amend or repeal any provision of this Certificate, and in addition to any other vote of holders of capital stock that is required by this Certificate or by law, such amendment or repeal shall require the affirmative vote of the majority of the outstanding shares of capital stock entitled to vote on such amendment or repeal, and the affirmative vote of the majority of the outstanding shares of each class entitled to vote thereon as a class, at a duly constituted meeting of stockholders called expressly for such purpose; provided, however, that the affirmative vote of not less than 75% of the outstanding shares of capital stock entitled to vote on such amendment or repeal, and the affirmative vote of not less than 75% of the outstanding shares of each class entitled to vote thereon as a class, shall be required to amend or repeal any provision of Article V, Article VI, Article VII, Article VIII, Article IX or Article X of this Certificate.

IN WITNESS WHEREOF, this Amended and Restated Certificate of Incorporation has been executed by a duly authorized officer of this corporation on this _____ day of _____, 2013.

bluebird bio, Inc.

By: _____

Name: Nick Leschly
Title: President & CEO

Exhibit 3.2

AMENDED AND RESTATED CERTIFICATE OF INCORPORATION OF BLUEBIRD BIO, INC.

bluebird bio, Inc., a corporation organized and existing under the laws of the State of Delaware (the " **Corporation**"), hereby certifies as follows:

1. The name of the Corporation is bluebird bio, Inc. The date of the filing of its original Certificate of Incorporation with the Secretary of State of the State of Delaware was April 16, 1992 (the "**Original Certificate**"). The name under which the Corporation filed the Original Certificate was Genetix Pharmaceuticals Inc.

2. This Amended and Restated Certificate of Incorporation (the " **Certificate**") amends, restates and integrates the provisions of the Amended and Restated Certificate of Incorporation that was filed with the Secretary of State of the State of Delaware on June [•], 2013, as amended (the " **Existing Certificate**"), and was duly adopted in accordance with the provisions of Sections 228, 242 and 245 of the General Corporation Law of the State of Delaware (the "**DGCL**").

3. The text of the Existing Certificate is hereby amended and restated in its entirety to provide as herein set forth in full.

ARTICLE I

The name of the Corporation is bluebird bio, Inc.

ARTICLE II

The address of the Corporation's registered office in the State of Delaware is 2711 Centerville Road, Suite 400, City of Wilmington, County of New Castle, 19808. The name of its registered agent at that address is Corporation Service Company.

ARTICLE III

The purpose of the Corporation is to engage in any lawful act or activity for which corporations may be organized under the DGCL.

ARTICLE IV

CAPITAL STOCK

The total number of shares of capital stock which the Corporation shall have authority to issue is one hundred thirty million (130,000,000) of which (i) one hundred twenty-five million (125,000,000) shares shall be a class designated as common stock, par value $0.01 per share (the " **Common Stock**"), and (ii) five million (5,000,000) shares shall be a class designated as undesignated preferred stock, par value $0.01 per share (the " **Undesignated Preferred Stock**").

Except as otherwise provided in any certificate of designations of any series of Undesignated Preferred Stock, the number of authorized shares of the class of Common Stock or Undesignated Preferred Stock may from time to time be increased or decreased (but not below the number of shares of such class outstanding) by the affirmative vote of the holders of a majority in voting power of the outstanding shares of capital stock of the Corporation irrespective of the provisions of Section 242(b)(2) of the DGCL.

The powers, preferences and rights of, and the qualifications, limitations and restrictions upon, each class or series of stock shall be determined in accordance with, or as set forth below in, this Article IV.

A. COMMON STOCK

Subject to all the rights, powers and preferences of the Undesignated Preferred Stock and except as provided by law or in this Certificate (or in any certificate of designations of any series of Undesignated Preferred Stock):

(a) the holders of the Common Stock shall have the exclusive right to vote for the election of directors of the Corporation (the " **Directors**") and on all other matters requiring stockholder action, each outstanding share entitling the holder thereof to one vote on each matter properly submitted to the stockholders of the Corporation for their vote; provided, however, that, except as otherwise required by law, holders of Common Stock, as such, shall not be entitled to vote on any amendment to this Certificate (or on any amendment to a certificate of designations of any series of Undesignated Preferred Stock) that alters or changes the powers, preferences, rights or other terms of one or more outstanding series of Undesignated Preferred Stock if the holders of such affected series of Undesignated Preferred Stock are entitled to vote, either separately or together with the holders of one or more other such series, on such amendment pursuant to this Certificate (or pursuant to a certificate of designations of any series of Undesignated Preferred Stock) or pursuant to the DGCL;

(b) dividends may be declared and paid or set apart for payment upon the Common Stock out of any assets or funds of the Corporation legally available for the payment of dividends, but only when and as declared by the Board of Directors or any authorized committee thereof; and

(c) upon the voluntary or involuntary liquidation, dissolution or winding up of the Corporation, the net assets of the Corporation shall be distributed pro rata to the holders of the Common Stock.

B. UNDESIGNATED PREFERRED STOCK

The Board of Directors or any authorized committee thereof is expressly authorized, to the fullest extent permitted by law, to provide by resolution or resolutions for, out of the unissued shares of Undesignated Preferred Stock, the issuance of the shares of Undesignated Preferred Stock in one or more series of such stock, and by filing a certificate of designations pursuant to applicable law of the State of Delaware, to establish or change from time to time the number of shares of each such series, and to fix the designations, powers, including voting powers, full or limited, or no voting powers, preferences and the relative, participating, optional or other special rights of the shares of each series and any qualifications, limitations and restrictions thereof.

ARTICLE V

STOCKHOLDER ACTION

1. Action without Meeting. Any action required or permitted to be taken by the stockholders of the Corporation at any annual or special meeting of stockholders of the Corporation must be effected at a duly called annual or special meeting of stockholders and may not be taken or effected by a written consent of stockholders in lieu thereof.

2. Special Meetings. Except as otherwise required by statute and subject to the rights, if any, of the holders of any series of Undesignated Preferred Stock, special meetings of the stockholders of the Corporation may be called only by the Board of Directors acting pursuant to a resolution approved by the affirmative vote of a majority of the Directors then in office, and special meetings of stockholders may not be called by any other person or persons. Only those matters set forth in the notice of the special meeting may be considered or acted upon at a special meeting of stockholders of the Corporation.

ARTICLE VI

DIRECTORS

1. General. The business and affairs of the Corporation shall be managed by or under the direction of the Board of Directors except as otherwise provided herein or required by law.

2. Election of Directors. Election of Directors need not be by written ballot unless the By-laws of the Corporation (the " **By-laws**") shall so provide.

3. Number of Directors; Term of Office. The number of Directors of the Corporation shall be fixed solely and exclusively by resolution duly adopted from time to time by the Board of Directors. The Directors, other than those who may be elected by the holders of any series of Undesignated Preferred Stock, shall be classified, with respect to the term for which they severally hold office, into three classes. The initial Class I Directors of the Corporation shall be Nick Leschly, Steven Gillis and Axel Polack; the initial Class II Directors of the Corporation shall be Robert I. Tepper, Daniel S. Lynch, and John M. Maraganore; and the initial Class III Directors of the Corporation shall be Wendy L. Dixon and David P. Schenkein. The initial Class I Directors shall serve for a term expiring at the annual meeting of stockholders to be held in 2014, the initial Class II Directors shall serve for a term expiring at the annual meeting

of stockholders to be held in 2015, and the initial Class III Directors shall serve for a term expiring at the annual meeting of stockholders to be held in 2016. At each annual meeting of stockholders, Directors elected to succeed those Directors whose terms expire shall be elected for a term of office to expire at the third succeeding annual meeting of stockholders after their election. Notwithstanding the foregoing, the Directors elected to each class shall hold office until their successors are duly elected and qualified or until their earlier resignation, death or removal.

Notwithstanding the foregoing, whenever, pursuant to the provisions of Article IV of this Certificate, the holders of any one or more series of Undesignated Preferred Stock shall have the right, voting separately as a series or together with holders of other such series, to elect Directors at an annual or special meeting of stockholders, the election, term of office, filling of vacancies and other features of such directorships shall be governed by the terms of this Certificate and any certificate of designations applicable to such series.

4. Vacancies. Subject to the rights, if any, of the holders of any series of Undesignated Preferred Stock to elect Directors and to fill vacancies in the Board of Directors relating thereto, any and all vacancies in the Board of Directors, however occurring, including, without limitation, by reason of an increase in the size of the Board of Directors, or the death, resignation, disqualification or removal of a Director, shall be filled solely and exclusively by the affirmative vote of a majority of the remaining Directors then in office, even if less than a quorum of the Board of Directors, and not by the stockholders. Any Director appointed in accordance with the preceding sentence shall hold office for the remainder of the full term of the class of Directors in which the new directorship was created or the vacancy occurred and until such Director's successor shall have been duly elected and qualified or until his or her earlier resignation, death or removal. Subject to the rights, if any, of the holders of any series of Undesignated Preferred Stock to elect Directors, when the number of Directors is increased or decreased, the Board of Directors shall, subject to Article VI.3 hereof, determine the class or classes to which the increased or decreased number of Directors shall be apportioned; provided, however, that no decrease in the number of Directors shall shorten the term of any incumbent Director. In the event of a vacancy in the Board of Directors, the remaining Directors, except as otherwise provided by law, shall exercise the powers of the full Board of Directors until the vacancy is filled.

5. Removal. Subject to the rights, if any, of any series of Undesignated Preferred Stock to elect Directors and to remove any Director whom the holders of any such series have the right to elect, any Director (including persons elected by Directors to fill vacancies in the Board of Directors) may be removed from office (i) only with cause and (ii) only by the affirmative vote of the holders of 75% or more of the outstanding shares of capital stock then entitled to vote at an election of Directors. At least forty-five (45) days prior to any annual or special meeting of stockholders at which it is proposed that any Director be removed from office, written notice of such proposed removal and the alleged grounds thereof shall be sent to the Director whose removal will be considered at the meeting.

ARTICLE VII

LIMITATION OF LIABILITY

A Director of the Corporation shall not be personally liable to the Corporation or its stockholders for monetary damages for breach of fiduciary duty as a Director, except for liability (a) for any breach of the Director's duty of loyalty to the Corporation or its stockholders, (b) for acts or omissions not in good faith or which involve intentional misconduct or a knowing violation of law, (c) under Section 174 of the DGCL or (d) for any transaction from which the Director derived an improper personal benefit. If the DGCL is amended after the effective date of this Certificate to authorize corporate action further eliminating or limiting the personal liability of Directors, then the liability of a Director of the Corporation shall be eliminated or limited to the fullest extent permitted by the DGCL, as so amended.

Any amendment, repeal or modification of this Article VII by either of (i) the stockholders of the Corporation or (ii) an amendment to the DGCL, shall not adversely affect any right or protection existing at the time of such amendment, repeal or modification with respect to any acts or omissions occurring before such amendment, repeal or modification of a person serving as a Director at the time of such amendment, repeal or modification.

ARTICLE VIII

EXCLUSIVE JURISDICTION OF DELAWARE COURTS

Unless the Corporation consents in writing to the selection of an alternative forum, the Court of Chancery of the State of Delaware shall be the sole and exclusive forum for (i) any derivative action or proceeding brought on behalf of the Corporation, (ii) any action asserting a claim of breach of a fiduciary duty owed by any director, officer or other employee of the Corporation to the Corporation or the Corporation's stockholders, (iii) any action asserting a claim arising pursuant to any provision of the DGCL or the Corporation's Certificate of Incorporation or By-laws, or (iv) any action asserting a claim against the Corporation governed by the internal affairs doctrine. Any person or entity purchasing or otherwise acquiring any interest in shares of capital stock of the Corporation shall be deemed to have notice of and consented to the provisions of this Article VIII.

ARTICLE IX

AMENDMENT OF BY-LAWS

1. Amendment by Directors. Except as otherwise provided by law, the By-laws of the Corporation may be amended or repealed by the Board of Directors by the affirmative vote of a majority of the Directors then in office.

2. Amendment by Stockholders. The By-laws of the Corporation may be amended or repealed at any annual meeting of stockholders, or special meeting of stockholders called for such purpose, by the affirmative vote of at least 75% of the outstanding shares of capital stock entitled to vote on such amendment or repeal, voting together as a single class; provided, however, that if the Board of Directors recommends that stockholders approve such amendment or repeal at such meeting of stockholders, such amendment or repeal shall only require the affirmative vote of the majority of the outstanding shares of capital stock entitled to vote on such amendment or repeal, voting together as a single class.

ARTICLE X

AMENDMENT OF CERTIFICATE OF INCORPORATION

The Corporation reserves the right to amend or repeal this Certificate in the manner now or hereafter prescribed by statute and this Certificate, and all rights conferred upon stockholders herein are granted subject to this reservation. Whenever any vote of the holders of capital stock of the Corporation is required to amend or repeal any provision of this Certificate, and in addition to any other vote of holders of capital stock that is required by this Certificate or by law, such amendment or repeal shall require the affirmative vote of the majority of the outstanding shares of capital stock entitled to vote on such amendment or repeal, and the affirmative vote of the majority of the outstanding shares of each class entitled to vote thereon as a class, at a duly constituted meeting of stockholders called expressly for such purpose; provided, however, that the affirmative vote of not less than 75% of the outstanding shares of capital stock entitled to vote on such amendment or repeal, and the affirmative vote of not less than 75% of the outstanding shares of each class entitled to vote thereon as a class, shall be required to amend or repeal any provision of Article V, Article VI, Article VII, Article VIII, Article IX or Article X of this Certificate.

IN WITNESS WHEREOF, this Amended and Restated Certificate of Incorporation has been executed by a duly authorized officer of this corporation on this _____ day of _____, 2013.

bluebird bio, Inc.

By: _____

Name: Nick Leschly
Title: President & CEO

Exhibit 4.1


A
BLUEBIRD BIO, INC.
INCORPORATED UNDER THE LAWS OF THE STATE OF DELAWARE
COMMON STOCK
SEE REVERSE FOR CERTAIN DEFINITIONS
CUSIP 096096 10 0
THIS CERTIFIES THAT
SPECIMEN
IS THE RECORD HOLDER OF
FULLY PAID AND NON-ASSESSABLE SHARES OF COMMON STOCK, $0.01 PAR VALUE, OF
BLUEBIRD BIO, INC.
transferable only on the books of the Corporation in person or by duly authorized attorney, upon surrender of this Certificate properly endorsed.
This Certificate is not valid unless countersigned by the Transfer Agent and Registered by the Registrar.
IN WITNESS whereof, the facsimile signatures of the Corporation's duly authorized officers.
Dated:
SECRETARY
PRESIDENT
AMERICAN STOCK TRANSFER & TRUST COMPANY, LLC

The following abbreviations, when used in the inscription on the face of this certificate, shall be construed as though they were written out in full according to applicable laws or regulations:

TEN COM – as tenants in common
TEN ENT – as tenants by the entireties
JT TEN – as joint tenants with right of survivorship and not as tenants in common

UNIF GIFT MIN ACT– .....Custodian.....
(Cust) (Minor)
under Uniform Gifts to Minors Act.....
(State)

Additional abbreviations may also be used though not in the above list.

For value received, _____ hereby sell, assign and transfer unto

PLEASE INSERT SOCIAL SECURITY OR OTHER IDENTIFYING NUMBER OF ASSIGNEE

_____

PLEASE PRINT OR TYPEWRITE NAME AND ADDRESS INCLUDING ZIP CODE, OF ASSIGNEE

_____

_____

_____ Shares of the common stock represented by the within Certificate, and do hereby irrevocably constitute and appoint

_____ Attorney to transfer the said stock on the books of the within named Corporation with full power of substitution in the premises.

Dated _____

NOTICE: THE SIGNATURE TO THIS ASSIGNMENT MUST CORRESPOND WITH THE NAME AS WRITTEN UPON THE FACE OF THE CERTIFICATE, IN EVERY PARTICULAR, WITHOUT ALTERATION OR ENLARGEMENT, OR ANY CHANGE WHATSOEVER.

SIGNATURE(S) GUARANTEED:

_____

THE SIGNATURE(S) MUST BE GUARANTEED BY AN ELIGIBLE GUARANTOR INSTITUTION (BANKS, STOCKBROKERS, SAVINGS AND LOAN ASSOCIATIONS AND CREDIT UNIONS WITH MEMBERSHIP IN AN APPROVED SIGNATURE GUARANTEE MEDALLION PROGRAM), PURSUANT TO S.E.C. RULE 17Ad-15.

Exhibit 5.1

June 4, 2013

bluebird bio, Inc.
840 Memorial Drive, 4th Floor
Cambridge, MA 02139

Re: Securities Registered under Registration Statement on Form S-1

Ladies and Gentlemen:

We have acted as counsel to you in connection with your filing of a Registration Statement on Form S-1 (File No. 333-188605) (as amended or supplemented, the "Registration Statement") pursuant to the Securities Act of 1933, as amended (the "Securities Act"), relating to the registration of the offering by bluebird bio, Inc., a Delaware corporation (the "Company") of up to 5,750,000 shares (the "Shares") of the Company's Common Stock, $0.01 par value per share, including Shares purchasable by the underwriters upon their exercise of an over-allotment option granted to the underwriters by the Company. The Shares are being sold to the several underwriters named in, and pursuant to, an underwriting agreement among the Company and such underwriters.

We have reviewed such documents and made such examination of law as we have deemed appropriate to give the opinions set forth below. We have relied, without independent verification, on certificates of public officials and, as to matters of fact material to the opinions set forth below, on certificates of officers of the Company.

The opinion set forth below is limited to the Delaware General Corporation Law (which includes reported judicial decisions interpreting the Delaware General Corporation Law).

Based on the foregoing, we are of the opinion that the Shares have been duly authorized and, when the price and other terms upon which the Shares are to be sold have been approved by or on behalf of the Board of Directors of the Company (or a duly authorized committee of the Board of Directors) and the Shares have been issued and delivered against payment in accordance with such terms, the Shares will be validly issued, fully paid and non-assessable.

We hereby consent to the inclusion of this opinion as Exhibit 5.1 to the Registration Statement and to the references to our firm under the caption "Legal Matters" in the Registration Statement. In giving our consent, we do not admit that we are in the category of persons whose consent is required under Section 7 of the Securities Act or the rules and regulations thereunder.

Very truly yours,

/s/ Goodwin Procter LLP

GOODWIN PROCTER LLP

Exhibit 10.3

BLUEBIRD BIO, INC.

2013 STOCK OPTION AND INCENTIVE PLAN

SECTION 1. GENERAL PURPOSE OF THE PLAN; DEFINITIONS

The name of the plan is the bluebird bio, Inc. 2013 Stock Option and Incentive Plan (the "Plan"). The purpose of the Plan is to encourage and enable the officers, employees, Non-Employee Directors and other key persons (including Consultants) of bluebird bio, Inc. (the "Company") and its Subsidiaries upon whose judgment, initiative and efforts the Company largely depends for the successful conduct of its business to acquire a proprietary interest in the Company. It is anticipated that providing such persons with a direct stake in the Company's welfare will assure a closer identification of their interests with those of the Company and its stockholders, thereby stimulating their efforts on the Company's behalf and strengthening their desire to remain with the Company.

The following terms shall be defined as set forth below:

"Act" means the Securities Act of 1933, as amended, and the rules and regulations thereunder.

"Administrator" means either the Board or the compensation committee of the Board or a similar committee performing the functions of the compensation committee and which is comprised of not less than two Non-Employee Directors who are independent.

"Award" or *"Awards,"* except where referring to a particular category of grant under the Plan, shall include Incentive Stock Options, Non-Qualified Stock Options, Stock Appreciation Rights, Restricted Stock Units, Restricted Stock Awards, Unrestricted Stock Awards, Cash-Based Awards, Performance Share Awards and Dividend Equivalent Rights.

"Award Certificate" means a written or electronic document setting forth the terms and provisions applicable to an Award granted under the Plan. Each Award Certificate is subject to the terms and conditions of the Plan.

"Board" means the Board of Directors of the Company.

"Cash-Based Award" means an Award entitling the recipient to receive a cash-denominated payment.

"Code" means the Internal Revenue Code of 1986, as amended, and any successor Code, and related rules, regulations and interpretations.

"Consultant" means any natural person that provides bona fide services to the Company, and such services are not in connection with the offer or sale of securities in a capital-raising transaction and do not directly or indirectly promote or maintain a market for the Company's securities.

"Covered Employee" means an employee who is a "Covered Employee" within the meaning of Section 162(m) of the Code.

"Dividend Equivalent Right" means an Award entitling the grantee to receive credits based on cash dividends that would have been paid on the shares of Stock specified in the Dividend Equivalent Right (or other award to which it relates) if such shares had been issued to and held by the grantee.

"Effective Date" means the date on which the Plan is approved by the Company's stockholders as set forth in Section 21.

"Exchange Act" means the Securities Exchange Act of 1934, as amended, and the rules and regulations thereunder.

"Fair Market Value" of the Stock on any given date means the fair market value of the Stock determined in good faith by the Administrator; provided, however, that if the Stock is admitted to quotation on the National Association of Securities Dealers Automated Quotation System ("NASDAQ"), NASDAQ Global Market, the New York Stock Exchange or another national securities exchange, the determination shall be made by reference to the closing price of the Stock. If there is no closing price for such date, the determination shall be made by reference to the last date preceding such date for which there is a closing price; provided further, however, that if the date for which Fair Market Value is determined is the first day when trading prices for the Stock are reported on a national securities exchange, the Fair Market Value shall be the "Price to the Public" (or equivalent) set forth on the cover page for the final prospectus relating to the Company's Initial Public Offering.

"Incentive Stock Option" means any Stock Option designated and qualified as an "incentive stock option" as defined in Section 422 of the Code.

"Initial Public Offering" means the consummation of the first underwritten, firm commitment public offering pursuant to an effective registration statement under the Act covering the offer and sale by the Company of its equity securities, or such other event as a result of or following which the Stock shall be publicly held.

"Non-Employee Director" means a member of the Board who is not also an employee of the Company or any Subsidiary.

"Non-Qualified Stock Option" means any Stock Option that is not an Incentive Stock Option.

"Option" or *"Stock Option"* means any option to purchase shares of Stock granted pursuant to Section 5.

"Performance-Based Award" means any Restricted Stock Award, Restricted Stock Units, Performance Share Award or Cash-Based Award granted to a Covered Employee that is intended to qualify as "performance-based compensation" under Section 162(m) of the Code and the regulations promulgated thereunder.

"Performance Criteria" means the criteria that the Administrator selects for purposes of establishing the Performance Goal or Performance Goals for an individual for a Performance Cycle. The Performance Criteria (which shall be applicable to the organizational level specified by the Administrator, including, but not limited to, the Company or a unit, division, group, or Subsidiary of the Company) that will be used to establish Performance Goals are limited to the following: achievement of specified research and development, publication, clinical and/or regulatory milestones, total shareholder return, earnings before interest, taxes, depreciation and amortization, net income (loss) (either before or after interest, taxes, depreciation and/or amortization), changes in the market price of the Stock, economic value-added, funds from operations or similar measure, sales or revenue, acquisitions or strategic transactions, operating income (loss), cash flow (including, but not limited to, operating cash flow and free cash flow), return on capital, assets, equity, or investment, return on sales, gross or net profit levels, productivity, expense, margins, operating efficiency, customer satisfaction, working capital, earnings (loss) per share of Stock, sales or market shares and number of customers, any of which may be measured either in absolute terms or as compared to any incremental increase or as compared to results of a peer group.

"Performance Cycle" means one or more periods of time, which may be of varying and overlapping durations, as the Administrator may select, over which the attainment of one or more Performance Criteria will be measured for the purpose of determining a grantee's right to and the payment of a Restricted Stock Award, Restricted Stock Units, Performance Share Award or Cash-Based Award, the vesting and/or payment of which is subject to the attainment of one or more Performance Goals. Each such period shall not be less than 12 months.

"Performance Goals" means, for a Performance Cycle, the specific goals established in writing by the Administrator for a Performance Cycle based upon the Performance Criteria.

"Performance Share Award" means an Award entitling the recipient to acquire shares of Stock upon the attainment of specified Performance Goals.

"Restricted Stock Award" means an Award of shares of Stock subject to such restrictions and conditions as the Administrator may determine at the time of grant.

"Restricted Stock Units" means an Award of phantom stock units to a grantee.

"Sale Event" shall mean (i) the sale of all or substantially all of the assets of the Company on a consolidated basis to an unrelated person or entity, (ii) a merger, reorganization or consolidation pursuant to which the holders of the Company's outstanding voting power and outstanding stock immediately prior to such transaction do not own a majority of the outstanding voting power and outstanding stock or other equity interests of the resulting or successor entity (or its ultimate parent, if applicable) immediately upon completion of such transaction, (iii) the sale of all of the Stock of the Company to an unrelated person, entity or group thereof acting in concert, or (iv) any other transaction in which the owners of the Company's outstanding voting power immediately prior to such transaction do not own at least a majority of the outstanding voting power of the Company or any successor entity immediately upon completion of the transaction other than as a result of the acquisition of securities directly from the Company.

"*Sale Price*" means the value as determined by the Administrator of the consideration payable, or otherwise to be received by stockholders, per share of Stock pursuant to a Sale Event.

"Section 409A" means Section 409A of the Code and the regulations and other guidance promulgated thereunder.

"Stock" means the Common Stock, par value $0.01 per share, of the Company, subject to adjustments pursuant to Section 3.

"Stock Appreciation Right" means an Award entitling the recipient to receive shares of Stock having a value equal to the excess of the Fair Market Value of the Stock on the date of exercise over the exercise price of the Stock Appreciation Right multiplied by the number of shares of Stock with respect to which the Stock Appreciation Right shall have been exercised.

"Subsidiary" means any corporation or other entity (other than the Company) in which the Company has at least a 50 percent interest, either directly or indirectly.

"Ten Percent Owner" means an employee who owns or is deemed to own (by reason of the attribution rules of Section 424(d) of the Code) more than 10 percent of the combined voting power of all classes of stock of the Company or any parent or subsidiary corporation.

"Unrestricted Stock Award" means an Award of shares of Stock free of any restrictions.

SECTION 2. ADMINISTRATION OF PLAN; ADMINISTRATOR AUTHORITY TO SELECT GRANTEES AND DETERMINE AWARDS

(a) Administration of Plan. The Plan shall be administered by the Administrator.

(b) Powers of Administrator. The Administrator shall have the power and authority to grant Awards consistent with the terms of the Plan, including the power and authority:

(i) to select the individuals to whom Awards may from time to time be granted;

(ii) to determine the time or times of grant, and the extent, if any, of Incentive Stock Options, Non-Qualified Stock Options, Stock Appreciation Rights, Restricted Stock Awards, Restricted Stock Units, Unrestricted Stock Awards, Cash-Based Awards, Performance Share Awards and Dividend Equivalent Rights, or any combination of the foregoing, granted to any one or more grantees;

(iii) to determine the number of shares of Stock to be covered by any Award;

(iv) to determine and modify from time to time the terms and conditions, including restrictions, not inconsistent with the terms of the Plan, of any Award, which terms and conditions may differ among individual Awards and grantees, and to approve the forms of Award Certificates;

(v) to accelerate at any time the exercisability or vesting of all or any portion of any Award provided that the Administrator generally shall not exercise such discretion to accelerate Awards subject to Sections 7 and 8 except in the event of the grantee's death, disability or retirement, or a change in control (including a Sale Event);

(vi) subject to the provisions of Section 5(b), to extend at any time the period in which Stock Options may be exercised; and

(vii) at any time to adopt, alter and repeal such rules, guidelines and practices for administration of the Plan and for its own acts and proceedings as it shall deem advisable; to interpret the terms and provisions of the Plan and any Award (including related written instruments); to make all determinations it deems advisable for the administration of the Plan; to decide all disputes arising in connection with the Plan; and to otherwise supervise the administration of the Plan.

All decisions and interpretations of the Administrator shall be binding on all persons, including the Company and Plan grantees.

(c) Delegation of Authority to Grant Options . Subject to applicable law, the Administrator, in its discretion, may delegate to the Chief Executive Officer of the Company all or part of the Administrator's authority and duties with respect to the granting of Options to individuals who are (i) not subject to the reporting and other provisions of Section 16 of the Exchange Act and (ii) not Covered Employees. Any such delegation by the Administrator shall include a limitation as to the amount of Options that may be granted during the period of the delegation and shall contain guidelines as to the determination of the exercise price and the vesting criteria. The Administrator may revoke or amend the terms of a delegation at any time but such action shall not invalidate any prior actions of the Administrator's delegate or delegates that were consistent with the terms of the Plan.

(d) Award Certificate. Awards under the Plan shall be evidenced by Award Certificates that set forth the terms, conditions and limitations for each Award which may include, without limitation, the term of an Award and the provisions applicable in the event employment or service terminates.

(e) Indemnification. Neither the Board nor the Administrator, nor any member of either or any delegate thereof, shall be liable for any act, omission, interpretation, construction or determination made in good faith in connection with the Plan, and the members of the Board and the Administrator (and any delegate thereof) shall be entitled in all cases to indemnification and reimbursement by the Company in respect of any claim, loss, damage or expense (including, without limitation, reasonable attorneys' fees) arising or resulting therefrom to the fullest extent permitted by law and/or under the Company's articles or bylaws or any directors' and officers' liability insurance coverage which may be in effect from time to time and/or any indemnification agreement between such individual and the Company.

(f) Foreign Award Recipients. Notwithstanding any provision of the Plan to the contrary, in order to comply with the laws in other countries in which the Company and its Subsidiaries operate or have employees or other individuals eligible for Awards, the

Administrator, in its sole discretion, shall have the power and authority to: (i) determine which Subsidiaries shall be covered by the Plan; (ii) determine which individuals outside the United States are eligible to participate in the Plan; (iii) modify the terms and conditions of any Award granted to individuals outside the United States to comply with applicable foreign laws; (iv) establish subplans and modify exercise procedures and other terms and procedures, to the extent the Administrator determines such actions to be necessary or advisable (and such subplans and/or modifications shall be attached to this Plan as appendices); provided, however, that no such subplans and/or modifications shall increase the share limitations contained in Section 3(a) hereof; and (v) take any action, before or after an Award is made, that the Administrator determines to be necessary or advisable to obtain approval or comply with any local governmental regulatory exemptions or approvals. Notwithstanding the foregoing, the Administrator may not take any actions hereunder, and no Awards shall be granted, that would violate the Exchange Act or any other applicable United States securities law, the Code, or any other applicable United States governing statute or law.

SECTION 3. STOCK ISSUABLE UNDER THE PLAN; MERGERS; SUBSTITUTION

(a) Stock Issuable. The maximum number of shares of Stock reserved and available for issuance under the Plan shall be nine hundred fifty-five thousand (955,000) shares (the "Initial Limit"), subject to adjustment as provided in Section 3(c), plus on January 1, 2014 and each January 1 thereafter, the number of shares of Stock reserved and available for issuance under the Plan shall be cumulatively increased by 4 percent of the number of shares of Stock issued and outstanding on the immediately preceding December 31 or such lesser number of shares of Stock as determined by the Administrator (the "Annual Increase"). Subject to such overall limitation, the maximum aggregate number of shares of Stock that may be issued in the form of Incentive Stock Options shall not exceed the Initial Limit cumulatively increased on January 1, 2014 and on each January 1 thereafter by the lesser of the Annual Increase for such year or one million (1,000,000) shares of Stock, subject in all cases to adjustment as provided in Section 3(c). The shares of Stock underlying any Awards under the Plan and under the Company's 2010 Stock Option and Grant Plan, as amended, and the Company's 2002 Employee, Director and Consultant Stock Plan that are forfeited, canceled, held back upon exercise of an Option or settlement of an Award to cover the exercise price or tax withholding, reacquired by the Company prior to vesting, satisfied without the issuance of Stock or otherwise terminated (other than by exercise) shall be added back to the shares of Stock available for issuance under the Plan. In the event the Company repurchases shares of Stock on the open market, such shares shall not be added to the shares of Stock available for issuance under the Plan. Subject to such overall limitations, shares of Stock may be issued up to such maximum number pursuant to any type or types of Award; provided, however, that Stock Options or Stock Appreciation Rights with respect to no more than nine hundred fifty-five thousand (955,000) shares of Stock may be granted to any one individual grantee during any one calendar year period. The shares available for issuance under the Plan may be authorized but unissued shares of Stock or shares of Stock reacquired by the Company.

(b) [Reserved]

(c) Changes in Stock. Subject to Section 3(d) hereof, if, as a result of any reorganization, recapitalization, reclassification, stock dividend, stock split, reverse stock split or other similar change in the Company's capital stock, the outstanding shares of Stock are increased or decreased or are exchanged for a different number or kind of shares or other securities of the Company, or additional shares or new or different shares or other securities of the Company or other non-cash assets are distributed with respect to such shares of Stock or other securities, or, if, as a result of any merger or consolidation, sale of all or substantially all of the assets of the Company, the outstanding shares of Stock are converted into or exchanged for securities of the Company or any successor entity (or a parent or subsidiary thereof), the Administrator shall make an appropriate or proportionate adjustment in (i) the maximum number of shares reserved for issuance under the Plan, including the maximum number of shares that may be issued in the form of Incentive Stock Options, (ii) the number of Stock Options or Stock Appreciation Rights that can be granted to any one individual grantee and the maximum number of shares that may be granted under a Performance-Based Award, (iii) the number and kind of shares or other securities subject to any then outstanding Awards under the Plan, (iv) the repurchase price, if any, per share subject to each outstanding Restricted Stock Award, and (v) the exercise price for each share subject to any then outstanding Stock Options and Stock Appreciation Rights under the Plan, without changing the aggregate exercise price (i.e., the exercise price multiplied by the number of Stock Options and Stock Appreciation Rights) as to which such Stock Options and Stock Appreciation Rights remain exercisable. The Administrator shall also make equitable or proportionate adjustments in the number of shares subject to outstanding Awards and the exercise price and the terms of outstanding Awards to take into consideration cash dividends paid other than in the ordinary course or any other extraordinary corporate event. The adjustment by the Administrator shall be final, binding and conclusive. No fractional shares of Stock shall be issued under the Plan resulting from any such adjustment, but the Administrator in its discretion may make a cash payment in lieu of fractional shares.

(d) Mergers and Other Transactions. Except as the Administrator may otherwise specify with respect to particular Awards in the relevant Award Certificate, in the case of and subject to the consummation of a Sale Event, the parties thereto may cause the assumption or continuation of Awards theretofore granted by the successor entity, or the substitution of such Awards with new Awards of the successor entity or parent thereof, with appropriate adjustment as to the number and kind of shares and, if appropriate, the per share exercise prices, as such parties shall agree. To the extent the parties to such Sale Event do not provide for the assumption, continuation or substitution of Awards, the Plan and all outstanding Awards hereunder will terminate at the effective time of such Sale Event. Notwithstanding the foregoing, the Administrator may in its discretion, or to the extent specified in the relevant Award Certificate, cause certain Awards to become vested and/or exercisable immediately prior to such Sale Event. In the event of such termination, (i) the Company shall have the option (in its sole discretion) to make or provide for a cash payment to the grantees holding Options and Stock Appreciation Rights, in exchange for the cancellation thereof, in an amount equal to the difference between (A) the Sale Price multiplied by the number of shares of Stock subject to outstanding Options and Stock Appreciation Rights (to the extent then exercisable after taking into account any acceleration thereunder at prices not in excess of the Sale Price) and (B) the aggregate exercise price of all such outstanding Options and Stock Appreciation Rights; or (ii) each grantee shall be permitted, within a specified period of time prior to the consummation of the Sale Event as determined by the Administrator, to exercise all outstanding Options and Stock Appreciation Rights (to the extent then exercisable) held by such grantee, including those that will become exercisable upon the consummation of the Sale Event (provided that such exercise shall be subject to the consummation of the Sale Event).

(e) Substitute Awards. The Administrator may grant Awards under the Plan in substitution for stock and stock based awards held by employees, directors or other key persons of another corporation in connection with the merger or consolidation of the employing corporation with the Company or a Subsidiary or the acquisition by the Company or a Subsidiary of property or stock of the employing corporation. The Administrator may direct that the substitute awards be granted on such terms and conditions as the Administrator considers appropriate in the circumstances. Any substitute Awards granted under the Plan shall not count against the share limitation set forth in Section 3(a).

SECTION 4. ELIGIBILITY

Grantees under the Plan will be such full or part-time officers and other employees, Non-Employee Directors and key persons (including Consultants) of the Company and its Subsidiaries as are selected from time to time by the Administrator in its sole discretion.

SECTION 5. STOCK OPTIONS

Any Stock Option granted under the Plan shall be in such form as the Administrator may from time to time approve.

Stock Options granted under the Plan may be either Incentive Stock Options or Non-Qualified Stock Options. Incentive Stock Options may be granted only to employees of the Company or any Subsidiary that is a "subsidiary corporation" within the meaning of Section 424(f) of the Code. To the extent that any Option does not qualify as an Incentive Stock Option, it shall be deemed a Non-Qualified Stock Option.

Stock Options granted pursuant to this Section 5 shall be subject to the following terms and conditions and shall contain such additional terms and conditions, not inconsistent with the terms of the Plan, as the Administrator shall deem desirable. If the Administrator so determines, Stock Options may be granted in lieu of cash compensation at the optionee's election, subject to such terms and conditions as the Administrator may establish.

(a) Exercise Price. The exercise price per share for the Stock covered by a Stock Option granted pursuant to this Section 5 shall be determined by the Administrator at the time of grant but shall not be less than 100 percent of the Fair Market Value on the date of grant. In the case of an Incentive Stock Option that is granted to a Ten Percent Owner, the option price of such Incentive Stock Option shall be not less than 110 percent of the Fair Market Value on the grant date.

(b) Option Term. The term of each Stock Option shall be fixed by the Administrator, but no Stock Option shall be exercisable more than ten years after the date the Stock Option is granted. In the case of an Incentive Stock Option that is granted to a Ten Percent Owner, the term of such Stock Option shall be no more than five years from the date of grant.

(c) Exercisability; Rights of a Stockholder. Stock Options shall become exercisable at such time or times, whether or not in installments, as shall be determined by the Administrator at or after the grant date. The Administrator may at any time accelerate the exercisability of all or any portion of any Stock Option. An optionee shall have the rights of a stockholder only as to shares acquired upon the exercise of a Stock Option and not as to unexercised Stock Options.

(d) Method of Exercise. Stock Options may be exercised in whole or in part, by giving written or electronic notice of exercise to the Company, specifying the number of shares to be purchased. Payment of the purchase price may be made by one or more of the following methods to the extent provided in the Option Award Certificate:

(i) In cash, by certified or bank check or other instrument acceptable to the Administrator;

(ii) Through the delivery (or attestation to the ownership) of shares of Stock that are not then subject to restrictions under any Company plan. Such surrendered shares shall be valued at Fair Market Value on the exercise date;

(iii) By the optionee delivering to the Company a properly executed exercise notice together with irrevocable instructions to a broker to promptly deliver to the Company cash or a check payable and acceptable to the Company for the purchase price; provided that in the event the optionee chooses to pay the purchase price as so provided, the optionee and the broker shall comply with such procedures and enter into such agreements of indemnity and other agreements as the Administrator shall prescribe as a condition of such payment procedure; or

(iv) With respect to Stock Options that are not Incentive Stock Options, by a "net exercise" arrangement pursuant to which the Company will reduce the number of shares of Stock issuable upon exercise by the largest whole number of shares with a Fair Market Value that does not exceed the aggregate exercise price.

Payment instruments will be received subject to collection. The transfer to the optionee on the records of the Company or of the transfer agent of the shares of Stock to be purchased pursuant to the exercise of a Stock Option will be contingent upon receipt from the optionee (or a purchaser acting in his stead in accordance with the provisions of the Stock Option) by the Company of the full purchase price for such shares and the fulfillment of any other requirements contained in the Option Award Certificate or applicable provisions of laws (including the satisfaction of any withholding taxes that the Company is obligated to withhold with respect to the optionee). In the event an optionee chooses to pay the purchase price by previously-owned shares of Stock through the attestation method, the number of shares of Stock transferred to the optionee upon the exercise of the Stock Option shall be net of the number of attested shares. In the event that the Company establishes, for itself or using the services of a third party, an automated system for the exercise of Stock Options, such as a system using an internet website or interactive voice response, then the paperless exercise of Stock Options may be permitted through the use of such an automated system.

(e) Annual Limit on Incentive Stock Options. To the extent required for "incentive stock option" treatment under Section 422 of the Code, the aggregate Fair Market Value (determined as of the time of grant) of the shares of Stock with respect to which Incentive Stock Options granted under this Plan and any other plan of the Company or its parent and subsidiary corporations become exercisable for the first time by an optionee during any calendar year shall not exceed $100,000. To the extent that any Stock Option exceeds this limit, it shall constitute a Non-Qualified Stock Option.

SECTION 6. STOCK APPRECIATION RIGHTS

(a) Exercise Price of Stock Appreciation Rights. The exercise price of a Stock Appreciation Right shall not be less than 100 percent of the Fair Market Value of the Stock on the date of grant.

(b) Grant and Exercise of Stock Appreciation Rights. Stock Appreciation Rights may be granted by the Administrator independently of any Stock Option granted pursuant to Section 5 of the Plan.

(c) Terms and Conditions of Stock Appreciation Rights. Stock Appreciation Rights shall be subject to such terms and conditions as shall be determined from time to time by the Administrator. The term of a Stock Appreciation Right may not exceed ten years.

SECTION 7. RESTRICTED STOCK AWARDS

(a) Nature of Restricted Stock Awards. The Administrator shall determine the restrictions and conditions applicable to each Restricted Stock Award at the time of grant. Conditions may be based on continuing employment (or other service relationship) and/or achievement of pre-established performance goals and objectives. The terms and conditions of each such Award Certificate shall be determined by the Administrator, and such terms and conditions may differ among individual Awards and grantees.

(b) Rights as a Stockholder. Upon the grant of the Restricted Stock Award and payment of any applicable purchase price, a grantee shall have the rights of a stockholder with respect to the voting of the Restricted Stock and receipt of dividends; provided that if the lapse of restrictions with respect to the Restricted Stock Award is tied to the attainment of performance goals, any dividends paid by the Company during the performance period shall accrue and shall not be paid to the grantee until and to the extent the performance goals are met with respect to the Restricted Stock Award. Unless the Administrator shall otherwise determine, (i) uncertificated Restricted Stock shall be accompanied by a notation on the records of the Company or the transfer agent to the effect that they are subject to forfeiture until such Restricted Stock are vested as provided in Section 7(d) below, and (ii) certificated Restricted Stock shall remain in the possession of the Company until such Restricted Stock is vested as provided in Section 7(d) below, and the grantee shall be required, as a condition of the grant, to deliver to the Company such instruments of transfer as the Administrator may prescribe.

(c) Restrictions. Restricted Stock may not be sold, assigned, transferred, pledged or otherwise encumbered or disposed of except as specifically provided herein or in the Restricted Stock Award Certificate. Except as may otherwise be provided by the Administrator either in the Award Certificate or, subject to Section 18 below, in writing after the Award is issued, if a grantee's employment (or other service relationship) with the Company and its Subsidiaries terminates for any reason, any Restricted Stock that has not vested at the time of termination shall automatically and without any requirement of notice to such grantee from or other action by or on behalf of, the Company be deemed to have been reacquired by the Company at its original

purchase price (if any) from such grantee or such grantee's legal representative simultaneously with such termination of employment (or other service relationship), and thereafter shall cease to represent any ownership of the Company by the grantee or rights of the grantee as a stockholder. Following such deemed reacquisition of unvested Restricted Stock that are represented by physical certificates, a grantee shall surrender such certificates to the Company upon request without consideration.

(d) Vesting of Restricted Stock. The Administrator at the time of grant shall specify the date or dates and/or the attainment of pre-established performance goals, objectives and other conditions on which the non-transferability of the Restricted Stock and the Company's right of repurchase or forfeiture shall lapse. Subsequent to such date or dates and/or the attainment of such pre-established performance goals, objectives and other conditions, the shares on which all restrictions have lapsed shall no longer be Restricted Stock and shall be deemed "vested." Except as may otherwise be provided by the Administrator either in the Award Certificate or, subject to Section 18 below, in writing after the Award is issued, a grantee's rights in any shares of Restricted Stock that have not vested shall automatically terminate upon the grantee's termination of employment (or other service relationship) with the Company and its Subsidiaries and such shares shall be subject to the provisions of Section 7(c) above.

SECTION 8. RESTRICTED STOCK UNITS

(a) Nature of Restricted Stock Units. The Administrator shall determine the restrictions and conditions applicable to each Restricted Stock Unit at the time of grant. Conditions may be based on continuing employment (or other service relationship) and/or achievement of pre-established performance goals and objectives. The terms and conditions of such Award Certificate shall be determined by the Administrator, and such terms and conditions may differ among individual Awards and grantees. At the end of the deferral period, the Restricted Stock Units, to the extent vested, shall be settled in the form of shares of Stock. To the extent that an award of Restricted Stock Units is subject to Section 409A, it may contain such additional terms and conditions as the Administrator shall determine in its sole discretion in order for such Award to comply with the requirements of Section 409A.

(b) Election to Receive Restricted Stock Units in Lieu of Compensation. The Administrator may, in its sole discretion, permit a grantee to elect to receive a portion of future cash compensation otherwise due to such grantee in the form of an award of Restricted Stock Units. Any such election shall be made in writing and shall be delivered to the Company no later than the date specified by the Administrator and in accordance with Section 409A and such other rules and procedures established by the Administrator. Any such future cash compensation that the grantee elects to defer shall be converted to a fixed number of Restricted Stock Units based on the Fair Market Value of Stock on the date the compensation would otherwise have been paid to the grantee if such payment had not been deferred as provided herein. The Administrator shall have the sole right to determine whether and under what circumstances to permit such elections and to impose such limitations and other terms and conditions thereon as the Administrator deems appropriate. Any Restricted Stock Units that are elected to be received in lieu of cash compensation shall be fully vested, unless otherwise provided in the Award Certificate.

(c) Rights as a Stockholder. A grantee shall have the rights as a stockholder only as to shares of Stock acquired by the grantee upon settlement of Restricted Stock Units; provided, however, that the grantee may be credited with Dividend Equivalent Rights with respect to the phantom stock units underlying his Restricted Stock Units, subject to such terms and conditions as the Administrator may determine.

(d) Termination. Except as may otherwise be provided by the Administrator either in the Award Certificate or, subject to Section 18 below, in writing after the Award is issued, a grantee's right in all Restricted Stock Units that have not vested shall automatically terminate upon the grantee's termination of employment (or cessation of service relationship) with the Company and its Subsidiaries for any reason.

SECTION 9. UNRESTRICTED STOCK AWARDS

Grant or Sale of Unrestricted Stock. The Administrator may, in its sole discretion, grant (or sell at par value or such higher purchase price determined by the Administrator) an Unrestricted Stock Award under the Plan. Unrestricted Stock Awards may be granted in respect of past services or other valid consideration, or in lieu of cash compensation due to such grantee.

SECTION 10. CASH-BASED AWARDS

Grant of Cash-Based Awards. The Administrator may, in its sole discretion, grant Cash-Based Awards to any grantee in such number or amount and upon such terms, and subject to such conditions, as the Administrator shall determine at the time of grant. The Administrator shall determine the maximum duration of the Cash-Based Award, the amount of cash to which the Cash-Based Award pertains, the conditions upon which the Cash-Based Award shall become vested or payable, and such other provisions as the Administrator shall determine. Each Cash-Based Award shall specify a cash-denominated payment amount, formula or payment ranges as determined by the Administrator. Payment, if any, with respect to a Cash-Based Award shall be made in accordance with the terms of the Award and may be made in cash or in shares of Stock, as the Administrator determines.

SECTION 11. PERFORMANCE SHARE AWARDS

(a) Nature of Performance Share Awards. The Administrator may, in its sole discretion, grant Performance Share Awards independent of, or in connection with, the granting of any other Award under the Plan. The Administrator shall determine whether and to whom Performance Share Awards shall be granted, the Performance Goals, the periods during which performance is to be measured, which may not be less than one year except in the case of a Sale Event, and such other limitations and conditions as the Administrator shall determine.

(b) Rights as a Stockholder. A grantee receiving a Performance Share Award shall have the rights of a stockholder only as to shares actually received by the grantee under the Plan and not with respect to shares subject to the Award but not actually received by the grantee. A grantee shall be entitled to receive shares of Stock under a Performance Share Award only upon satisfaction of all conditions specified in the Performance Share Award Certificate (or in a performance plan adopted by the Administrator).

(c) Termination. Except as may otherwise be provided by the Administrator either in the Award agreement or, subject to Section 18 below, in writing after the Award is issued, a grantee's rights in all Performance Share Awards shall automatically terminate upon the grantee's termination of employment (or cessation of service relationship) with the Company and its Subsidiaries for any reason.

SECTION 12. PERFORMANCE-BASED AWARDS TO COVERED EMPLOYEES

(a) Performance-Based Awards. Any employee or other key person providing services to the Company and who is selected by the Administrator may be granted one or more Performance-Based Awards in the form of a Restricted Stock Award, Restricted Stock Units, Performance Share Awards or Cash-Based Award payable upon the attainment of Performance Goals that are established by the Administrator and relate to one or more of the Performance Criteria, in each case on a specified date or dates or over any period or periods determined by the Administrator. The Administrator shall define in an objective fashion the manner of calculating the Performance Criteria it selects to use for any Performance Cycle. Depending on the Performance Criteria used to establish such Performance Goals, the Performance Goals may be expressed in terms of overall Company performance or the performance of a division, business unit, or an individual. The Administrator, in its discretion, may adjust or modify the calculation of Performance Goals for such Performance Cycle in order to prevent the dilution or enlargement of the rights of an individual (i) in the event of, or in anticipation of, any unusual or extraordinary corporate item, transaction, event or development, (ii) in recognition of, or in anticipation of, any other unusual or nonrecurring events affecting the Company, or the financial statements of the Company, or (iii) in response to, or in anticipation of, changes in applicable laws, regulations, accounting principles, or business conditions; provided, however, that the Administrator may not exercise such discretion in a manner that would increase the Performance-Based Award granted to a Covered Employee. Each Performance-Based Award shall comply with the provisions set forth below.

(b) Grant of Performance-Based Awards. With respect to each Performance-Based Award granted to a Covered Employee (or any other eligible individual that the Administrator determines is reasonably likely to become a Covered Employee), the Administrator shall select, within the first 90 days of a Performance Cycle (or, if shorter, within the maximum period allowed under Section 162(m) of the Code) the Performance Criteria for such grant, and the Performance Goals with respect to each Performance Criterion (including a threshold level of performance below which no amount will become payable with respect to such Award). Each Performance-Based Award will specify the amount payable, or the formula for determining the amount payable, upon achievement of the various applicable performance targets. The Performance Criteria established by the Administrator may be (but need not be) different for each Performance Cycle and different Performance Goals may be applicable to Performance-Based Awards to different Covered Employees.

(c) Payment of Performance-Based Awards. Following the completion of a Performance Cycle, the Administrator shall meet to review and certify in writing whether, and to what extent, the Performance Goals for the Performance Cycle have been achieved and, if so, to also calculate and certify in writing the amount of the Performance-Based Awards earned for the Performance Cycle. The Administrator shall then determine the actual size of each Covered

Employee's Performance-Based Award, and, in doing so, may reduce or eliminate the amount of the Performance-Based Award for a Covered Employee if, in its sole judgment, such reduction or elimination is appropriate.

(d) Maximum Award Payable. The maximum Performance-Based Award payable to any one Covered Employee under the Plan for a Performance Cycle is nine hundred fifty-five thousand (955,000) shares of Stock (subject to adjustment as provided in Section 3(c) hereof) or two million dollars ($2,000,000) in the case of a Performance-Based Award that is a Cash-Based Award.

SECTION 13. DIVIDEND EQUIVALENT RIGHTS

(a) Dividend Equivalent Rights. A Dividend Equivalent Right may be granted hereunder to any grantee as a component of an award of Restricted Stock Units, Restricted Stock Award or Performance Share Award or as a freestanding award. The terms and conditions of Dividend Equivalent Rights shall be specified in the Award Certificate. Dividend equivalents credited to the holder of a Dividend Equivalent Right may be paid currently or may be deemed to be reinvested in additional shares of Stock, which may thereafter accrue additional equivalents. Any such reinvestment shall be at Fair Market Value on the date of reinvestment or such other price as may then apply under a dividend reinvestment plan sponsored by the Company, if any. Dividend Equivalent Rights may be settled in cash or shares of Stock or a combination thereof, in a single installment or installments. A Dividend Equivalent Right granted as a component of an award of Restricted Stock Units or Restricted Stock Award with performance vesting or Performance Share Award shall provide that such Dividend Equivalent Right shall be settled only upon settlement or payment of, or lapse of restrictions on, such other Award, and that such Dividend Equivalent Right shall expire or be forfeited or annulled under the same conditions as such other Award.

(b) Interest Equivalents. Any Award under this Plan that is settled in whole or in part in cash on a deferred basis may provide in the grant for interest equivalents to be credited with respect to such cash payment. Interest equivalents may be compounded and shall be paid upon such terms and conditions as may be specified by the grant.

(c) Termination. Except as may otherwise be provided by the Administrator either in the Award Certificate or, subject to Section 18 below, in writing after the Award is issued, a grantee's rights in all Dividend Equivalent Rights or interest equivalents granted as a component of an award of Restricted Stock Units, Restricted Stock Award or Performance Share Award that has not vested shall automatically terminate upon the grantee's termination of employment (or cessation of service relationship) with the Company and its Subsidiaries for any reason.

SECTION 14. TRANSFERABILITY OF AWARDS

(a) Transferability. Except as provided in Section 14(b) below, during a grantee's lifetime, his or her Awards shall be exercisable only by the grantee, or by the grantee's legal representative or guardian in the event of the grantee's incapacity. No Awards shall be sold, assigned, transferred or otherwise encumbered or disposed of by a grantee other than by will or by the laws of descent and distribution or pursuant to a domestic relations order. No Awards shall be subject, in whole or in part, to attachment, execution, or levy of any kind, and any purported transfer in violation hereof shall be null and void.

(b) Administrator Action. Notwithstanding Section 14(a), the Administrator, in its discretion, may provide either in the Award Certificate regarding a given Award or by subsequent written approval that the grantee (who is an employee or director) may transfer his or her Non-Qualified Options to his or her immediate family members, to trusts for the benefit of such family members, or to partnerships in which such family members are the only partners, provided that the transferee agrees in writing with the Company to be bound by all of the terms and conditions of this Plan and the applicable Award. In no event may an Award be transferred by a grantee for value.

(c) Family Member. For purposes of Section 14(b), "family member" shall mean a grantee's child, stepchild, grandchild, parent, stepparent, grandparent, spouse, former spouse, sibling, niece, nephew, mother-in-law, father-in-law, son-in-law, daughter-in-law, brother-in-law, or sister-in-law, including adoptive relationships, any person sharing the grantee's household (other than a tenant of the grantee), a trust in which these persons (or the grantee) have more than 50 percent of the beneficial interest, a foundation in which these persons (or the grantee) control the management of assets, and any other entity in which these persons (or the grantee) own more than 50 percent of the voting interests.

(d) Designation of Beneficiary. Each grantee to whom an Award has been made under the Plan may designate a beneficiary or beneficiaries to exercise any Award or receive any payment under any Award payable on or after the grantee's death. Any such designation shall be on a form provided for that purpose by the Administrator and shall not be effective until received by the Administrator. If no beneficiary has been designated by a deceased grantee, or if the designated beneficiaries have predeceased the grantee, the beneficiary shall be the grantee's estate.

SECTION 15. TAX WITHHOLDING

(a) Payment by Grantee. Each grantee shall, no later than the date as of which the value of an Award or of any Stock or other amounts received thereunder first becomes includable in the gross income of the grantee for Federal income tax purposes, pay to the Company, or make arrangements satisfactory to the Administrator regarding payment of, any Federal, state, or local taxes of any kind required by law to be withheld by the Company with respect to such income. The Company and its Subsidiaries shall, to the extent permitted by law, have the right to deduct any such taxes from any payment of any kind otherwise due to the grantee. The Company's obligation to deliver evidence of book entry (or stock certificates) to any grantee is subject to and conditioned on tax withholding obligations being satisfied by the grantee.

(b) Payment in Stock. Subject to approval by the Administrator, the Company's minimum required tax withholding obligation may be satisfied, in whole or in part, by the Company withholding from shares of Stock to be issued pursuant to any Award a number of shares with an aggregate Fair Market Value (as of the date the withholding is effected) that would satisfy the withholding amount due.

SECTION 16. SECTION 409A AWARDS

To the extent that any Award is determined to constitute "nonqualified deferred compensation" within the meaning of Section 409A (a "409A Award"), the Award shall be subject to such additional rules and requirements as specified by the Administrator from time to time in order to comply with Section 409A. In this regard, if any amount under a 409A Award is payable upon a "separation from service" (within the meaning of Section 409A) to a grantee who is then considered a "specified employee" (within the meaning of Section 409A), then no such payment shall be made prior to the date that is the earlier of (i) six months and one day after the grantee's separation from service, or (ii) the grantee's death, but only to the extent such delay is necessary to prevent such payment from being subject to interest, penalties and/or additional tax imposed pursuant to Section 409A. Further, the settlement of any such Award may not be accelerated except to the extent permitted by Section 409A.

SECTION 17. TRANSFER, LEAVE OF ABSENCE, ETC.

For purposes of the Plan, the following events shall not be deemed a termination of employment:

(a) a transfer to the employment of the Company from a Subsidiary or from the Company to a Subsidiary, or from one Subsidiary to another; or

(b) an approved leave of absence for military service or sickness, or for any other purpose approved by the Company, if the employee's right to re-employment is guaranteed either by a statute or by contract or under the policy pursuant to which the leave of absence was granted or if the Administrator otherwise so provides in writing.

SECTION 18. AMENDMENTS AND TERMINATION

The Board may, at any time, amend or discontinue the Plan and the Administrator may, at any time, amend or cancel any outstanding Award for the purpose of satisfying changes in law or for any other lawful purpose, but no such action shall adversely affect rights under any outstanding Award without the holder's consent. Except as provided in Section 3(c) or 3(d), without prior stockholder approval, in no event may the Administrator exercise its discretion to reduce the exercise price of outstanding Stock Options or Stock Appreciation Rights or effect repricing through cancellation and re-grants or cancellation of Stock Options or Stock Appreciation Rights in exchange for cash. To the extent required under the rules of any securities exchange or market system on which the Stock is listed, to the extent determined by the Administrator to be required by the Code to ensure that Incentive Stock Options granted under the Plan are qualified under Section 422 of the Code, or to ensure that compensation earned under Awards qualifies as performance-based compensation under Section 162(m) of the Code, Plan amendments shall be subject to approval by the Company stockholders entitled to vote at a meeting of stockholders. Nothing in this Section 18 shall limit the Administrator's authority to take any action permitted pursuant to Section 3(c) or 3(d).

SECTION 19. STATUS OF PLAN

With respect to the portion of any Award that has not been exercised and any payments in cash, Stock or other consideration not received by a grantee, a grantee shall have no rights greater than those of a general creditor of the Company unless the Administrator shall otherwise expressly determine in connection with any Award or Awards. In its sole discretion, the Administrator may authorize the creation of trusts or other arrangements to meet the Company's obligations to deliver Stock or make payments with respect to Awards hereunder, provided that the existence of such trusts or other arrangements is consistent with the foregoing sentence.

SECTION 20. GENERAL PROVISIONS

(a) No Distribution. The Administrator may require each person acquiring Stock pursuant to an Award to represent to and agree with the Company in writing that such person is acquiring the shares without a view to distribution thereof.

(b) Delivery of Stock Certificates. Stock certificates to grantees under this Plan shall be deemed delivered for all purposes when the Company or a stock transfer agent of the Company shall have mailed such certificates in the United States mail, addressed to the grantee, at the grantee's last known address on file with the Company. Uncertificated Stock shall be deemed delivered for all purposes when the Company or a Stock transfer agent of the Company shall have given to the grantee by electronic mail (with proof of receipt) or by United States mail, addressed to the grantee, at the grantee's last known address on file with the Company, notice of issuance and recorded the issuance in its records (which may include electronic "book entry" records). Notwithstanding anything herein to the contrary, the Company shall not be required to issue or deliver any certificates evidencing shares of Stock pursuant to the exercise of any Award, unless and until the Administrator has determined, with advice of counsel (to the extent the Administrator deems such advice necessary or advisable), that the issuance and delivery of such certificates is in compliance with all applicable laws, regulations of governmental authorities and, if applicable, the requirements of any exchange on which the shares of Stock are listed, quoted or traded. All Stock certificates delivered pursuant to the Plan shall be subject to any stop-transfer orders and other restrictions as the Administrator deems necessary or advisable to comply with federal, state or foreign jurisdiction, securities or other laws, rules and quotation system on which the Stock is listed, quoted or traded. The Administrator may place legends on any Stock certificate to reference restrictions applicable to the Stock. In addition to the terms and conditions provided herein, the Administrator may require that an individual make such reasonable covenants, agreements, and representations as the Administrator, in its discretion, deems necessary or advisable in order to comply with any such laws, regulations, or requirements. The Administrator shall have the right to require any individual to comply with any timing or other restrictions with respect to the settlement or exercise of any Award, including a window-period limitation, as may be imposed in the discretion of the Administrator.

(c) Stockholder Rights. Until Stock is deemed delivered in accordance with Section 20(b), no right to vote or receive dividends or any other rights of a stockholder will exist with respect to shares of Stock to be issued in connection with an Award, notwithstanding the exercise of a Stock Option or any other action by the grantee with respect to an Award.

(d) Other Compensation Arrangements; No Employment Rights . Nothing contained in this Plan shall prevent the Board from adopting other or additional compensation arrangements, including trusts, and such arrangements may be either generally applicable or applicable only in specific cases. The adoption of this Plan and the grant of Awards do not confer upon any employee any right to continued employment with the Company or any Subsidiary.

(e) Trading Policy Restrictions. Option exercises and other Awards under the Plan shall be subject to the Company's insider trading policies and procedures, as in effect from time to time.

(f) Forfeiture of Awards. If the Company is required to prepare an accounting restatement due to the material noncompliance of the Company, as a result of misconduct, with any financial reporting requirement under the securities laws, then any grantee who is one of the individuals subject to automatic forfeiture under Section 304 of the Sarbanes-Oxley Act of 2002 shall reimburse the Company for the amount of any Award received by such individual under the Plan during the 12-month period following the first public issuance or filing with the United States Securities and Exchange Commission, as the case may be, of the financial document embodying such financial reporting requirement. The Administrator shall also have the authority to cause the forfeiture of Awards to the extent required under other applicable Federal law.

SECTION 21. EFFECTIVE DATE OF PLAN

This Plan shall become effective immediately prior to the Company's Initial Public Offering, following stockholder approval of the Plan in accordance with applicable state law, the Company's bylaws and articles of incorporation, and applicable stock exchange rules or pursuant to written consent. No grants of Stock Options and other Awards may be made hereunder after the tenth anniversary of the Effective Date and no grants of Incentive Stock Options may be made hereunder after the tenth anniversary of the date the Plan is approved by the Board.

SECTION 22. GOVERNING LAW

This Plan and all Awards and actions taken thereunder shall be governed by, and construed in accordance with, the laws of the State of Delaware, applied without regard to conflict of law principles.

DATE APPROVED BY BOARD OF DIRECTORS: June 3, 2013

DATE APPROVED BY STOCKHOLDERS: June 3, 2013

INCENTIVE STOCK OPTION AGREEMENT
UNDER THE BLUEBIRD BIO, INC.
2013 STOCK OPTION AND INCENTIVE PLAN

Name of Optionee: _____

No. of Option Shares: _____

Option Exercise Price per Share: $_____
[FMV on Grant Date (110% of FMV if a 10% owner)]

Grant Date: _____

Expiration Date: _____
[up to 10 years (5 if a 10% owner)]

Pursuant to the bluebird bio, Inc. 2013 Stock Option and Incentive Plan as amended through the date hereof (the "Plan"), bluebird bio, Inc. (the "Company") hereby grants to the Optionee named above an option (the "Stock Option") to purchase on or prior to the Expiration Date specified above all or part of the number of shares of Common Stock, par value $0.01 per share (the "Stock"), of the Company specified above at the Option Exercise Price per Share specified above subject to the terms and conditions set forth herein and in the Plan.

1. Exercisability Schedule. No portion of this Stock Option may be exercised until such portion shall have become exercisable. Except as set forth below, and subject to the discretion of the Administrator (as defined in Section 2 of the Plan) to accelerate the exercisability schedule hereunder, this Stock Option shall be exercisable with respect to the following number of Option Shares on the dates indicated so long as the Optionee remains an employee of the Company or a Subsidiary on such dates:

Incremental Number of Option Shares Exercisable*	Exercisability Date
_____ (____%)	_____
_____ (____%)	_____
_____ (____%)	_____
_____ (____%)	_____
_____ (____%)	_____

* Max. of $100,000 per yr.

Once exercisable, this Stock Option shall continue to be exercisable at any time or times prior to the close of business on the Expiration Date, subject to the provisions hereof and of the Plan.

2. Manner of Exercise.

(a) The Optionee may exercise this Stock Option only in the following manner: from time to time on or prior to the Expiration Date of this Stock Option, the Optionee may give written notice to the Administrator of his or her election to purchase some or all of the Option Shares purchasable at the time of such notice. This notice shall specify the number of Option Shares to be purchased.

Payment of the purchase price for the Option Shares may be made by one or more of the following methods: (i) in cash, by certified or bank check or other instrument acceptable to the Administrator; (ii) through the delivery (or attestation to the ownership) of shares of Stock that have been purchased by the Optionee on the open market or that are beneficially owned by the Optionee and are not then subject to any restrictions under any Company plan and that otherwise satisfy any holding periods as may be required by the Administrator; or (iii) by the Optionee delivering to the Company a properly executed exercise notice together with irrevocable instructions to a broker to promptly deliver to the Company cash or a check payable and acceptable to the Company to pay the option purchase price, provided that in the event the Optionee chooses to pay the option purchase price as so provided, the Optionee and the broker shall comply with such procedures and enter into such agreements of indemnity and other agreements as the Administrator shall prescribe as a condition of such payment procedure; or (iv) a combination of (i), (ii) and (iii) above. Payment instruments will be received subject to collection.

The transfer to the Optionee on the records of the Company or of the transfer agent of the Option Shares will be contingent upon (i) the Company's receipt from the Optionee of the full purchase price for the Option Shares, as set forth above, (ii) the fulfillment of any other requirements contained herein or in the Plan or in any other agreement or provision of laws, and (iii) the receipt by the Company of any agreement, statement or other evidence that the Company may require to satisfy itself that the issuance of Stock to be purchased pursuant to the exercise of Stock Options under the Plan and any subsequent resale of the shares of Stock will be in compliance with applicable laws and regulations. In the event the Optionee chooses to pay the purchase price by previously-owned shares of Stock through the attestation method, the number of shares of Stock transferred to the Optionee upon the exercise of the Stock Option shall be net of the Shares attested to.

(b) The shares of Stock purchased upon exercise of this Stock Option shall be transferred to the Optionee on the records of the Company or of the transfer agent upon compliance to the satisfaction of the Administrator with all requirements under applicable laws or regulations in connection with such transfer and with the requirements hereof and of the Plan. The determination of the Administrator as to such compliance shall be final and binding on the Optionee. The Optionee shall not be deemed to be the holder of, or to have any of the rights of a holder with respect to, any shares of Stock subject to this Stock Option unless and until this Stock Option shall have been exercised pursuant to the terms hereof, the Company or the transfer agent shall have transferred the shares to the Optionee, and the Optionee's name shall have been entered as the stockholder of record on the books of the Company. Thereupon, the Optionee shall have full voting, dividend and other ownership rights with respect to such shares of Stock.

(c) The minimum number of shares with respect to which this Stock Option may be exercised at any one time shall be 100 shares, unless the number of shares with respect to which this Stock Option is being exercised is the total number of shares subject to exercise under this Stock Option at the time.

(d) Notwithstanding any other provision hereof or of the Plan, no portion of this Stock Option shall be exercisable after the Expiration Date hereof.

3. Termination of Employment. If the Optionee's employment by the Company or a Subsidiary (as defined in the Plan) is terminated, the period within which to exercise the Stock Option may be subject to earlier termination as set forth below.

(a) Termination Due to Death. If the Optionee's employment terminates by reason of the Optionee's death, any portion of this Stock Option outstanding on such date, to the extent exercisable on the date of death, may thereafter be exercised by the Optionee's legal representative or legatee for a period of 12 months from the date of death or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date of death shall terminate immediately and be of no further force or effect.

(b) Termination Due to Disability. If the Optionee's employment terminates by reason of the Optionee's disability (as determined by the Administrator), any portion of this Stock Option outstanding on such date, to the extent exercisable on the date of such disability, may thereafter be exercised by the Optionee for a period of 12 months from the date of disability or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date of disability shall terminate immediately and be of no further force or effect.

(c) Termination for Cause. If the Optionee's employment terminates for Cause, any portion of this Stock Option outstanding on such date shall terminate immediately and be of no further force and effect. For purposes hereof, "Cause" shall mean, unless otherwise provided in an employment agreement between the Company and the Optionee, a determination by the Administrator that the Optionee shall be dismissed as a result of (i) the Optionee's dishonest statements or acts with respect to the Company or any affiliate of the Company, or any of the Company's current or prospective customers, suppliers vendors or other third parties with which such entity does business; (ii) the Optionee's commission of (A) a felony or (B) any misdemeanor involving moral turpitude, deceit, dishonesty or fraud; (iii) the Optionee's failure to perform his assigned duties and responsibilities to the reasonable satisfaction of the Company which failure continues, in the reasonable judgment of the Company, after written notice given to the grantee by the Company; (iv) the Optionee's gross negligence, willful misconduct or insubordination with respect to the Company or any affiliate of the Company; or (v) the Optionee's violation of any provision of any agreement(s) between the Optionee and the Company relating to noncompetition, nondisclosure and/or assignment of inventions.

(d) Other Termination. If the Optionee's employment terminates for any reason other than the Optionee's death, the Optionee's disability, or Cause, and unless otherwise determined by the Administrator, any portion of this Stock Option outstanding on such date may be exercised, to the extent exercisable on the date of termination, for a period of three months from the date of termination or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date of termination shall terminate immediately and be of no further force or effect.

The Administrator's determination of the reason for termination of the Optionee's employment shall be conclusive and binding on the Optionee and his or her representatives or legatees.

4. Incorporation of Plan. Notwithstanding anything herein to the contrary, this Stock Option shall be subject to and governed by all the terms and conditions of the Plan, including the powers of the Administrator set forth in Section 2(b) of the Plan. Capitalized terms in this Agreement shall have the meaning specified in the Plan, unless a different meaning is specified herein.

5. Transferability. This Agreement is personal to the Optionee, is non-assignable and is not transferable in any manner, by operation of law or otherwise, other than by will or the laws of descent and distribution. This Stock Option is exercisable, during the Optionee's lifetime, only by the Optionee, and thereafter, only by the Optionee's legal representative or legatee.

6. Status of the Stock Option. This Stock Option is intended to qualify as an "incentive stock option" under Section 422 of the Internal Revenue Code of 1986, as amended (the "Code"), but the Company does not represent or warrant that this Stock Option qualifies as such. The Optionee should consult with his or her own tax advisors regarding the tax effects of this Stock Option and the requirements necessary to obtain favorable income tax treatment under Section 422 of the Code, including, but not limited to, holding period requirements. To the extent any portion of this Stock Option does not so qualify as an "incentive stock option," such portion shall be deemed to be a non-qualified stock option. If the Optionee intends to dispose or does dispose (whether by sale, gift, transfer or otherwise) of any Option Shares within the one-year period beginning on the date after the transfer of such shares to him or her, or within the two-year period beginning on the day after the grant of this Stock Option, he or she will so notify the Company within 30 days after such disposition.

7. Tax Withholding. The Optionee shall, not later than the date as of which the exercise of this Stock Option becomes a taxable event for Federal income tax purposes, pay to the Company or make arrangements satisfactory to the Administrator for payment of any Federal, state, and local taxes required by law to be withheld on account of such taxable event. The Company shall have the authority to cause the minimum required tax withholding obligation to be satisfied, in whole or in part, by withholding from shares of Stock to be issued to the Optionee a number of shares of Stock with an aggregate Fair Market Value that would satisfy the minimum withholding amount due.

8. No Obligation to Continue Employment. Neither the Company nor any Subsidiary is obligated by or as a result of the Plan or this Agreement to continue the Optionee in employment and neither the Plan nor this Agreement shall interfere in any way with the right of the Company or any Subsidiary to terminate the employment of the Optionee at any time.

9. Integration. This Agreement constitutes the entire agreement between the parties with respect to this Stock Option and supersedes all prior agreements and discussions between the parties concerning such subject matter.

10. Data Privacy Consent. In order to administer the Plan and this Agreement and to implement or structure future equity grants, the Company, its subsidiaries and affiliates and certain agents thereof (together, the "Relevant Companies") may process any and all personal or professional data, including but not limited to Social Security or other identification number, home address and telephone number, date of birth and other information that is necessary or desirable for the administration of the Plan and/or this Agreement (the "Relevant Information"). By entering into this Agreement, the Grantee (i) authorizes the Company to collect, process, register and transfer to the Relevant Companies all Relevant Information; (ii) waives any privacy rights the Grantee may have with respect to the Relevant Information; (iii) authorizes the Relevant Companies to store and transmit such information in electronic form; and (iv) authorizes the transfer of the Relevant Information to any jurisdiction in which the Relevant Companies consider appropriate. The Grantee shall have access to, and the right to change, the Relevant Information. Relevant Information will only be used in accordance with applicable law.

11. Notices. Notices hereunder shall be mailed or delivered to the Company at its principal place of business and shall be mailed or delivered to the Optionee at the address on file with the Company or, in either case, at such other address as one party may subsequently furnish to the other party in writing.

BLUEBIRD BIO, INC.

By: _____

Title:

The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned. Electronic acceptance of this Agreement pursuant to the Company's instructions to the Grantee (including through an online acceptance process) is acceptable.

Dated: _____

_____

Optionee's Signature

Optionee's name and address:

_____

_____

_____

NON-QUALIFIED STOCK OPTION AGREEMENT
FOR COMPANY EMPLOYEES
UNDER BLUEBIRD BIO, INC.
2013 STOCK OPTION AND INCENTIVE PLAN

Name of Optionee: _____

No. of Option Shares: _____

Option Exercise Price per Share: $_____
[FMV on Grant Date]

Grant Date: _____

Expiration Date: _____

Pursuant to the bluebird bio, Inc. 2013 Stock Option and Incentive Plan as amended through the date hereof (the "Plan"), bluebird bio, Inc. (the "Company") hereby grants to the Optionee named above an option (the "Stock Option") to purchase on or prior to the Expiration Date specified above all or part of the number of shares of Common Stock, par value $0.01 per share (the "Stock") of the Company specified above at the Option Exercise Price per Share specified above subject to the terms and conditions set forth herein and in the Plan. This Stock Option is not intended to be an "incentive stock option" under Section 422 of the Internal Revenue Code of 1986, as amended.

1. Exercisability Schedule. No portion of this Stock Option may be exercised until such portion shall have become exercisable. Except as set forth below, and subject to the discretion of the Administrator (as defined in Section 2 of the Plan) to accelerate the exercisability schedule hereunder, this Stock Option shall be exercisable with respect to the following number of Option Shares on the dates indicated so long as Optionee remains an employee of the Company or a Subsidiary on such dates:

Incremental Number of Option Shares Exercisable	Exercisability Date
_____ (____%)	_____
_____ (____%)	_____
_____ (____%)	_____
_____ (____%)	_____
_____ (____%)	_____

Once exercisable, this Stock Option shall continue to be exercisable at any time or times prior to the close of business on the Expiration Date, subject to the provisions hereof and of the Plan.

2. Manner of Exercise.

(a) The Optionee may exercise this Stock Option only in the following manner: from time to time on or prior to the Expiration Date of this Stock Option, the Optionee may give written notice to the Administrator of his or her election to purchase some or all of the Option Shares purchasable at the time of such notice. This notice shall specify the number of Option Shares to be purchased.

Payment of the purchase price for the Option Shares may be made by one or more of the following methods: (i) in cash, by certified or bank check or other instrument acceptable to the Administrator; (ii) through the delivery (or attestation to the ownership) of shares of Stock that have been purchased by the Optionee on the open market or that are beneficially owned by the Optionee and are not then subject to any restrictions under any Company plan and that otherwise satisfy any holding periods as may be required by the Administrator; (iii) by the Optionee delivering to the Company a properly executed exercise notice together with irrevocable instructions to a broker to promptly deliver to the Company cash or a check payable and acceptable to the Company to pay the option purchase price, provided that in the event the Optionee chooses to pay the option purchase price as so provided, the Optionee and the broker shall comply with such procedures and enter into such agreements of indemnity and other agreements as the Administrator shall prescribe as a condition of such payment procedure; (iv) by a "net exercise" arrangement pursuant to which the Company will reduce the number of shares of Stock issuable upon exercise by the largest whole number of shares with a Fair Market Value that does not exceed the aggregate exercise price; or (v) a combination of (i), (ii), (iii) and (iv) above. Payment instruments will be received subject to collection.

The transfer to the Optionee on the records of the Company or of the transfer agent of the Option Shares will be contingent upon (i) the Company's receipt from the Optionee of the full purchase price for the Option Shares, as set forth above, (ii) the fulfillment of any other requirements contained herein or in the Plan or in any other agreement or provision of laws, and (iii) the receipt by the Company of any agreement, statement or other evidence that the Company may require to satisfy itself that the issuance of Stock to be purchased pursuant to the exercise of Stock Options under the Plan and any subsequent resale of the shares of Stock will be in compliance with applicable laws and regulations. In the event the Optionee chooses to pay the purchase price by previously-owned shares of Stock through the attestation method, the number of shares of Stock transferred to the Optionee upon the exercise of the Stock Option shall be net of the Shares attested to.

(b) The shares of Stock purchased upon exercise of this Stock Option shall be transferred to the Optionee on the records of the Company or of the transfer agent upon compliance to the satisfaction of the Administrator with all requirements under applicable laws or regulations in connection with such transfer and with the requirements hereof and of the Plan. The determination of the Administrator as to such compliance shall be final and binding on the Optionee. The Optionee shall not be deemed to be the holder of, or to have any of the rights of a holder with respect to, any shares of Stock subject to this Stock Option unless and until this Stock Option shall have been exercised pursuant to the terms hereof, the Company or the transfer agent shall have transferred the shares to the Optionee, and the Optionee's name shall have been entered as the stockholder of record on the books of the Company. Thereupon, the Optionee shall have full voting, dividend and other ownership rights with respect to such shares of Stock.

(c) The minimum number of shares with respect to which this Stock Option may be exercised at any one time shall be 100 shares, unless the number of shares with respect to which this Stock Option is being exercised is the total number of shares subject to exercise under this Stock Option at the time.

(d) Notwithstanding any other provision hereof or of the Plan, no portion of this Stock Option shall be exercisable after the Expiration Date hereof.

3. Termination of Employment. If the Optionee's employment by the Company or a Subsidiary (as defined in the Plan) is terminated, the period within which to exercise the Stock Option may be subject to earlier termination as set forth below.

(a) Termination Due to Death. If the Optionee's employment terminates by reason of the Optionee's death, any portion of this Stock Option outstanding on such date, to the extent exercisable on the date of death, may thereafter be exercised by the Optionee's legal representative or legatee for a period of 12 months from the date of death or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date of death shall terminate immediately and be of no further force or effect.

(b) Termination Due to Disability. If the Optionee's employment terminates by reason of the Optionee's disability (as determined by the Administrator), any portion of this Stock Option outstanding on such date, to the extent exercisable on the date of such disability, may thereafter be exercised by the Optionee for a period of 12 months from the date of disability or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date of disability shall terminate immediately and be of no further force or effect.

(c) Termination for Cause. If the Optionee's employment terminates for Cause, any portion of this Stock Option outstanding on such date shall terminate immediately and be of no further force and effect. For purposes hereof, "Cause" shall mean, unless otherwise provided in an employment agreement between the Company and the Optionee, a determination by the Administrator that the Optionee shall be dismissed as a result of (i) the Optionee's dishonest statements or acts with respect to the Company or any affiliate of the Company, or any of the Company's current or prospective customers, suppliers vendors or other third parties with which such entity does business; (ii) the Optionee's commission of (A) a felony or (B) any misdemeanor involving moral turpitude, deceit, dishonesty or fraud; (iii) the Optionee's failure to perform his assigned duties and responsibilities to the reasonable satisfaction of the Company which failure continues, in the reasonable judgment of the Company, after written notice given to the grantee by the Company; (iv) the Optionee's gross negligence, willful misconduct or insubordination with respect to the Company or any affiliate of the Company; or (v) the Optionee's violation of any provision of any agreement(s) between the Optionee and the Company relating to noncompetition, nondisclosure and/or assignment of inventions.

(d) Other Termination. If the Optionee's employment terminates for any reason other than the Optionee's death, the Optionee's disability or Cause, and unless otherwise determined by the Administrator, any portion of this Stock Option outstanding on such date may be exercised, to the extent exercisable on the date of termination, for a period of three months from the date of termination or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date of termination shall terminate immediately and be of no further force or effect.

The Administrator's determination of the reason for termination of the Optionee's employment shall be conclusive and binding on the Optionee and his or her representatives or legatees.

4. Incorporation of Plan. Notwithstanding anything herein to the contrary, this Stock Option shall be subject to and governed by all the terms and conditions of the Plan, including the powers of the Administrator set forth in Section 2(b) of the Plan. Capitalized terms in this Agreement shall have the meaning specified in the Plan, unless a different meaning is specified herein.

5. Transferability. This Agreement is personal to the Optionee, is non-assignable and is not transferable in any manner, by operation of law or otherwise, other than by will or the laws of descent and distribution. This Stock Option is exercisable, during the Optionee's lifetime, only by the Optionee, and thereafter, only by the Optionee's legal representative or legatee.

6. Tax Withholding. The Optionee shall, not later than the date as of which the exercise of this Stock Option becomes a taxable event for Federal income tax purposes, pay to the Company or make arrangements satisfactory to the Administrator for payment of any Federal, state, and local taxes required by law to be withheld on account of such taxable event. The Company shall have the authority to cause the minimum required tax withholding obligation to be satisfied, in whole or in part, by withholding from shares of Stock to be issued to the Optionee a number of shares of Stock with an aggregate Fair Market Value that would satisfy the minimum withholding amount due.

7. No Obligation to Continue Employment. Neither the Company nor any Subsidiary is obligated by or as a result of the Plan or this Agreement to continue the Optionee in employment and neither the Plan nor this Agreement shall interfere in any way with the right of the Company or any Subsidiary to terminate the employment of the Optionee at any time.

8. Integration. This Agreement constitutes the entire agreement between the parties with respect to this Stock Option and supersedes all prior agreements and discussions between the parties concerning such subject matter.

9. Data Privacy Consent. In order to administer the Plan and this Agreement and to implement or structure future equity grants, the Company, its subsidiaries and affiliates and certain agents thereof (together, the "Relevant Companies") may process any and all personal or professional data, including but not limited to Social Security or other identification number, home address and telephone number, date of birth and other information that is necessary or desirable for the administration of the Plan and/or this Agreement (the "Relevant Information"). By entering into this Agreement, the Grantee (i) authorizes the Company to

collect, process, register and transfer to the Relevant Companies all Relevant Information; (ii) waives any privacy rights the Grantee may have with respect to the Relevant Information; (iii) authorizes the Relevant Companies to store and transmit such information in electronic form; and (iv) authorizes the transfer of the Relevant Information to any jurisdiction in which the Relevant Companies consider appropriate. The Grantee shall have access to, and the right to change, the Relevant Information. Relevant Information will only be used in accordance with applicable law.

10. Notices. Notices hereunder shall be mailed or delivered to the Company at its principal place of business and shall be mailed or delivered to the Optionee at the address on file with the Company or, in either case, at such other address as one party may subsequently furnish to the other party in writing.

BLUEBIRD BIO, INC.

By: _____

Title:

The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned. Electronic acceptance of this Agreement pursuant to the Company's instructions to the Grantee (including through an online acceptance process) is acceptable.

Dated: _____

_____

Optionee's Signature

Optionee's name and address:

_____

_____

_____

NON-QUALIFIED STOCK OPTION AGREEMENT
FOR NON-EMPLOYEE DIRECTORS
UNDER BLUEBIRD BIO, INC.
2013 STOCK OPTION AND INCENTIVE PLAN

Name of Optionee: _____

No. of Option Shares: _____

Option Exercise Price per Share: $_____
[FMV on Grant Date]

Grant Date: _____

Expiration Date: _____
[No more than 10 years]

Pursuant to the bluebird bio, Inc. 2013 Stock Option and Incentive Plan as amended through the date hereof (the "Plan"), bluebird bio, Inc. (the "Company") hereby grants to the Optionee named above, who is a Director of the Company but is not an employee of the Company, an option (the "Stock Option") to purchase on or prior to the Expiration Date specified above all or part of the number of shares of Common Stock, par value $0.01 per share (the "Stock"), of the Company specified above at the Option Exercise Price per Share specified above subject to the terms and conditions set forth herein and in the Plan. This Stock Option is not intended to be an "incentive stock option" under Section 422 of the Internal Revenue Code of 1986, as amended.

1. Exercisability Schedule. No portion of this Stock Option may be exercised until such portion shall have become exercisable. Except as set forth below, and subject to the discretion of the Administrator (as defined in Section 2 of the Plan) to accelerate the exercisability schedule hereunder, this Stock Option shall be exercisable with respect to the following number of Option Shares on the dates indicated so long as the Optionee remains in service as a member of the Board on such dates:

Incremental Number of Option Shares Exercisable	Exercisability Date
_____ (____%)	_____
_____ (____%)	_____
_____ (____%)	_____
_____ (____%)	_____
_____ (____%)	_____

Once exercisable, this Stock Option shall continue to be exercisable at any time or times prior to the close of business on the Expiration Date, subject to the provisions hereof and of the Plan.

2. Manner of Exercise.

(a) The Optionee may exercise this Stock Option only in the following manner: from time to time on or prior to the Expiration Date of this Stock Option, the Optionee may give written notice to the Administrator of his or her election to purchase some or all of the Option Shares purchasable at the time of such notice. This notice shall specify the number of Option Shares to be purchased.

Payment of the purchase price for the Option Shares may be made by one or more of the following methods: (i) in cash, by certified or bank check or other instrument acceptable to the Administrator; (ii) through the delivery (or attestation to the ownership) of shares of Stock that have been purchased by the Optionee on the open market or that are beneficially owned by the Optionee and are not then subject to any restrictions under any Company plan and that otherwise satisfy any holding periods as may be required by the Administrator; (iii) by the Optionee delivering to the Company a properly executed exercise notice together with irrevocable instructions to a broker to promptly deliver to the Company cash or a check payable and acceptable to the Company to pay the option purchase price, provided that in the event the Optionee chooses to pay the option purchase price as so provided, the Optionee and the broker shall comply with such procedures and enter into such agreements of indemnity and other agreements as the Administrator shall prescribe as a condition of such payment procedure; (iv) by a "net exercise" arrangement pursuant to which the Company will reduce the number of shares of Stock issuable upon exercise by the largest whole number of shares with a Fair Market Value that does not exceed the aggregate exercise price; or (v) a combination of (i), (ii), (iii) and (iv) above. Payment instruments will be received subject to collection.

The transfer to the Optionee on the records of the Company or of the transfer agent of the Option Shares will be contingent upon (i) the Company's receipt from the Optionee of the full purchase price for the Option Shares, as set forth above, (ii) the fulfillment of any other requirements contained herein or in the Plan or in any other agreement or provision of laws, and (iii) the receipt by the Company of any agreement, statement or other evidence that the Company may require to satisfy itself that the issuance of Stock to be purchased pursuant to the exercise of Stock Options under the Plan and any subsequent resale of the shares of Stock will be in compliance with applicable laws and regulations. In the event the Optionee chooses to pay the purchase price by previously-owned shares of Stock through the attestation method, the number of shares of Stock transferred to the Optionee upon the exercise of the Stock Option shall be net of the Shares attested to.

(b) The shares of Stock purchased upon exercise of this Stock Option shall be transferred to the Optionee on the records of the Company or of the transfer agent upon compliance to the satisfaction of the Administrator with all requirements under applicable laws or regulations in connection with such transfer and with the requirements hereof and of the Plan. The determination of the Administrator as to such compliance shall be final and binding on the Optionee. The Optionee shall not be deemed to be the holder of, or to have any of the rights of a

holder with respect to, any shares of Stock subject to this Stock Option unless and until this Stock Option shall have been exercised pursuant to the terms hereof, the Company or the transfer agent shall have transferred the shares to the Optionee, and the Optionee's name shall have been entered as the stockholder of record on the books of the Company. Thereupon, the Optionee shall have full voting, dividend and other ownership rights with respect to such shares of Stock.

(c) The minimum number of shares with respect to which this Stock Option may be exercised at any one time shall be 100 shares, unless the number of shares with respect to which this Stock Option is being exercised is the total number of shares subject to exercise under this Stock Option at the time.

(d) Notwithstanding any other provision hereof or of the Plan, no portion of this Stock Option shall be exercisable after the Expiration Date hereof.

3. Termination as Director. If the Optionee ceases to be a Director of the Company, the period within which to exercise the Stock Option may be subject to earlier termination as set forth below.

(a) Termination Due to Death. If the Optionee's service as a Director terminates by reason of the Optionee's death, any portion of this Stock Option outstanding on such date, to the extent exercisable on the date of death, may thereafter be exercised by the Optionee's legal representative or legatee for a period of 12 months from the date of death or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date of death shall terminate immediately and be of no further force or effect.

(b) Other Termination. If the Optionee ceases to be a Director for any reason other than the Optionee's death, any portion of this Stock Option outstanding on such date may be exercised, to the extent exercisable on the date the Optionee ceased to be a Director, for a period of six months from the date the Optionee ceased to be a Director or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date the Optionee ceases to be a Director shall terminate immediately and be of no further force or effect.

4. Incorporation of Plan. Notwithstanding anything herein to the contrary, this Stock Option shall be subject to and governed by all the terms and conditions of the Plan, including the powers of the Administrator set forth in Section 2(b) of the Plan. Capitalized terms in this Agreement shall have the meaning specified in the Plan, unless a different meaning is specified herein.

5. Transferability. This Agreement is personal to the Optionee, is non-assignable and is not transferable in any manner, by operation of law or otherwise, other than by will or the laws of descent and distribution. This Stock Option is exercisable, during the Optionee's lifetime, only by the Optionee, and thereafter, only by the Optionee's legal representative or legatee.

6. No Obligation to Continue as a Director. Neither the Plan nor this Stock Option confers upon the Optionee any rights with respect to continuance as a Director.

7. Integration. This Agreement constitutes the entire agreement between the parties with respect to this Stock Option and supersedes all prior agreements and discussions between the parties concerning such subject matter.

8. Data Privacy Consent. In order to administer the Plan and this Agreement and to implement or structure future equity grants, the Company, its subsidiaries and affiliates and certain agents thereof (together, the "Relevant Companies") may process any and all personal or professional data, including but not limited to Social Security or other identification number, home address and telephone number, date of birth and other information that is necessary or desirable for the administration of the Plan and/or this Agreement (the "Relevant Information"). By entering into this Agreement, the Grantee (i) authorizes the Company to collect, process, register and transfer to the Relevant Companies all Relevant Information; (ii) waives any privacy rights the Grantee may have with respect to the Relevant Information; (iii) authorizes the Relevant Companies to store and transmit such information in electronic form; and (iv) authorizes the transfer of the Relevant Information to any jurisdiction in which the Relevant Companies consider appropriate. The Grantee shall have access to, and the right to change, the Relevant Information. Relevant Information will only be used in accordance with applicable law.

9. Notices. Notices hereunder shall be mailed or delivered to the Company at its principal place of business and shall be mailed or delivered to the Optionee at the address on file with the Company or, in either case, at such other address as one party may subsequently furnish to the other party in writing.

BLUEBIRD BIO, INC.

By: _____

Title:

The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned. Electronic acceptance of this Agreement pursuant to the Company's instructions to the Grantee (including through an online acceptance process) is acceptable.

Dated: _____

_____

Optionee's Signature

Optionee's name and address:

_____

_____

_____

NON-QUALIFIED STOCK OPTION AGREEMENT
FOR NON-EMPLOYEE CONSULTANTS
UNDER THE BLUEBIRD BIO, INC.
2013 STOCK OPTION AND INCENTIVE PLAN

Name of Optionee: _____

No. of Option Shares: _____

Option Exercise Price per Share: $_____
[FMV on Grant Date]

Grant Date: _____

Expiration Date: _____
[No more than 10 years]

Pursuant to the bluebird bio, Inc. 2013 Stock Option and Incentive Plan as amended through the date hereof (the "Plan"), bluebird bio, Inc. (the "Company") hereby grants to the Optionee named above, who is a Consultant of the Company, an option (the "Stock Option") to purchase on or prior to the Expiration Date specified above all or part of the number of shares of Common Stock, par value $0.01 per share (the "Stock"), of the Company specified above at the Option Exercise Price per Share specified above subject to the terms and conditions set forth herein and in the Plan. This Stock Option is not intended to be an "incentive stock option" under Section 422 of the Internal Revenue Code of 1986, as amended.

1. Exercisability Schedule. No portion of this Stock Option may be exercised until such portion shall have become exercisable. Except as set forth below, and subject to the discretion of the Administrator (as defined in Section 2 of the Plan) to accelerate the exercisability schedule hereunder, this Stock Option shall be exercisable with respect to the following number of Option Shares on the dates indicated so long as the Optionee remains in service to the Company or a Subsidiary as a Consultant on such dates:

Incremental Number of Option Shares Exercisable	Exercisability Date
_____ (____%)	_____
_____ (____%)	_____
_____ (____%)	_____
_____ (____%)	_____
_____ (____%)	_____

Once exercisable, this Stock Option shall continue to be exercisable at any time or times prior to the close of business on the Expiration Date, subject to the provisions hereof and of the Plan.

2. Manner of Exercise.

(a) The Optionee may exercise this Stock Option only in the following manner: from time to time on or prior to the Expiration Date of this Stock Option, the Optionee may give written notice to the Administrator of his or her election to purchase some or all of the Option Shares purchasable at the time of such notice. This notice shall specify the number of Option Shares to be purchased.

Payment of the purchase price for the Option Shares may be made by one or more of the following methods: (i) in cash, by certified or bank check or other instrument acceptable to the Administrator; (ii) through the delivery (or attestation to the ownership) of shares of Stock that have been purchased by the Optionee on the open market or that are beneficially owned by the Optionee and are not then subject to any restrictions under any Company plan and that otherwise satisfy any holding periods as may be required by the Administrator; (iii) by the Optionee delivering to the Company a properly executed exercise notice together with irrevocable instructions to a broker to promptly deliver to the Company cash or a check payable and acceptable to the Company to pay the option purchase price, provided that in the event the Optionee chooses to pay the option purchase price as so provided, the Optionee and the broker shall comply with such procedures and enter into such agreements of indemnity and other agreements as the Administrator shall prescribe as a condition of such payment procedure; (iv) by a "net exercise" arrangement pursuant to which the Company will reduce the number of shares of Stock issuable upon exercise by the largest whole number of shares with a Fair Market Value that does not exceed the aggregate exercise price; or (v) a combination of (i), (ii), (iii) and (iv) above. Payment instruments will be received subject to collection.

The transfer to the Optionee on the records of the Company or of the transfer agent of the Option Shares will be contingent upon (i) the Company's receipt from the Optionee of the full purchase price for the Option Shares, as set forth above, (ii) the fulfillment of any other requirements contained herein or in the Plan or in any other agreement or provision of laws, and (iii) the receipt by the Company of any agreement, statement or other evidence that the Company may require to satisfy itself that the issuance of Stock to be purchased pursuant to the exercise of Stock Options under the Plan and any subsequent resale of the shares of Stock will be in compliance with applicable laws and regulations. In the event the Optionee chooses to pay the purchase price by previously-owned shares of Stock through the attestation method, the number of shares of Stock transferred to the Optionee upon the exercise of the Stock Option shall be net of the Shares attested to.

(b) The shares of Stock purchased upon exercise of this Stock Option shall be transferred to the Optionee on the records of the Company or of the transfer agent upon compliance to the satisfaction of the Administrator with all requirements under applicable laws or regulations in connection with such transfer and with the requirements hereof and of the Plan. The determination of the Administrator as to such compliance shall be final and binding on the Optionee. The Optionee shall not be deemed to be the holder of, or to have any of the rights of a

holder with respect to, any shares of Stock subject to this Stock Option unless and until this Stock Option shall have been exercised pursuant to the terms hereof, the Company or the transfer agent shall have transferred the shares to the Optionee, and the Optionee's name shall have been entered as the stockholder of record on the books of the Company. Thereupon, the Optionee shall have full voting, dividend and other ownership rights with respect to such shares of Stock.

(c) The minimum number of shares with respect to which this Stock Option may be exercised at any one time shall be 100 shares, unless the number of shares with respect to which this Stock Option is being exercised is the total number of shares subject to exercise under this Stock Option at the time.

(d) Notwithstanding any other provision hereof or of the Plan, no portion of this Stock Option shall be exercisable after the Expiration Date hereof.

3. Termination as Consultant. If the Optionee ceases to be a Consultant to the Company or a Subsidiary for any reason, any portion of this Stock Option outstanding on such date may be exercised, to the extent exercisable on the date the Optionee ceased to provide services, for a period of three months from the date the Optionee ceased to provide services or until the Expiration Date, if earlier. Any portion of this Stock Option that is not exercisable on the date the Optionee ceases to be a Consultant to the Company or a Subsidiary shall terminate immediately and be of no further force or effect.

4. Incorporation of Plan. Notwithstanding anything herein to the contrary, this Stock Option shall be subject to and governed by all the terms and conditions of the Plan, including the powers of the Administrator set forth in Section 2(b) of the Plan. Capitalized terms in this Agreement shall have the meaning specified in the Plan, unless a different meaning is specified herein.

5. Transferability. This Agreement is personal to the Optionee, is non-assignable and is not transferable in any manner, by operation of law or otherwise, other than by will or the laws of descent and distribution. This Stock Option is exercisable, during the Optionee's lifetime, only by the Optionee, and thereafter, only by the Optionee's legal representative or legatee.

6. No Obligation to Continue as a Consultant or Service Provider. Neither the Plan nor this Stock Option confers upon the Optionee any rights with respect to continuance as a Consultant or other service provider to the Company or a Subsidiary.

7. Integration. This Agreement constitutes the entire agreement between the parties with respect to this Stock Option and supersedes all prior agreements and discussions between the parties concerning such subject matter.

8. Data Privacy Consent. In order to administer the Plan and this Agreement and to implement or structure future equity grants, the Company, its subsidiaries and affiliates and certain agents thereof (together, the "Relevant Companies") may process any and all personal or professional data, including but not limited to Social Security or other identification number, home address and telephone number, date of birth and other information that is necessary or desirable for the administration of the Plan and/or this Agreement (the "Relevant

Information"). By entering into this Agreement, the Optionee (i) authorizes the Company to collect, process, register and transfer to the Relevant Companies all Relevant Information; (ii) waives any privacy rights the Optionee may have with respect to the Relevant Information; (iii) authorizes the Relevant Companies to store and transmit such information in electronic form; and (iv) authorizes the transfer of the Relevant Information to any jurisdiction in which the Relevant Companies consider appropriate. The Optionee shall have access to, and the right to change, the Relevant Information. Relevant Information will only be used in accordance with applicable law.

9. Notices. Notices hereunder shall be mailed or delivered to the Company at its principal place of business and shall be mailed or delivered to the Optionee at the address on file with the Company or, in either case, at such other address as one party may subsequently furnish to the other party in writing.

BLUEBIRD BIO, INC.

By: _____
Title:

The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned. Electronic acceptance of this Agreement pursuant to the Company's instructions to the Optionee (including through an online acceptance process) is acceptable.

Dated: _____

_____
Optionee's Signature

Optionee's name and address:

_____

_____

_____

RESTRICTED STOCK AWARD AGREEMENT
UNDER THE BLUEBIRD BIO, INC.
2013 STOCK OPTION AND INCENTIVE PLAN

Name of Grantee: _____

No. of Shares: _____

Grant Date: _____

Pursuant to the bluebird bio, Inc. 2013 Stock Option and Incentive Plan (the "Plan") as amended through the date hereof, bluebird bio, Inc. (the "Company") hereby grants a Restricted Stock Award (an "Award") to the Grantee named above. Upon acceptance of this Award, the Grantee shall receive the number of shares of Common Stock, par value $0.01 per share (the "Stock") of the Company specified above, subject to the restrictions and conditions set forth herein and in the Plan. The Company acknowledges the receipt from the Grantee of consideration with respect to the par value of the Stock in the form of cash, past or future services rendered to the Company by the Grantee or such other form of consideration as is acceptable to the Administrator.

1. Award. The shares of Restricted Stock awarded hereunder shall be issued and held by the Company's transfer agent in book entry form, and the Grantee's name shall be entered as the stockholder of record on the books of the Company. Thereupon, the Grantee shall have all the rights of a stockholder with respect to such shares, including voting and dividend rights, subject, however, to the restrictions and conditions specified in Paragraph 2 below. The Grantee shall (i) sign and deliver to the Company a copy of this Award Agreement and (ii) deliver to the Company a stock power endorsed in blank.

2. Restrictions and Conditions.

(a) Any book entries for the shares of Restricted Stock granted herein shall bear an appropriate legend, as determined by the Administrator in its sole discretion, to the effect that such shares are subject to restrictions as set forth herein and in the Plan.

(b) Shares of Restricted Stock granted herein may not be sold, assigned, transferred, pledged or otherwise encumbered or disposed of by the Grantee prior to vesting.

(c) If the Grantee's employment with the Company and its Subsidiaries is voluntarily or involuntarily terminated for any reason (including death) prior to vesting of shares of Restricted Stock granted herein, all shares of Restricted Stock shall immediately and automatically be forfeited and returned to the Company.

3. Vesting of Restricted Stock. The restrictions and conditions in Paragraph 2 of this Agreement shall lapse on the Vesting Date or Dates specified in the following schedule so long as the Grantee remains an employee of the Company or a Subsidiary on such Dates. If a series of Vesting Dates is specified, then the restrictions and conditions in Paragraph 2 shall lapse only with respect to the number of shares of Restricted Stock specified as vested on such date.

Incremental Number of Shares Vested	Vesting Date
_____ (____%)	_____
_____ (____%)	_____
_____ (____%)	_____
_____ (____%)	_____
_____ (____%)	_____

Subsequent to such Vesting Date or Dates, the shares of Stock on which all restrictions and conditions have lapsed shall no longer be deemed Restricted Stock. The Administrator may at any time accelerate the vesting schedule specified in this Paragraph 3.

4. Dividends. Dividends on shares of Restricted Stock shall be paid currently to the Grantee.

5. Incorporation of Plan. Notwithstanding anything herein to the contrary, this Award shall be subject to and governed by all the terms and conditions of the Plan, including the powers of the Administrator set forth in Section 2(b) of the Plan. Capitalized terms in this Agreement shall have the meaning specified in the Plan, unless a different meaning is specified herein.

6. Transferability. This Agreement is personal to the Grantee, is non-assignable and is not transferable in any manner, by operation of law or otherwise, other than by will or the laws of descent and distribution.

7. Tax Withholding. The Grantee shall, not later than the date as of which the receipt of this Award becomes a taxable event for Federal income tax purposes, pay to the Company or make arrangements satisfactory to the Administrator for payment of any Federal, state, and local taxes required by law to be withheld on account of such taxable event. Except in the case where an election is made pursuant to Paragraph 8 below, the Company shall have the authority to cause the required minimum tax withholding obligation to be satisfied, in whole or in part, by withholding from shares of Stock to be issued or released by the transfer agent a number of shares of Stock with an aggregate Fair Market Value that would satisfy the minimum withholding amount due.

8. Election Under Section 83(b). The Grantee and the Company hereby agree that the Grantee may, within 30 days following the Grant Date of this Award, file with the Internal Revenue Service and the Company an election under Section 83(b) of the Internal Revenue Code. In the event the Grantee makes such an election, he or she agrees to provide a copy of the election to the Company. The Grantee acknowledges that he or she is responsible for obtaining the advice of his or her tax advisors with regard to the Section 83(b) election and that he or she is relying solely on such advisors and not on any statements or representations of the Company or any of its agents with regard to such election.

9. No Obligation to Continue Employment. Neither the Company nor any Subsidiary is obligated by or as a result of the Plan or this Agreement to continue the Grantee in employment and neither the Plan nor this Agreement shall interfere in any way with the right of the Company or any Subsidiary to terminate the employment of the Grantee at any time.

10. Integration. This Agreement constitutes the entire agreement between the parties with respect to this Award and supersedes all prior agreements and discussions between the parties concerning such subject matter.

11. Data Privacy Consent. In order to administer the Plan and this Agreement and to implement or structure future equity grants, the Company, its subsidiaries and affiliates and certain agents thereof (together, the "Relevant Companies") may process any and all personal or professional data, including but not limited to Social Security or other identification number, home address and telephone number, date of birth and other information that is necessary or desirable for the administration of the Plan and/or this Agreement (the "Relevant Information"). By entering into this Agreement, the Grantee (i) authorizes the Company to collect, process, register and transfer to the Relevant Companies all Relevant Information; (ii) waives any privacy rights the Grantee may have with respect to the Relevant Information; (iii) authorizes the Relevant Companies to store and transmit such information in electronic form; and (iv) authorizes the transfer of the Relevant Information to any jurisdiction in which the Relevant Companies consider appropriate. The Grantee shall have access to, and the right to change, the Relevant Information. Relevant Information will only be used in accordance with applicable law.

12. Notices. Notices hereunder shall be mailed or delivered to the Company at its principal place of business and shall be mailed or delivered to the Grantee at the address on file with the Company or, in either case, at such other address as one party may subsequently furnish to the other party in writing.

BLUEBIRD BIO, INC.

By: _____

Title:

The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned. Electronic acceptance of this Agreement pursuant to the Company's instructions to the Grantee (including through an online acceptance process) is acceptable.

Dated: _____

_____

Grantee's Signature

Grantee's name and address:

_____

_____

_____

RESTRICTED STOCK UNIT AWARD AGREEMENT
FOR COMPANY EMPLOYEES
UNDER BLUEBIRD BIO, INC.
2013 STOCK OPTION AND INCENTIVE PLAN

Name of Grantee: _____

No. of Restricted Stock Units: _____

Grant Date: _____

Pursuant to the bluebird bio, Inc. 2013 Stock Option and Incentive Plan as amended through the date hereof (the "Plan"), bluebird bio, Inc. (the "Company") hereby grants an award of the number of Restricted Stock Units listed above (an "Award") to the Grantee named above. Each Restricted Stock Unit shall relate to one share of Common Stock, par value $0.01 per share (the "Stock") of the Company.

1. Restrictions on Transfer of Award. This Award may not be sold, transferred, pledged, assigned or otherwise encumbered or disposed of by the Grantee, and any shares of Stock issuable with respect to the Award may not be sold, transferred, pledged, assigned or otherwise encumbered or disposed of until (i) the Restricted Stock Units have vested as provided in Paragraph 2 of this Agreement and (ii) shares of Stock have been issued to the Grantee in accordance with the terms of the Plan and this Agreement.

2. Vesting of Restricted Stock Units. The restrictions and conditions of Paragraph 1 of this Agreement shall lapse on the Vesting Date or Dates specified in the following schedule so long as the Grantee remains an employee of the Company or a Subsidiary on such Dates. If a series of Vesting Dates is specified, then the restrictions and conditions in Paragraph 1 shall lapse only with respect to the number of Restricted Stock Units specified as vested on such date.

Incremental Number of Restricted Stock Units Vested	Vesting Date
_____ (____%)	_____
_____ (____%)	_____
_____ (____%)	_____
_____ (____%)	_____

The Administrator may at any time accelerate the vesting schedule specified in this Paragraph 2.

3. Termination of Employment. If the Grantee's employment with the Company and its Subsidiaries terminates for any reason (including death or disability) prior to the satisfaction of the vesting conditions set forth in Paragraph 2 above, any Restricted Stock Units that have not vested as of such date shall automatically and without notice terminate and be forfeited, and neither the Grantee nor any of his or her successors, heirs, assigns, or personal representatives will thereafter have any further rights or interests in such unvested Restricted Stock Units.

4. Issuance of Shares of Stock. As soon as practicable following each Vesting Date (but in no event later than two and one-half months after the end of the year in which the Vesting Date occurs), the Company shall issue to the Grantee the number of shares of Stock equal to the aggregate number of Restricted Stock Units that have vested pursuant to Paragraph 2 of this Agreement on such date and the Grantee shall thereafter have all the rights of a stockholder of the Company with respect to such shares.

5. Incorporation of Plan. Notwithstanding anything herein to the contrary, this Agreement shall be subject to and governed by all the terms and conditions of the Plan, including the powers of the Administrator set forth in Section 2(b) of the Plan. Capitalized terms in this Agreement shall have the meaning specified in the Plan, unless a different meaning is specified herein.

6. Tax Withholding. The Grantee shall, not later than the date as of which the receipt of this Award becomes a taxable event for Federal income tax purposes, pay to the Company or make arrangements satisfactory to the Administrator for payment of any Federal, state, and local taxes required by law to be withheld on account of such taxable event. The Company shall have the authority to cause the required minimum tax withholding obligation to be satisfied, in whole or in part, by withholding from shares of Stock to be issued to the Grantee a number of shares of Stock with an aggregate Fair Market Value that would satisfy the withholding amount due.

7. Section 409A of the Code. This Agreement shall be interpreted in such a manner that all provisions relating to the settlement of the Award are exempt from the requirements of Section 409A of the Code as "short-term deferrals" as described in Section 409A of the Code.

8. No Obligation to Continue Employment. Neither the Company nor any Subsidiary is obligated by or as a result of the Plan or this Agreement to continue the Grantee in employment and neither the Plan nor this Agreement shall interfere in any way with the right of the Company or any Subsidiary to terminate the employment of the Grantee at any time.

9. Integration. This Agreement constitutes the entire agreement between the parties with respect to this Award and supersedes all prior agreements and discussions between the parties concerning such subject matter.

10. Data Privacy Consent. In order to administer the Plan and this Agreement and to implement or structure future equity grants, the Company, its subsidiaries and affiliates and certain agents thereof (together, the "Relevant Companies") may process any and all personal or professional data, including but not limited to Social Security or other identification number, home address and telephone number, date of birth and other information that is necessary or desirable for the administration of the Plan and/or this Agreement (the "Relevant Information"). By entering into this Agreement, the Grantee (i) authorizes the Company to collect, process, register and transfer to the Relevant Companies all Relevant Information; (ii) waives any privacy rights the Grantee may have with respect to the Relevant Information; (iii) authorizes the Relevant Companies to store and transmit such information in electronic form; and (iv)

authorizes the transfer of the Relevant Information to any jurisdiction in which the Relevant Companies consider appropriate. The Grantee shall have access to, and the right to change, the Relevant Information. Relevant Information will only be used in accordance with applicable law.

11. Notices. Notices hereunder shall be mailed or delivered to the Company at its principal place of business and shall be mailed or delivered to the Grantee at the address on file with the Company or, in either case, at such other address as one party may subsequently furnish to the other party in writing.

BLUEBIRD BIO, INC.

By: _____

Title:

The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned. Electronic acceptance of this Agreement pursuant to the Company's instructions to the Grantee (including through an online acceptance process) is acceptable.

Dated: _____

_____

Grantee's Signature

Grantee's name and address:

_____

_____

_____

RESTRICTED STOCK UNIT AWARD AGREEMENT
FOR NON-EMPLOYEE DIRECTORS
UNDER BLUEBIRD BIO, INC.
2013 STOCK OPTION AND INCENTIVE PLAN

Name of Grantee: _____

No. of Restricted Stock Units: _____

Grant Date: _____

Pursuant to the bluebird bio, Inc. 2013 Stock Option and Incentive Plan as amended through the date hereof (the "Plan"), bluebird bio, Inc. (the "Company") hereby grants an award of the number of Restricted Stock Units listed above (an "Award") to the Grantee named above. Each Restricted Stock Unit shall relate to one share of Common Stock, par value $0.01 per share (the "Stock") of the Company.

1. Restrictions on Transfer of Award. This Award may not be sold, transferred, pledged, assigned or otherwise encumbered or disposed of by the Grantee, and any shares of Stock issuable with respect to the Award may not be sold, transferred, pledged, assigned or otherwise encumbered or disposed of until (i) the Restricted Stock Units have vested as provided in Paragraph 2 of this Agreement and (ii) shares of Stock have been issued to the Grantee in accordance with the terms of the Plan and this Agreement.

2. Vesting of Restricted Stock Units. The restrictions and conditions of Paragraph 1 of this Agreement shall lapse on the Vesting Date or Dates specified in the following schedule so long as the Grantee remains in service as a member of the Board on such Dates. If a series of Vesting Dates is specified, then the restrictions and conditions in Paragraph 1 shall lapse only with respect to the number of Restricted Stock Units specified as vested on such date.

Incremental Number of Restricted Stock Units Vested	Vesting Date
_____ (____%)	_____
_____ (____%)	_____
_____ (____%)	_____
_____ (____%)	_____

The Administrator may at any time accelerate the vesting schedule specified in this Paragraph 2.

3. Termination of Service. If the Grantee's service with the Company and its Subsidiaries terminates for any reason (including death or disability) prior to the satisfaction of the vesting conditions set forth in Paragraph 2 above, any Restricted Stock Units that have not vested as of such date shall automatically and without notice terminate and be forfeited, and neither the Grantee nor any of his or her successors, heirs, assigns, or personal representatives will thereafter have any further rights or interests in such unvested Restricted Stock Units.

4. Issuance of Shares of Stock. As soon as practicable following each Vesting Date (but in no event later than two and one-half months after the end of the year in which the Vesting Date occurs), the Company shall issue to the Grantee the number of shares of Stock equal to the aggregate number of Restricted Stock Units that have vested pursuant to Paragraph 2 of this Agreement on such date and the Grantee shall thereafter have all the rights of a stockholder of the Company with respect to such shares.

5. Incorporation of Plan. Notwithstanding anything herein to the contrary, this Agreement shall be subject to and governed by all the terms and conditions of the Plan, including the powers of the Administrator set forth in Section 2(b) of the Plan. Capitalized terms in this Agreement shall have the meaning specified in the Plan, unless a different meaning is specified herein.

6. Section 409A of the Code. This Agreement shall be interpreted in such a manner that all provisions relating to the settlement of the Award are exempt from the requirements of Section 409A of the Code as "short-term deferrals" as described in Section 409A of the Code.

7. No Obligation to Continue as a Director. Neither the Plan nor this Award confers upon the Grantee any rights with respect to continuance as a Director.

8. Integration. This Agreement constitutes the entire agreement between the parties with respect to this Award and supersedes all prior agreements and discussions between the parties concerning such subject matter.

9. Data Privacy Consent. In order to administer the Plan and this Agreement and to implement or structure future equity grants, the Company, its subsidiaries and affiliates and certain agents thereof (together, the "Relevant Companies") may process any and all personal or professional data, including but not limited to Social Security or other identification number, home address and telephone number, date of birth and other information that is necessary or desirable for the administration of the Plan and/or this Agreement (the "Relevant Information"). By entering into this Agreement, the Grantee (i) authorizes the Company to collect, process, register and transfer to the Relevant Companies all Relevant Information; (ii) waives any privacy rights the Grantee may have with respect to the Relevant Information; (iii) authorizes the Relevant Companies to store and transmit such information in electronic form; and (iv) authorizes the transfer of the Relevant Information to any jurisdiction in which the Relevant Companies consider appropriate. The Grantee shall have access to, and the right to change, the Relevant Information. Relevant Information will only be used in accordance with applicable law.

10. Notices. Notices hereunder shall be mailed or delivered to the Company at its principal place of business and shall be mailed or delivered to the Grantee at the address on file with the Company or, in either case, at such other address as one party may subsequently furnish to the other party in writing.

BLUEBIRD BIO, INC.

By: _____

Title:

The foregoing Agreement is hereby accepted and the terms and conditions thereof hereby agreed to by the undersigned. Electronic acceptance of this Agreement pursuant to the Company's instructions to the Grantee (including through an online acceptance process) is acceptable.

Dated: _____

_____

Grantee's Signature

Grantee's name and address:

_____

_____

_____

Exhibit 10.12

AMENDED AND RESTATED
EMPLOYMENT AGREEMENT

This Employment Agreement ("Agreement") is between bluebird bio, Inc., a Delaware corporation (the "Company"), and Nick Leschly (the "Executive") and is made effective as of the closing of the Company's first underwritten public offering of its equity securities pursuant to an effective registration statement under the Securities Act of 1933, as amended (the "IPO"), provided the IPO is consummated prior to December 31, 2013 (the "Effective Date").

WHEREAS, the Company and the Executive previously entered in an employment letter agreement, dated September 9, 2010, which the Company and the Executive intend to replace with this Agreement; and

WHEREAS, the Company desires to continue to employ the Executive and the Executive desires to continue to be employed by the Company on the new terms and conditions contained herein.

NOW, THEREFORE, in consideration of the mutual covenants and agreements herein contained and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties agree as follows:

1. Employment.

(a) Term. The term of this Agreement shall commence on the Effective Date and continue until terminated in accordance with the provisions of Section 3 (the "Term").

(b) Position and Duties. During the Term, the Executive shall serve as the President and Chief Executive Officer of the Company, and shall have supervision and control over and responsibility for the day-to-day business and affairs of the Company and shall have such other powers and duties as may from time to time be prescribed by the Board of Directors of the Company (the "Board"), provided that such duties are consistent with the Executive's position or other positions that he may hold from time to time. The Executive shall report to the Board. The Executive shall devote his full working time and efforts to the business and affairs of the Company. Notwithstanding the foregoing, the Executive may serve on other boards of directors, with the approval of the Board, or engage in religious, charitable or other community activities as long as such services and activities are disclosed to the Board and do not materially interfere with the Executive's performance of his duties to the Company as provided in this Agreement.

2. Compensation and Related Matters.

(a) Base Salary. During the Term, the Executive's initial annual base salary shall be $390,000. The Executive's base salary shall be redetermined annually by the Board or the Compensation Committee. The annual base salary in effect at any given time is referred to herein as "Base Salary." The Base Salary shall be payable in a manner that is consistent with the Company's usual payroll practices for senior executives.

(b) Incentive Compensation. During the Term, the Executive shall be eligible to receive cash incentive compensation as determined by the Board or the Compensation Committee from time to time. The Executive's target annual incentive compensation shall be 50 percent (50%) of his Base Salary. To earn incentive compensation, the Executive must be employed by the Company on the day such incentive compensation is paid.

(c) Expenses. The Executive shall be entitled to receive prompt reimbursement for all reasonable expenses incurred by him during the Term in performing services hereunder, in accordance with the policies and procedures then in effect and established by the Company for its senior executive officers.

(d) Other Benefits. During the Term, the Executive shall be eligible to participate in or receive benefits under the Company's employee benefit plans in effect from time to time, subject to the terms of such plans.

(e) Vacations. During the Term, the Executive shall be entitled to accrue paid vacation in accordance with the Company's applicable policy.

3. Termination. During the Term, the Executive's employment hereunder may be terminated without any breach of this Agreement under the following circumstances:

(a) Death. The Executive's employment hereunder shall terminate upon his death.

(b) Disability. The Company may terminate the Executive's employment if he is disabled and unable to perform the essential functions of the Executive's then existing position or positions under this Agreement with or without reasonable accommodation for a period of 180 days (which need not be consecutive) in any 12-month period. If any question shall arise as to whether during any period the Executive is disabled so as to be unable to perform the essential functions of the Executive's then existing position or positions with or without reasonable accommodation, the Executive may, and at the request of the Company shall, submit to the Company a certification in reasonable detail by a physician selected by the Company to whom the Executive or the Executive's guardian has no reasonable objection as to whether the Executive is so disabled or how long such disability is expected to continue, and such certification shall for the purposes of this Agreement be conclusive of the issue. The Executive shall cooperate with any reasonable request of the physician in connection with such certification. If such question shall arise and the Executive shall fail to submit such certification, the Company's determination of such issue shall be binding on the Executive. Nothing in this Section 3(b) shall be construed to waive the Executive's rights, if any, under existing law including, without limitation, the Family and Medical Leave Act of 1993, 29 U.S.C. §2601 *et seq*. and the Americans with Disabilities Act, 42 U.S.C. §12101 *et seq*.

(c) Termination by Company for Cause. The Company may terminate the Executive's employment hereunder for Cause by a vote of the Board at a meeting of the Board called and held for such purpose. For purposes of this Agreement, "Cause" shall mean: (i) the Executive's commission of any felony or commission of any crime involving fraud, dishonesty or moral turpitude; (ii) the Executive's commission or attempted commission of or participation in a fraud or act of dishonesty against the Company; (iii) the Executive's material breach of any contract or agreement between the Executive and the Company or the Executive's material

breach of any legal duty he owes to the Company; (iv) conduct by the Executive that constitutes insubordination, incompetence or neglect of duties; or (v) the Executive's failure to perform the duties, functions and responsibilities of the Executive's position; provided, however, the actions or conduct described in clauses (iv) and (v) above shall only constitute Cause if the Company provides the Executive with written notice thereof and the Executive has not cured within 30 days of such written notice.

(d) Termination Without Cause. The Company may terminate the Executive's employment hereunder at any time without Cause. Any termination by the Company of the Executive's employment under this Agreement which does not constitute a termination for Cause under Section 3(c) and does not result from the death or disability of the Executive under Section 3(a) or (b) shall be deemed a termination without Cause.

(e) Termination by the Executive. The Executive may terminate his employment hereunder at any time for any reason, including but not limited to Good Reason. For purposes of this Agreement, "Good Reason" shall mean that the Executive has complied with the "Good Reason Process" (hereinafter defined) following the occurrence of any of the following events without the Executive's express written consent: (i) a material diminution in the Executive's responsibilities, authority and function, an adverse change to the Executive's job title as Chief Executive Officer, or a change in the Executive's reporting relationship that results in the Executive no longer reporting directly to the Board; (ii) a material reduction in the Executive's Base Salary except pursuant to a salary reduction program affecting substantially all of the employees of the Company, provided, that it does not adversely affect the Executive to a greater extent than other similarly situated employees and, provided further, that any reduction in the Executive's Base Salary of more than ten percent (10%) shall constitute Good Reason; (iii) a material change in the geographic location at which the Executive must regularly report to work and provide services to the Company (except for required travel on Company business); (iv) the material breach by the Company of this Agreement, the Company's equity incentive plan, the agreements governing any stock-based awards made to the Executive or any other material agreement between the Executive and the Company, if any, concerning the terms and conditions of the Executive's employment, benefits or compensation; or (v) the Executive's removal from or failure to be elected to the Board. "Good Reason Process" shall mean that (i) the Executive reasonably determines in good faith that a "Good Reason" condition has occurred; (ii) the Executive notifies the Company in writing of the first occurrence of the Good Reason condition within 60 days of the first occurrence of such condition; (iii) the Executive cooperates in good faith with the Company's efforts, for a period not less than 30 days following such notice (the "Cure Period") to remedy the condition; (iv) notwithstanding such efforts, the Good Reason condition continues to exist; and (v) the Executive terminates his employment within 60 days after the end of the Cure Period. If the Company cures the Good Reason condition during the Cure Period, Good Reason shall be deemed not to have occurred.

(f) Notice of Termination. Except for termination as specified in Section 3(a), any termination of the Executive's employment by the Company or any such termination by the Executive shall be communicated by written Notice of Termination to the other party hereto. For purposes of this Agreement, a "Notice of Termination" shall mean a notice which shall indicate the specific termination provision in this Agreement relied upon.

(g) Date of Termination. "Date of Termination" shall mean: (i) if the Executive's employment is terminated by his death, the date of his death; (ii) if the Executive's employment is terminated on account of disability under Section 3(b) or by the Company for Cause under Section 3(c), the date on which Notice of Termination is given; (iii) if the Executive's employment is terminated by the Company under Section 3(d), the date on which a Notice of Termination is given; (iv) if the Executive's employment is terminated by the Executive under Section 3(e) without Good Reason, 30 days after the date on which a Notice of Termination is given, and (v) if the Executive's employment is terminated by the Executive under Section 3(e) with Good Reason, the date on which a Notice of Termination is given after the end of the Cure Period. Notwithstanding the foregoing, (A) in the event that the Executive gives a Notice of Termination to the Company, the Company may unilaterally accelerate the Date of Termination and such acceleration shall not result in a termination by the Company for purposes of this Agreement, and (B) in the event that the Company terminates the Executive's employment without Cause under Section 3(d), the Company may unilaterally accelerate the Date of Termination to any earlier effective date provided that the Company continues to pay the Executive the Base Salary for the 30-day period immediately following the date on which a Notice of Termination is given to the Executive.

4. Compensation Upon Termination.

(a) Termination Generally. If the Executive's employment with the Company is terminated for any reason, the Company shall pay or provide to the Executive (or to his authorized representative or estate) (i) any Base Salary earned through the Date of Termination, unpaid expense reimbursements (subject to, and in accordance with, Section 2(c) of this Agreement) and unused vacation that accrued through the Date of Termination on or before the time required by law but in no event more than 30 days after the Executive's Date of Termination; and (ii) any vested benefits the Executive may have under any employee benefit plan of the Company through the Date of Termination, which vested benefits shall be paid and/or provided in accordance with the terms of such employee benefit plans (collectively, the "Accrued Benefit").

(b) Termination by the Company Without Cause or by the Executive with Good Reason. During the Term, if the Executive's employment is terminated by the Company without Cause as provided in Section 3(d), or the Executive terminates his employment for Good Reason as provided in Section 3(e), then the Company shall pay the Executive his Accrued Benefit. In addition, subject to the Executive signing a separation agreement containing, among other provisions, a general release of claims in favor of the Company and related persons and entities, confidentiality, return of property and non-disparagement, in a form and manner satisfactory to the Company (the "Separation Agreement and Release") and the Separation Agreement and Release becoming fully effective, all within the time frame set forth in the Separation Agreement and Release:

(i) the Company shall pay the Executive an amount equal to one times the Executive's Base Salary (the "Severance Amount"); and

(ii) if the Executive was participating in the Company's group health plan immediately prior to the Date of Termination and elects COBRA health continuation, then the Company shall pay to the Executive a monthly cash payment for 12 months or the Executive's COBRA health continuation period, whichever ends earlier, in an amount equal to the monthly employer contribution that the Company would have made to provide health insurance to the Executive if the Executive had remained employed by the Company; and

(iii) the amounts payable under this Section 4(b) shall be paid out in substantially equal installments in accordance with the Company's payroll practice over 12 months commencing within 60 days after the Date of Termination; provided, however, that if the 60-day period begins in one calendar year and ends in a second calendar year, the Severance Amount shall begin to be paid in the second calendar year by the last day of such 60-day period; provided, further, that the initial payment shall include a catch-up payment to cover amounts retroactive to the day immediately following the Date of Termination. Each payment pursuant to this Agreement is intended to constitute a separate payment for purposes of Treasury Regulation Section 1.409A-2(b)(2).

(iv) The receipt of any severance payments or benefits pursuant to Section 4 will be subject to Executive not violating the Restrictive Covenant Agreement referenced in Section 7 of this Agreement and attached hereto as Exhibit A, the terms of which are hereby incorporated by reference. In the event Executive breaches the Restrictive Covenant Agreement, in addition to all other legal and equitable remedies, the Company shall have the right to terminate or suspend all continuing payments and benefits to which Executive may otherwise be entitled pursuant to Section 4 without affecting the Executive's release or Executive's obligations under the Separation Agreement and Release.

5. Change in Control Payment. The provisions of this Section 5 set forth certain terms of an agreement reached between the Executive and the Company regarding the Executive's rights and obligations upon the occurrence of a Change in Control of the Company. These provisions are intended to assure and encourage in advance the Executive's continued attention and dedication to his assigned duties and his objectivity during the pendency and after the occurrence of any such event. These provisions shall apply in lieu of, and expressly supersede, the provisions of Section 4(b) regarding severance pay and benefits upon a termination of employment, if such termination of employment occurs within 12 months after the occurrence of the first event constituting a Change in Control. These provisions shall terminate and be of no further force or effect beginning 12 months after the occurrence of a Change in Control.

(a) Change in Control. During the Term, if within 12 months after a Change in Control, the Executive's employment is terminated by the Company without Cause as provided in Section 3(d) or the Executive terminates his employment for Good Reason as provided in Section 3(e), then, subject to the signing of the Separation Agreement and Release by the Executive and the Separation Agreement and Release becoming irrevocable, all within 60 days after the Date of Termination,

(i) the Company shall pay the Executive a lump sum in cash in an amount equal to one and a half times the sum of (A) the Executive's current Base Salary (or the Executive's Base Salary in effect immediately prior to the Change in Control, if higher) plus (B) the Executive's Target Incentive Compensation. For purposes of this Agreement, "Target Incentive Compensation" shall mean the Executive's target annual incentive compensation as set forth in Section 2(b); and

(ii) notwithstanding anything to the contrary in any applicable option agreement or stock-based award agreement, all stock options and other stock-based awards granted to the Executive after the date of this Agreement shall immediately accelerate and become fully exercisable or nonforfeitable as of the Date of Termination. The treatment of stock options and other stock-based awards held by the Executive as of the date of this Agreement shall be governed by the terms of the applicable option agreement or other stock-based award agreement; and

(iii) if the Executive was participating in the Company's group health plan immediately prior to the Date of Termination and elects COBRA health continuation, then the Company shall pay to the Executive a monthly cash payment for 18 months or the Executive's COBRA health continuation period, whichever ends earlier, in an amount equal to the monthly employer contribution that the Company would have made to provide health insurance to the Executive if the Executive had remained employed by the Company; and

(iv) The amounts payable under this Section 5(a) shall be paid or commence to be paid within 60 days after the Date of Termination; provided, however, that if the 60-day period begins in one calendar year and ends in a second calendar year, such payment shall be paid or commence to be paid in the second calendar year by the last day of such 60-day period.

(b) Additional Limitation.

(i) Anything in this Agreement to the contrary notwithstanding, in the event that the amount of any compensation, payment or distribution by the Company to or for the benefit of the Executive, whether paid or payable or distributed or distributable pursuant to the terms of this Agreement or otherwise, calculated in a manner consistent with Section 280G of the Internal Revenue Code of 1986, as amended (the "Code") and the applicable regulations thereunder (the "Severance Payments"), would be subject to the excise tax imposed by Section 4999 of the Code, the following provisions shall apply:

(A) If the Severance Payments, reduced by the sum of (1) the Excise Tax and (2) the total of the federal, state, and local income and employment taxes payable by the Executive on the amount of the Severance Payments which are in excess of the Threshold Amount, are greater than or equal to the Threshold Amount, the Executive shall be entitled to the full benefits payable under this Agreement.

(B) If the Threshold Amount is less than (x) the Severance Payments, but greater than (y) the Severance Payments reduced by the sum of (1) the Excise Tax and (2) the total of the federal, state, and local income and employment taxes on the amount of the Severance Payments which are in excess of the Threshold Amount, then the Severance Payments shall be reduced (but not below zero) to the extent necessary so that the sum of all Severance Payments shall not exceed the Threshold Amount. In such event, the Severance Payments shall be reduced in the following order: (1) cash payments not subject to Section 409A of the Code; (2) cash payments subject to Section 409A of the Code; (3) equity-based payments and acceleration; and (4) non-cash forms of benefits. To the extent any payment is to be made over time (e.g., in installments, etc.), then the payments shall be reduced in reverse chronological order.

(ii) For the purposes of this Section 5(b), "Threshold Amount" shall mean three times the Executive's "base amount" within the meaning of Section 280G(b)(3) of the Code and the regulations promulgated thereunder less one dollar ($1.00); and "Excise Tax" shall mean the excise tax imposed by Section 4999 of the Code, and any interest or penalties incurred by the Executive with respect to such excise tax.

(iii) The determination as to which of the alternative provisions of Section 5(b)(i) shall apply to the Executive shall be made by a nationally recognized accounting firm selected by the Company (the "Accounting Firm"), which shall provide detailed supporting calculations both to the Company and the Executive within 15 business days of the Date of Termination, if applicable, or at such earlier time as is reasonably requested by the Company or the Executive. For purposes of determining which of the alternative provisions of Section 5(b)(i) shall apply, the Executive shall be deemed to pay federal income taxes at the highest marginal rate of federal income taxation applicable to individuals for the calendar year in which the determination is to be made, and state and local income taxes at the highest marginal rates of individual taxation in the state and locality of the Executive's residence on the Date of Termination, net of the maximum reduction in federal income taxes which could be obtained from deduction of such state and local taxes. Any determination by the Accounting Firm shall be binding upon the Company and the Executive.

(b) Definitions. For purposes of this Section 5, the following terms shall have the following meanings:

"Change in Control" shall mean "Sale Event," as such term is defined in the Company's 2013 Stock Option and Incentive Plan.

6. Section 409A.

(a) Anything in this Agreement to the contrary notwithstanding, if at the time of the Executive's separation from service within the meaning of Section 409A of the Code, the Company determines that the Executive is a "specified employee" within the meaning of Section 409A(a)(2)(B)(i) of the Code, then to the extent any payment or benefit that the Executive becomes entitled to under this Agreement on account of the Executive's separation from service would be considered deferred compensation otherwise subject to the 20 percent additional tax imposed pursuant to Section 409A(a) of the Code as a result of the application of Section

409A(a)(2)(B)(i) of the Code, such payment shall not be payable and such benefit shall not be provided until the date that is the earlier of (A) six months and one day after the Executive's separation from service, or (B) the Executive's death. If any such delayed cash payment is otherwise payable on an installment basis, the first payment shall include a catch-up payment covering amounts that would otherwise have been paid during the six-month period but for the application of this provision, and the balance of the installments shall be payable in accordance with their original schedule.

(b) All in-kind benefits provided and expenses eligible for reimbursement under this Agreement shall be provided by the Company or incurred by the Executive during the time periods set forth in this Agreement. All reimbursements shall be paid as soon as administratively practicable, but in no event shall any reimbursement be paid after the last day of the taxable year following the taxable year in which the expense was incurred. The amount of in-kind benefits provided or reimbursable expenses incurred in one taxable year shall not affect the in-kind benefits to be provided or the expenses eligible for reimbursement in any other taxable year (except for any lifetime or other aggregate limitation applicable to medical expenses). Such right to reimbursement or in-kind benefits is not subject to liquidation or exchange for another benefit.

(c) To the extent that any payment or benefit described in this Agreement constitutes "non-qualified deferred compensation" under Section 409A of the Code, and to the extent that such payment or benefit is payable upon the Executive's termination of employment, then such payments or benefits shall be payable only upon the Executive's "separation from service." The determination of whether and when a separation from service has occurred shall be made in accordance with the presumptions set forth in Treasury Regulation Section 1.409A-1(h).

(d) The parties intend that this Agreement will be administered in accordance with Section 409A of the Code. To the extent that any provision of this Agreement is ambiguous as to its compliance with Section 409A of the Code, the provision shall be read in such a manner so that all payments hereunder comply with Section 409A of the Code. Each payment pursuant to this Agreement is intended to constitute a separate payment for purposes of Treasury Regulation Section 1.409A-2(b)(2). The parties agree that this Agreement may be amended, as reasonably requested by either party, and as may be necessary to fully comply with Section 409A of the Code and all related rules and regulations in order to preserve the payments and benefits provided hereunder without additional cost to either party.

(e) The Company makes no representation or warranty and shall have no liability to the Executive or any other person if any provisions of this Agreement are determined to constitute deferred compensation subject to Section 409A of the Code but do not satisfy an exemption from, or the conditions of, such Section.

7. Confidential Information, Noncompetition and Cooperation. The Executive agrees to terms of the Assignment of Invention, Nondisclosure and Noncompetition Agreement ("Restrictive Covenant Agreement") attached hereto as Exhibit A, the terms of which are hereby incorporated by reference as material terms of this Agreement.

8. Consent to Jurisdiction. The parties hereby consent to the jurisdiction of the Superior Court of the Commonwealth of Massachusetts and the United States District Court for the District of Massachusetts. Accordingly, with respect to any such court action, the Executive (a) submits to the personal jurisdiction of such courts; (b) consents to service of process; and (c) waives any other requirement (whether imposed by statute, rule of court, or otherwise) with respect to personal jurisdiction or service of process.

9. Integration. This Agreement constitutes the entire agreement between the parties with respect to the subject matter hereof and supersedes all prior agreements between the parties concerning such subject matter.

10. Withholding. All payments made by the Company to the Executive under this Agreement shall be net of any tax or other amounts required to be withheld by the Company under applicable law.

11. Successor to the Executive. This Agreement shall inure to the benefit of and be enforceable by the Executive's personal representatives, executors, administrators, heirs, distributees, devisees and legatees. In the event of the Executive's death after his termination of employment but prior to the completion by the Company of all payments due him under this Agreement, the Company shall continue such payments to the Executive's beneficiary designated in writing to the Company prior to his death (or to his estate, if the Executive fails to make such designation).

12. Enforceability. If any portion or provision of this Agreement (including, without limitation, any portion or provision of any section of this Agreement) shall to any extent be declared illegal or unenforceable by a court of competent jurisdiction, then the remainder of this Agreement, or the application of such portion or provision in circumstances other than those as to which it is so declared illegal or unenforceable, shall not be affected thereby, and each portion and provision of this Agreement shall be valid and enforceable to the fullest extent permitted by law.

13. Survival. The provisions of this Agreement shall survive the termination of this Agreement and/or the termination of the Executive's employment to the extent necessary to effectuate the terms contained herein.

14. Waiver. No waiver of any provision hereof shall be effective unless made in writing and signed by the waiving party. The failure of any party to require the performance of any term or obligation of this Agreement, or the waiver by any party of any breach of this Agreement, shall not prevent any subsequent enforcement of such term or obligation or be deemed a waiver of any subsequent breach.

15. Notices. Any notices, requests, demands and other communications provided for by this Agreement shall be sufficient if in writing and delivered in person or sent by a nationally recognized overnight courier service or by registered or certified mail, postage prepaid, return receipt requested, to the Executive at the last address the Executive has filed in writing with the Company or, in the case of the Company, at its main offices, attention of the Board.

16. Amendment. This Agreement may be amended or modified only by a written instrument signed by the Executive and by a duly authorized representative of the Company.

17. Governing Law. This is a Massachusetts contract and shall be construed under and be governed in all respects by the laws of the Commonwealth of Massachusetts, without giving effect to the conflict of laws principles of such Commonwealth. With respect to any disputes concerning federal law, such disputes shall be determined in accordance with the law as it would be interpreted and applied by the United States Court of Appeals for the First Circuit.

18. Counterparts. This Agreement may be executed in any number of counterparts, each of which when so executed and delivered shall be taken to be an original; but such counterparts shall together constitute one and the same document.

19. Successor to Company. The Company shall require any successor (whether direct or indirect, by purchase, merger, consolidation or otherwise) to all or substantially all of the business or assets of the Company expressly to assume and agree to perform this Agreement to the same extent that the Company would be required to perform it if no succession had taken place. Failure of the Company to obtain an assumption of this Agreement at or prior to the effectiveness of any succession shall be a material breach of this Agreement.

20. Gender Neutral. Wherever used herein, a pronoun in the masculine gender shall be considered as including the feminine gender unless the context clearly indicates otherwise.

IN WITNESS WHEREOF, the parties have executed this Agreement effective on the date and year first above written.

BLUEBIRD BIO, INC.

By: /s/ Jeffrey T. Walsh
Its: Chief Operating Officer

/s/ Nick Leschly
Nick Leschly

[Signature Page to the Amended and Restated Employment Agreement]

Exhibit A

Restrictive Covenant Agreement

EXHIBIT A

bluebird bio, Inc.

Form of Assignment of Invention, Nondisclosure and Noncompetition Agreement

In consideration and as a material condition of my employment by bluebird bio, Inc. (along with its subsidiaries and affiliates the "Company"), I agree as follows:

1. **Proprietary Information.** I agree that all information, whether or not in writing, concerning the Company's business, technology, business relationships or financial affairs which the Company has not released to the general public (collectively, "Proprietary Information") is and will be the exclusive property of the Company. By way of illustration, Proprietary Information may include information or material which has not been made generally available to the public, such as: (a) *corporate information*, including plans, strategies, methods, policies, resolutions, negotiations or litigation; (b) *marketing information*, including strategies, methods, customer identities or other information about customers, prospect identities or other information about prospects, or market analyses or projections; (c) *financial information*, including cost and performance data, debt arrangements, equity structure, investors and holdings, purchasing and sales data and price lists; and (d) *operational and technological information*, including plans, specifications, manuals, forms, templates, software, designs, methods, procedures, formulas, discoveries, inventions, improvements, concepts and ideas; and (e) *personnel information*, including personnel lists, reporting or organizational structure, resumes, personnel data, compensation structure, performance evaluations and termination arrangements or documents. Proprietary Information also includes information received in confidence by the Company from its customers or suppliers or other third parties.

2. **Recognition of Company's Rights.** I will not, at any time, without the Company's prior written permission, either during or after my employment, disclose any Proprietary Information to anyone outside of the Company, or use or permit to be used any Proprietary Information for any purpose other than in connection with the performance of my duties as an employee of the Company. I will cooperate with the Company and use my best efforts to prevent the unauthorized disclosure of all Proprietary Information. I will deliver to the Company all copies of Proprietary Information in my possession or control upon the earlier of a request by the Company or termination of my employment.

3. **Rights of Others.** I understand that the Company is now and may hereafter be subject to non-disclosure or confidentiality agreements with third persons which require the Company to protect or refrain from use of proprietary information. I agree to be bound by the terms of such of those agreements as to which I have knowledge in the event I have access to such proprietary information.

4. **Commitment to Company; Avoidance of Conflict of Interest.** Subject to the express terms of my employment agreement with the Company, while an employee of the Company, I will devote my full-time efforts to the Company's business and I will not engage in any other business activity that conflicts with my duties to the Company. I will advise the president of the Company or his or her nominee at such time as any activity of either the Company or another business presents me with a conflict of interest or the appearance of a conflict of interest as an employee of the Company. I will take whatever action is requested of me by the Company to resolve any conflict or appearance of conflict which it finds to exist.

5. **Developments.** I will make full and prompt disclosure to the Company of all inventions, discoveries, designs, developments, methods, modifications, improvements, processes, algorithms, databases, computer programs, formulae, techniques, trade secrets, graphics or images, and audio or visual works and other works of authorship related to the business of the Company (collectively "Developments"), whether or not patentable or copyrightable, that are created, made, conceived or reduced to practice by me (alone or jointly with others) or under my direction during the period of my employment. I acknowledge that all work performed by me for the Company is on a "work for hire" basis, and I hereby do assign and transfer and, to the extent any such assignment cannot be made at present, will assign and transfer, to the Company and its successors and assigns all my right, title and interest in all Developments made, conceived or reduced to practice by me (alone or jointly with others) that (a) relate to the business of the Company or any customer of or supplier to the Company or any of the products or services being researched, developed, manufactured or sold by the Company or which may be used with such products or services; or (b) result from tasks assigned to me by the Company; or (c) result from the use of premises or personal property (whether tangible or intangible) owned, leased or contracted for by the Company ("Company-Related Developments"), and all related patents, patent applications, trademarks and trademark applications, copyrights and copyright applications, and other intellectual property rights in all countries and territories worldwide and under any international conventions ("Intellectual Property Rights").

To preclude any possible uncertainty, I have set forth on Exhibit A attached hereto a complete list of Developments that I have, alone or jointly with others, conceived, developed or reduced to practice prior to the commencement of my employment with the Company that I consider to be my property or the property of third parties and that I wish to have excluded from the scope of this Agreement ("Prior Inventions"). If disclosure of any such Prior Invention would cause me to violate any prior confidentiality agreement, I understand that I am not to list such Prior Inventions in Exhibit A but am only to disclose a cursory name for each such invention, a listing of the party(ies) to whom it belongs

and the fact that full disclosure as to such inventions has not been made for that reason. I have also listed on Exhibit A all patents and patent applications in which I am named as an inventor, other than those which have been assigned to the Company ("Other Patent Rights"). If no such disclosure is attached, I represent that there are no Prior Inventions or Other Patent Rights. If, in the course of my employment with the Company, I incorporate a Prior Invention into a Company product, process or machine or other work done for the Company, I hereby grant to the Company a nonexclusive, royalty-free, paid-up, irrevocable, worldwide license (with the full right to sublicense) to make, have made, modify, use, sell, offer for sale and import such Prior Invention. Notwithstanding the foregoing, I will not incorporate, or permit to be incorporated, Prior Inventions in any Company-Related Development without the Company's prior written consent.

This Agreement does not obligate me to assign to the Company any Development which, in the sole judgment of the Company, reasonably exercised, is developed entirely on my own time and does not relate to the business efforts or research and development efforts in which, during the period of my employment, the Company actually is engaged or reasonably would be engaged, and does not result from the use of premises or equipment owned or leased by the Company. However, I will also promptly disclose to the Company any such Developments for the purpose of determining whether they qualify for such exclusion. I understand that to the extent this Agreement is required to be construed in accordance with the laws of any state which precludes a requirement in an employee agreement to assign certain classes of inventions made by an employee, this paragraph 5 will be interpreted not to apply to any invention which a court rules and/or the Company agrees falls within such classes. I also hereby waive all claims to any moral rights or other special rights which I may have or accrue in any Company-Related Developments.

6. **Documents and Other Materials.** I will keep and maintain adequate and current records of all Proprietary Information and Company-Related Developments developed by me during my employment, which records will be available to and remain the sole property of the Company at all times.

All files, letters, notes, memoranda, reports, records, data, sketches, drawings, notebooks, layouts, charts, quotations and proposals, specification sheets, program listings, blueprints, models, prototypes, or other written, photographic or other tangible material containing Proprietary Information, whether created by me or others, which come into my custody or possession, are the exclusive property of the Company to be used by me only in the performance of my duties for the Company. Any property situated on the Company's premises and owned by the Company, including without limitation computers, disks and other storage media, filing cabinets or other work areas, is subject to inspection by the Company at any time with or without notice. In the event of the termination of my employment for any reason, I will deliver to the Company all files, letters, notes, memoranda, reports, records, data, sketches, drawings, notebooks, layouts, charts, quotations and proposals, specification sheets, program listings, blueprints, models, prototypes, or other written, photographic or other tangible material containing Proprietary Information, and other materials of any nature pertaining to the Proprietary Information of the Company and to my work, and will not take or keep in my possession any of the foregoing or any copies.

7. **Enforcement of Intellectual Property Rights.** I will cooperate fully with the Company, both during and after my employment with the Company, with respect to the procurement, maintenance and enforcement of Intellectual Property Rights in Company-Related Developments. I will sign, both during and after the term of this Agreement, all papers, including without limitation copyright applications, patent applications, declarations, oaths, assignments of priority rights, and powers of attorney, which the Company may deem necessary or desirable in order to protect its rights and interests in any Company-Related Development. If the Company is unable, after reasonable effort, to secure my signature on any such papers, I hereby irrevocably designate and appoint each officer of the Company as my agent and attorney-in-fact to execute any such papers on my behalf, and to take any and all actions as the Company may deem necessary or desirable in order to protect its rights and interests in any Company-Related Development.

8. **Non-Competition and Non-Solicitation.** In order to protect the Company's Proprietary Information and good will, during my employment and for a period of twelve (12) months following the termination of my employment for any reason (the "Restricted Period"), I will not directly or indirectly, whether as owner, partner, shareholder, director, manager, consultant, agent, employee, co-venturer or otherwise, engage, participate or invest in any business activity anywhere in the world that develops, manufactures or markets any products, or performs any services, that are competitive with the products or services of the Company, or products or services that the Company or its affiliates, has under development or that are the subject of active planning at any time during my employment; provided that this shall not prohibit any possible investment in publicly traded stock of a company representing less than one percent of the stock of such company. In addition, during the Restricted Period, I will not, directly or indirectly, in any manner, other than for the benefit of the Company, (a) call upon, solicit, divert, take away, accept or conduct any business from or with any of the customers or prospective customers of the Company or any of its suppliers, and/or (b) solicit, entice, attempt to persuade any other employee or consultant of the Company to leave the Company for any reason or otherwise participate in or facilitate the hire, directly or through another entity, of any person who is employed or engaged by the Company or who was employed or engaged by the Company within six months of any attempt to hire such person. I acknowledge and agree that if I violate any of the provisions of this paragraph 8, the running of the Restricted Period will be extended by the time during which I engage in such violation(s). For purposes of this Agreement, a "prospective customer" means any potential customer of the Company which I knew or reasonably should have known that the Company was actively soliciting (other than through a general campaign) or actively considered soliciting (other than through a general campaign) at any time within the twelve (12) calendar months prior to the last day of my employment.

9. **Prior Agreements.** I hereby represent that, except as I have fully disclosed previously in writing to the Company, I am not bound by the terms of any agreement with any previous employer or other party to refrain from using or disclosing any trade secret or confidential or proprietary information in the course of my employment with the Company or to refrain from competing, directly or indirectly, with the business of such previous employer or any other party. I further represent that my performance of all the terms of this Agreement as an employee of the Company does not and will not breach any agreement to keep in confidence proprietary information, knowledge or data acquired by me in confidence or in trust prior to my employment with the Company. I will not disclose to the Company or induce the Company to use any confidential or proprietary information or material belonging to any previous employer or others.

10. **Remedies Upon Breach.** I understand that the restrictions contained in this Agreement are necessary for the protection of the business and goodwill of the Company and I consider them to be reasonable for such purpose. Any breach of this Agreement is likely to cause the Company substantial and irrevocable damage and therefore, in the event of such breach, the Company, in addition to such other remedies which may be available, will be entitled to specific performance and other injunctive relief, without the posting of a bond. If I violate this Agreement, in addition to all other remedies available to the Company at law, in equity, and under contract, I agree that I am obligated to pay all the Company's costs of enforcement of this Agreement, including attorneys' fees and expenses.

11. **Use of Voice, Image and Likeness.** I give the Company permission to use any and all of my voice, image and likeness, with or without using my name, in connection with the products and/or services of the Company, for the purposes of advertising and promoting such products and/or services and/or the Company, and/or for other purposes deemed appropriate by the Company in its reasonable discretion, except to the extent expressly prohibited by law.

12. **Publications and Public Statements.** I will obtain the Company's written approval before publishing or submitting for publication any material that relates to my work at the Company and/or incorporates any Proprietary Information. To ensure that the Company delivers a consistent message about its products, services and operations to the public, and further in recognition that even positive statements may have a detrimental effect on the Company in certain securities transactions and other contexts, any statement about the Company which I create, publish or post during my period of employment and for six (6) months thereafter, on any media accessible by the public, including but not limited to electronic bulletin boards and Internet-based chat rooms, must first be reviewed and approved by an officer of the Company before it is released in the public domain.

13. **No Employment Obligation.** I understand that this Agreement does not create an obligation on the Company or any other person to continue my employment. I acknowledge that, unless otherwise agreed in a formal written employment agreement signed on behalf of the Company by an authorized officer, my employment with the Company is at will and therefore may be terminated by the Company or me at any time and for any reason, with or without cause.

14. **Survival and Assignment by the Company.** I understand that my obligations under this Agreement will continue in accordance with its express terms regardless of any changes in my title, position, duties, salary, compensation or benefits or other terms and conditions of employment. I further understand that my obligations under this Agreement will continue following the termination of my employment regardless of the manner of such termination and will be binding upon my heirs, executors and administrators. The Company will have the right to assign this Agreement to its affiliates, successors and assigns. I expressly consent to be bound by the provisions of this Agreement for the benefit of the Company or any parent, subsidiary or affiliate to whose employ I may be transferred or successor who assumes my employment agreement with the Company without the necessity that this Agreement be resigned at the time of such transfer or assumption.

15. **Exit Interview.** If and when I depart from the Company, I may be required to attend an exit interview and sign an "Employee Exit Acknowledgement" to reaffirm my acceptance and acknowledgement of the obligations set forth in this Agreement. For twelve (12) months following termination of my employment, I will notify the Company of any change in my address and of each subsequent employment or business activity, including the name and address of my employer or other post-Company employment plans and the nature of my activities.

16. **Disclosure to Future Employers.** During the Restricted Period, I will provide a copy of this Agreement to any prospective employer, partner or coventurer prior to entering into an employment, partnership or other business relationship with such person or entity.

17. **Severability.** In case any provisions (or portions thereof) contained in this Agreement shall, for any reason, be held invalid, illegal or unenforceable in any respect, such invalidity, illegality or unenforceability shall not affect the other provisions of this Agreement, and this Agreement shall be construed as if such invalid, illegal or unenforceable provision had never been contained herein. If, moreover, any one or more of the provisions contained in this Agreement shall for any reason be held to be excessively broad as to duration, geographical scope, activity or subject, it shall be construed by limiting and reducing it, so as to be enforceable to the extent compatible with the applicable law as it shall then appear.

18. **Interpretation.** This Agreement will be deemed to be made and entered into in the Commonwealth of Massachusetts, and will in all respects be interpreted, enforced and governed under the laws of the Commonwealth of Massachusetts. I hereby agree to consent to personal jurisdiction of the state and federal courts situated within Suffolk County, Massachusetts for purposes of enforcing this Agreement, and waive any objection that I might have to personal jurisdiction or venue in those courts.

I UNDERSTAND THAT THIS AGREEMENT AFFECTS IMPORTANT RIGHTS. BY SIGNING BELOW, I CERTIFY THAT I HAVE READ IT CAREFULLY AND AM SATISFIED THAT I UNDERSTAND IT COMPLETELY.

IN WITNESS WHEREOF, the undersigned has executed this agreement as a sealed instrument as of the date set forth below.

Signed: _____

Type or print name:

Date:

EXHIBIT A

To: **bluebird bio, Inc.**

From: _____

Date: _____

SUBJECT: **Prior Inventions**

The following is a complete list of all inventions or improvements relevant to the subject matter of my employment by the Company that have been made or conceived or first reduced to practice by me alone or jointly with others prior to my engagement by the Company:

☐ No inventions or improvements

☐ See below:

_____

_____

_____

☐ Additional sheets attached

The following is a list of all patents and patent applications in which I have been named as an inventor:

☐ None

☐ See below:

_____

_____

_____

Exhibit 10.13

AMENDED AND RESTATED
EMPLOYMENT AGREEMENT

This Employment Agreement ("Agreement") is between bluebird bio, Inc., a Delaware corporation (the "Company"), and Jeffrey T. Walsh (the "Executive") and is made effective as of the closing of the Company's first underwritten public offering of its equity securities pursuant to an effective registration statement under the Securities Act of 1933, as amended (the "IPO"), provided the IPO is consummated prior to December 31, 2013 (the "Effective Date").

WHEREAS, the Company and the Executive previously entered in an offer letter agreement, dated April 27, 2011 (the "Offer Letter"), which the Company and the Executive intend to replace with this Agreement; and

WHEREAS, the Company desires to continue to employ the Executive and the Executive desires to continue to be employed by the Company on the new terms and conditions contained herein.

NOW, THEREFORE, in consideration of the mutual covenants and agreements herein contained and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties agree as follows:

1. Employment.

(a) Term. The term of this Agreement shall commence on the Effective Date and continue until terminated in accordance with the provisions of Section 3 (the "Term").

(b) Position and Duties. During the Term, the Executive shall serve as the Chief Operating Officer of the Company, and shall have supervision and control over and responsibility for the day-to-day business and affairs of the Company and shall have such other powers and duties as may from time to time be prescribed by the Chairman of the Board of Directors of the Company (the "Board"), the Chief Executive Officer of the Company (the "CEO") or other authorized executive, provided that such duties are consistent with the Executive's position or other positions that he may hold from time to time. The Executive shall report to the CEO. The Executive shall devote his full working time and efforts to the business and affairs of the Company. Notwithstanding the foregoing, the Executive may serve on other boards of directors, with the approval of the Board, or engage in religious, charitable or other community activities as long as such services and activities are disclosed to the Board and do not materially interfere with the Executive's performance of his duties to the Company as provided in this Agreement.

2. Compensation and Related Matters.

(a) Base Salary. During the Term, the Executive's initial annual base salary shall be $320,000. The Executive's base salary shall be redetermined annually by the Board or the Compensation Committee. The annual base salary in effect at any given time is referred to herein as "Base Salary." The Base Salary shall be payable in a manner that is consistent with the Company's usual payroll practices for senior executives.

(b) Incentive Compensation. During the Term, the Executive shall be eligible to receive cash incentive compensation as determined by the Board or the Compensation Committee from time to time. The Executive's target annual incentive compensation shall be 40 percent (40%) of his Base Salary. To earn incentive compensation, the Executive must be employed by the Company on the day such incentive compensation is paid.

(c) Expenses. The Executive shall be entitled to receive prompt reimbursement for all reasonable expenses incurred by him during the Term in performing services hereunder, in accordance with the policies and procedures then in effect and established by the Company for its senior executive officers.

(d) Other Benefits. During the Term, the Executive shall be eligible to participate in or receive benefits under the Company's employee benefit plans in effect from time to time, subject to the terms of such plans.

(e) Vacations. During the Term, the Executive shall be entitled to accrue paid vacation in accordance with the Company's applicable policy.

3. Termination. During the Term, the Executive's employment hereunder may be terminated without any breach of this Agreement under the following circumstances:

(a) Death. The Executive's employment hereunder shall terminate upon his death.

(b) Disability. The Company may terminate the Executive's employment if he is disabled and unable to perform the essential functions of the Executive's then existing position or positions under this Agreement with or without reasonable accommodation for a period of 180 days (which need not be consecutive) in any 12-month period. If any question shall arise as to whether during any period the Executive is disabled so as to be unable to perform the essential functions of the Executive's then existing position or positions with or without reasonable accommodation, the Executive may, and at the request of the Company shall, submit to the Company a certification in reasonable detail by a physician selected by the Company to whom the Executive or the Executive's guardian has no reasonable objection as to whether the Executive is so disabled or how long such disability is expected to continue, and such certification shall for the purposes of this Agreement be conclusive of the issue. The Executive shall cooperate with any reasonable request of the physician in connection with such certification. If such question shall arise and the Executive shall fail to submit such certification, the Company's determination of such issue shall be binding on the Executive. Nothing in this Section 3(b) shall be construed to waive the Executive's rights, if any, under existing law including, without limitation, the Family and Medical Leave Act of 1993, 29 U.S.C. §2601 *et seq*. and the Americans with Disabilities Act, 42 U.S.C. §12101 *et seq*.

(c) Termination by Company for Cause. The Company may terminate the Executive's employment hereunder for Cause by a vote of the Board at a meeting of the Board called and held for such purpose. For purposes of this Agreement, "Cause" shall mean: (i) the Executive's dishonest statements or acts with respect to the Company, any affiliate of the Company or any of the Company's current or prospective customers, suppliers, vendors or other

third parties with which such entity does business; (ii) the Executive's commission of a felony or any misdemeanor involving moral turpitude, deceit, dishonesty or fraud; (iii) the Executive's failure to perform his assigned duties to the reasonable satisfaction of the Company, which failure continues, in the reasonable judgment of the Company, after written notice given to the Executive by the Company; (iv) the Executive's gross negligence, willful misconduct or insubordination with respect to the Company or any affiliate of the Company; or (v) the Executive's violation of any provision of any agreement(s) between the Executive and the Company relating to noncompetition, nondisclosure and/or assignment of inventions.

(d) Termination Without Cause. The Company may terminate the Executive's employment hereunder at any time without Cause. Any termination by the Company of the Executive's employment under this Agreement which does not constitute a termination for Cause under Section 3(c) and does not result from the death or disability of the Executive under Section 3(a) or (b) shall be deemed a termination without Cause.

(e) Termination by the Executive. The Executive may terminate his employment hereunder at any time for any reason, including but not limited to Good Reason. For purposes of this Agreement, "Good Reason" shall mean that the Executive has complied with the "Good Reason Process" (hereinafter defined) following the occurrence of any of the following events without the Executive's express written consent: (i) a material diminution in the Executive's responsibilities, authority and function; (ii) a material reduction in the Executive's Base Salary except pursuant to a salary reduction program affecting substantially all of the employees of the Company, provided, that it does not adversely affect the Executive to a greater extent than other similarly situated employees and, provided further, that any reduction in the Executive's Base Salary of more than ten percent (10%) shall constitute Good Reason; (iii) a material change of more than 30 miles in the geographic location at which the Executive must provide services to the Company (except for required travel on Company business to an extent substantially consistent with the Executive's usual business travel obligations); or (iv) the material breach by the Company of the Company's equity incentive plan or the stock option agreement governing the stock option granted to the Executive in connection with his hire (as described in the Offer Letter) or any other material agreement between the Executive and the Company, if any, concerning the terms and conditions of the Executive's employment, benefits or compensation. "Good Reason Process" shall mean that (i) the Executive reasonably determines in good faith that a "Good Reason" condition has occurred; (ii) the Executive notifies the Company in writing of the first occurrence of the Good Reason condition within 60 days of the first occurrence of such condition; (iii) the Executive cooperates in good faith with the Company's efforts, for a period not less than 30 days following such notice (the "Cure Period") to remedy the condition; (iv) notwithstanding such efforts, the Good Reason condition continues to exist; and (v) the Executive terminates his employment within 60 days after the end of the Cure Period. If the Company cures the Good Reason condition during the Cure Period, Good Reason shall be deemed not to have occurred.

(f) Notice of Termination. Except for termination as specified in Section 3(a), any termination of the Executive's employment by the Company or any such termination by the Executive shall be communicated by written Notice of Termination to the other party hereto. For purposes of this Agreement, a "Notice of Termination" shall mean a notice which shall indicate the specific termination provision in this Agreement relied upon.

(g) Date of Termination. "Date of Termination" shall mean: (i) if the Executive's employment is terminated by his death, the date of his death; (ii) if the Executive's employment is terminated on account of disability under Section 3(b) or by the Company for Cause under Section 3(c), the date on which Notice of Termination is given; (iii) if the Executive's employment is terminated by the Company under Section 3(d), the date on which a Notice of Termination is given; (iv) if the Executive's employment is terminated by the Executive under Section 3(e) without Good Reason, 30 days after the date on which a Notice of Termination is given, and (v) if the Executive's employment is terminated by the Executive under Section 3(e) with Good Reason, the date on which a Notice of Termination is given after the end of the Cure Period. Notwithstanding the foregoing, (A) in the event that the Executive gives a Notice of Termination to the Company, the Company may unilaterally accelerate the Date of Termination and such acceleration shall not result in a termination by the Company for purposes of this Agreement, and (B) in the event that the Company terminates the Executive's employment without Cause under Section 3(d), the Company may unilaterally accelerate the Date of Termination to any earlier effective date provided that the Company continues to pay the Executive the Base Salary for the 30-day period immediately following the date on which a Notice of Termination is given to the Executive.

4. Compensation Upon Termination.

(a) Termination Generally. If the Executive's employment with the Company is terminated for any reason, the Company shall pay or provide to the Executive (or to his authorized representative or estate) (i) any Base Salary earned through the Date of Termination, unpaid expense reimbursements (subject to, and in accordance with, Section 2(c) of this Agreement) and unused vacation that accrued through the Date of Termination on or before the time required by law but in no event more than 30 days after the Executive's Date of Termination; and (ii) any vested benefits the Executive may have under any employee benefit plan of the Company through the Date of Termination, which vested benefits shall be paid and/or provided in accordance with the terms of such employee benefit plans (collectively, the "Accrued Benefit").

(b) Termination by the Company Without Cause or by the Executive with Good Reason. During the Term, if the Executive's employment is terminated by the Company without Cause as provided in Section 3(d), or the Executive terminates his employment for Good Reason as provided in Section 3(e), then the Company shall pay the Executive his Accrued Benefit. In addition, subject to the Executive signing a separation agreement containing, among other provisions, a general release of claims in favor of the Company and related persons and entities, confidentiality, return of property and non-disparagement, in a form and manner satisfactory to the Company (the "Separation Agreement and Release") and the Separation Agreement and Release becoming fully effective, all within the time frame set forth in the Separation Agreement and Release:

(i) the Company shall pay the Executive an amount equal to one times the Executive's Base Salary the "Severance Amount"); and

(ii) if the Executive was participating in the Company's group health plan immediately prior to the Date of Termination and elects COBRA health continuation, then the Company shall pay to the Executive a monthly cash payment for 12 months or the Executive's COBRA health continuation period, whichever ends earlier, in an amount equal to the monthly employer contribution that the Company would have made to provide health insurance to the Executive if the Executive had remained employed by the Company; and

(iii) the amounts payable under this Section 4(b) shall be paid out in substantially equal installments in accordance with the Company's payroll practice over 12 months commencing within 60 days after the Date of Termination; provided, however, that if the 60-day period begins in one calendar year and ends in a second calendar year, the Severance Amount shall begin to be paid in the second calendar year by the last day of such 60-day period; provided, further, that the initial payment shall include a catch-up payment to cover amounts retroactive to the day immediately following the Date of Termination. Each payment pursuant to this Agreement is intended to constitute a separate payment for purposes of Treasury Regulation Section 1.409A-2(b)(2).

(iv) The receipt of any severance payments or benefits pursuant to Section 4 will be subject to Executive not violating the Restrictive Covenant Agreement referenced in Section 7 of this Agreement and attached hereto as Exhibit A, the terms of which are hereby incorporated by reference. In the event Executive breaches the Restrictive Covenant Agreement, in addition to all other legal and equitable remedies, the Company shall have the right to terminate or suspend all continuing payments and benefits to which Executive may otherwise be entitled pursuant to Section 4 without affecting the Executive's release or Executive's obligations under the Separation Agreement and Release.

5. Change in Control Payment. The provisions of this Section 5 set forth certain terms of an agreement reached between the Executive and the Company regarding the Executive's rights and obligations upon the occurrence of a Change in Control of the Company. These provisions are intended to assure and encourage in advance the Executive's continued attention and dedication to his assigned duties and his objectivity during the pendency and after the occurrence of any such event. These provisions shall apply in lieu of, and expressly supersede, the provisions of Section 4(b) regarding severance pay and benefits upon a termination of employment, if such termination of employment occurs within 12 months after the occurrence of the first event constituting a Change in Control. These provisions shall terminate and be of no further force or effect beginning 12 months after the occurrence of a Change in Control.

(a) Change in Control. During the Term, if within 12 months after a Change in Control, the Executive's employment is terminated by the Company without Cause as provided in Section 3(d) or the Executive terminates his employment for Good Reason as provided in Section 3(e), then, subject to the signing of the Separation Agreement and Release by the Executive and the Separation Agreement and Release becoming irrevocable, all within 60 days after the Date of Termination,

(i) the Company shall pay the Executive a lump sum in cash in an amount equal to one times the sum of (A) the Executive's current Base Salary (or the Executive's Base Salary in effect immediately prior to the Change in Control, if higher) plus (B) the Executive's Target Incentive Compensation. For purposes of this Agreement, "Target Incentive Compensation" shall mean the Executive's target annual incentive compensation as set forth in Section 2(b); and

(ii) notwithstanding anything to the contrary in any applicable option agreement or stock-based award agreement, all stock options and other stock-based awards granted to the Executive after the date of this Agreement shall immediately accelerate and become fully exercisable or nonforfeitable as of the Date of Termination. The treatment of stock options and other stock-based awards held by the Executive as of the date of this Agreement shall be governed by the terms of the applicable option agreement or other stock-based award agreement; and

(iii) if the Executive was participating in the Company's group health plan immediately prior to the Date of Termination and elects COBRA health continuation, then the Company shall pay to the Executive a monthly cash payment for 12 months or the Executive's COBRA health continuation period, whichever ends earlier, in an amount equal to the monthly employer contribution that the Company would have made to provide health insurance to the Executive if the Executive had remained employed by the Company; and

(iv) The amounts payable under this Section 5(a) shall be paid or commence to be paid within 60 days after the Date of Termination; provided, however, that if the 60-day period begins in one calendar year and ends in a second calendar year, such payment shall be paid or commence to be paid in the second calendar year by the last day of such 60-day period.

(b) Additional Limitation.

(i) Anything in this Agreement to the contrary notwithstanding, in the event that the amount of any compensation, payment or distribution by the Company to or for the benefit of the Executive, whether paid or payable or distributed or distributable pursuant to the terms of this Agreement or otherwise, calculated in a manner consistent with Section 280G of the Internal Revenue Code of 1986, as amended (the "Code") and the applicable regulations thereunder (the "Severance Payments"), would be subject to the excise tax imposed by Section 4999 of the Code, the following provisions shall apply:

(A) If the Severance Payments, reduced by the sum of (1) the Excise Tax and (2) the total of the federal, state, and local income and employment taxes payable by the Executive on the amount of the Severance Payments which are in excess of the Threshold Amount, are greater than or equal to the Threshold Amount, the Executive shall be entitled to the full benefits payable under this Agreement.

(B) If the Threshold Amount is less than (x) the Severance Payments, but greater than (y) the Severance Payments reduced by the sum of (1) the Excise Tax and (2) the total of the federal, state, and local income and employment taxes on the amount of the Severance Payments which are in excess of the Threshold Amount, then the Severance Payments shall be reduced (but not below zero) to the extent necessary so that the sum of all Severance Payments shall not exceed the Threshold Amount. In such event, the Severance Payments shall be reduced in the following order: (1) cash payments not subject to Section 409A of the Code; (2) cash payments subject to Section 409A of the Code; (3) equity-based payments and acceleration; and (4) non-cash forms of benefits. To the extent any payment is to be made over time (e.g., in installments, etc.), then the payments shall be reduced in reverse chronological order.

(ii) For the purposes of this Section 5(b), "Threshold Amount" shall mean three times the Executive's "base amount" within the meaning of Section 280G(b)(3) of the Code and the regulations promulgated thereunder less one dollar ($1.00); and "Excise Tax" shall mean the excise tax imposed by Section 4999 of the Code, and any interest or penalties incurred by the Executive with respect to such excise tax.

(iii) The determination as to which of the alternative provisions of Section 5(b)(i) shall apply to the Executive shall be made by a nationally recognized accounting firm selected by the Company (the "Accounting Firm"), which shall provide detailed supporting calculations both to the Company and the Executive within 15 business days of the Date of Termination, if applicable, or at such earlier time as is reasonably requested by the Company or the Executive. For purposes of determining which of the alternative provisions of Section 5(b)(i) shall apply, the Executive shall be deemed to pay federal income taxes at the highest marginal rate of federal income taxation applicable to individuals for the calendar year in which the determination is to be made, and state and local income taxes at the highest marginal rates of individual taxation in the state and locality of the Executive's residence on the Date of Termination, net of the maximum reduction in federal income taxes which could be obtained from deduction of such state and local taxes. Any determination by the Accounting Firm shall be binding upon the Company and the Executive.

(b) Definitions. For purposes of this Section 5, the following terms shall have the following meanings:

"Change in Control" shall mean "Sale Event," as such term is defined in the Company's 2013 Stock Option and Incentive Plan.

6. Section 409A.

(a) Anything in this Agreement to the contrary notwithstanding, if at the time of the Executive's separation from service within the meaning of Section 409A of the Code, the Company determines that the Executive is a "specified employee" within the meaning of Section 409A(a)(2)(B)(i) of the Code, then to the extent any payment or benefit that the Executive becomes entitled to under this Agreement on account of the Executive's separation from service would be considered deferred compensation otherwise subject to the 20 percent additional tax imposed pursuant to Section 409A(a) of the Code as a result of the application of Section

409A(a)(2)(B)(i) of the Code, such payment shall not be payable and such benefit shall not be provided until the date that is the earlier of (A) six months and one day after the Executive's separation from service, or (B) the Executive's death. If any such delayed cash payment is otherwise payable on an installment basis, the first payment shall include a catch-up payment covering amounts that would otherwise have been paid during the six-month period but for the application of this provision, and the balance of the installments shall be payable in accordance with their original schedule.

(b) All in-kind benefits provided and expenses eligible for reimbursement under this Agreement shall be provided by the Company or incurred by the Executive during the time periods set forth in this Agreement. All reimbursements shall be paid as soon as administratively practicable, but in no event shall any reimbursement be paid after the last day of the taxable year following the taxable year in which the expense was incurred. The amount of in-kind benefits provided or reimbursable expenses incurred in one taxable year shall not affect the in-kind benefits to be provided or the expenses eligible for reimbursement in any other taxable year (except for any lifetime or other aggregate limitation applicable to medical expenses). Such right to reimbursement or in-kind benefits is not subject to liquidation or exchange for another benefit.

(c) To the extent that any payment or benefit described in this Agreement constitutes "non-qualified deferred compensation" under Section 409A of the Code, and to the extent that such payment or benefit is payable upon the Executive's termination of employment, then such payments or benefits shall be payable only upon the Executive's "separation from service." The determination of whether and when a separation from service has occurred shall be made in accordance with the presumptions set forth in Treasury Regulation Section 1.409A-1(h).

(d) The parties intend that this Agreement will be administered in accordance with Section 409A of the Code. To the extent that any provision of this Agreement is ambiguous as to its compliance with Section 409A of the Code, the provision shall be read in such a manner so that all payments hereunder comply with Section 409A of the Code. Each payment pursuant to this Agreement is intended to constitute a separate payment for purposes of Treasury Regulation Section 1.409A-2(b)(2). The parties agree that this Agreement may be amended, as reasonably requested by either party, and as may be necessary to fully comply with Section 409A of the Code and all related rules and regulations in order to preserve the payments and benefits provided hereunder without additional cost to either party.

(e) The Company makes no representation or warranty and shall have no liability to the Executive or any other person if any provisions of this Agreement are determined to constitute deferred compensation subject to Section 409A of the Code but do not satisfy an exemption from, or the conditions of, such Section.

7. Confidential Information, Noncompetition and Cooperation. The Executive agrees to terms of the Assignment of Invention, Nondisclosure and Noncompetition Agreement ("Restrictive Covenant Agreement") attached hereto as Exhibit A, the terms of which are hereby incorporated by reference as material terms of this Agreement.

8. Consent to Jurisdiction. The parties hereby consent to the jurisdiction of the Superior Court of the Commonwealth of Massachusetts and the United States District Court for the District of Massachusetts. Accordingly, with respect to any such court action, the Executive (a) submits to the personal jurisdiction of such courts; (b) consents to service of process; and (c) waives any other requirement (whether imposed by statute, rule of court, or otherwise) with respect to personal jurisdiction or service of process.

9. Integration. This Agreement constitutes the entire agreement between the parties with respect to the subject matter hereof and supersedes all prior agreements between the parties concerning such subject matter.

10. Withholding. All payments made by the Company to the Executive under this Agreement shall be net of any tax or other amounts required to be withheld by the Company under applicable law.

11. Successor to the Executive. This Agreement shall inure to the benefit of and be enforceable by the Executive's personal representatives, executors, administrators, heirs, distributees, devisees and legatees. In the event of the Executive's death after his termination of employment but prior to the completion by the Company of all payments due him under this Agreement, the Company shall continue such payments to the Executive's beneficiary designated in writing to the Company prior to his death (or to his estate, if the Executive fails to make such designation).

12. Enforceability. If any portion or provision of this Agreement (including, without limitation, any portion or provision of any section of this Agreement) shall to any extent be declared illegal or unenforceable by a court of competent jurisdiction, then the remainder of this Agreement, or the application of such portion or provision in circumstances other than those as to which it is so declared illegal or unenforceable, shall not be affected thereby, and each portion and provision of this Agreement shall be valid and enforceable to the fullest extent permitted by law.

13. Survival. The provisions of this Agreement shall survive the termination of this Agreement and/or the termination of the Executive's employment to the extent necessary to effectuate the terms contained herein.

14. Waiver. No waiver of any provision hereof shall be effective unless made in writing and signed by the waiving party. The failure of any party to require the performance of any term or obligation of this Agreement, or the waiver by any party of any breach of this Agreement, shall not prevent any subsequent enforcement of such term or obligation or be deemed a waiver of any subsequent breach.

15. Notices. Any notices, requests, demands and other communications provided for by this Agreement shall be sufficient if in writing and delivered in person or sent by a nationally recognized overnight courier service or by registered or certified mail, postage prepaid, return receipt requested, to the Executive at the last address the Executive has filed in writing with the Company or, in the case of the Company, at its main offices, attention of the Board.

16. Amendment. This Agreement may be amended or modified only by a written instrument signed by the Executive and by a duly authorized representative of the Company.

17. Governing Law. This is a Massachusetts contract and shall be construed under and be governed in all respects by the laws of the Commonwealth of Massachusetts, without giving effect to the conflict of laws principles of such Commonwealth. With respect to any disputes concerning federal law, such disputes shall be determined in accordance with the law as it would be interpreted and applied by the United States Court of Appeals for the First Circuit.

18. Counterparts. This Agreement may be executed in any number of counterparts, each of which when so executed and delivered shall be taken to be an original; but such counterparts shall together constitute one and the same document.

19. Successor to Company. The Company shall require any successor (whether direct or indirect, by purchase, merger, consolidation or otherwise) to all or substantially all of the business or assets of the Company expressly to assume and agree to perform this Agreement to the same extent that the Company would be required to perform it if no succession had taken place. Failure of the Company to obtain an assumption of this Agreement at or prior to the effectiveness of any succession shall be a material breach of this Agreement.

20. Gender Neutral. Wherever used herein, a pronoun in the masculine gender shall be considered as including the feminine gender unless the context clearly indicates otherwise.

IN WITNESS WHEREOF, the parties have executed this Agreement effective on the date and year first above written.

BLUEBIRD BIO, INC.

By: /s/ Nick Leschly
Its: Chief Executive Officer

/s/ Jeffrey T. Walsh
Jeffrey T. Walsh

Exhibit A

Restrictive Covenant Agreement

EXHIBIT A

bluebird bio, Inc.

Form of Assignment of Invention, Nondisclosure and Noncompetition Agreement

In consideration and as a material condition of my employment by bluebird bio, Inc. (along with its subsidiaries and affiliates the "Company"), I agree as follows:

1. **Proprietary Information.** I agree that all information, whether or not in writing, concerning the Company's business, technology, business relationships or financial affairs which the Company has not released to the general public (collectively, "Proprietary Information") is and will be the exclusive property of the Company. By way of illustration, Proprietary Information may include information or material which has not been made generally available to the public, such as: (a) *corporate information*, including plans, strategies, methods, policies, resolutions, negotiations or litigation; (b) *marketing information*, including strategies, methods, customer identities or other information about customers, prospect identities or other information about prospects, or market analyses or projections; (c) *financial information*, including cost and performance data, debt arrangements, equity structure, investors and holdings, purchasing and sales data and price lists; and (d) *operational and technological information*, including plans, specifications, manuals, forms, templates, software, designs, methods, procedures, formulas, discoveries, inventions, improvements, concepts and ideas; and (e) *personnel information*, including personnel lists, reporting or organizational structure, resumes, personnel data, compensation structure, performance evaluations and termination arrangements or documents. Proprietary Information also includes information received in confidence by the Company from its customers or suppliers or other third parties.

2. **Recognition of Company's Rights.** I will not, at any time, without the Company's prior written permission, either during or after my employment, disclose any Proprietary Information to anyone outside of the Company, or use or permit to be used any Proprietary Information for any purpose other than in connection with the performance of my duties as an employee of the Company. I will cooperate with the Company and use my best efforts to prevent the unauthorized disclosure of all Proprietary Information. I will deliver to the Company all copies of Proprietary Information in my possession or control upon the earlier of a request by the Company or termination of my employment.

3. **Rights of Others.** I understand that the Company is now and may hereafter be subject to non-disclosure or confidentiality agreements with third persons which require the Company to protect or refrain from use of proprietary information. I agree to be bound by the terms of such of those agreements as to which I have knowledge in the event I have access to such proprietary information.

4. **Commitment to Company; Avoidance of Conflict of Interest.** Subject to the express terms of my employment agreement with the Company, while an employee of the Company, I will devote my full-time efforts to the Company's business and I will not engage in any other business activity that conflicts with my duties to the Company. I will advise the president of the Company or his or her nominee at such time as any activity of either the Company or another business presents me with a conflict of interest or the appearance of a conflict of interest as an employee of the Company. I will take whatever action is requested of me by the Company to resolve any conflict or appearance of conflict which it finds to exist.

5. **Developments.** I will make full and prompt disclosure to the Company of all inventions, discoveries, designs, developments, methods, modifications, improvements, processes, algorithms, databases, computer programs, formulae, techniques, trade secrets, graphics or images, and audio or visual works and other works of authorship related to the business of the Company (collectively "Developments"), whether or not patentable or copyrightable, that are created, made, conceived or reduced to practice by me (alone or jointly with others) or under my direction during the period of my employment. I acknowledge that all work performed by me for the Company is on a "work for hire" basis, and I hereby do assign and transfer and, to the extent any such assignment cannot be made at present, will assign and transfer, to the Company and its successors and assigns all my right, title and interest in all Developments made, conceived or reduced to practice by me (alone or jointly with others) that (a) relate to the business of the Company or any customer of or supplier to the Company or any of the products or services being researched, developed, manufactured or sold by the Company or which may be used with such products or services; or (b) result from tasks assigned to me by the Company; or (c) result from the use of premises or personal property (whether tangible or intangible) owned, leased or contracted for by the Company ("Company-Related Developments"), and all related patents, patent applications, trademarks and trademark applications, copyrights and copyright applications, and other intellectual property rights in all countries and territories worldwide and under any international conventions ("Intellectual Property Rights").

To preclude any possible uncertainty, I have set forth on Exhibit A attached hereto a complete list of Developments that I have, alone or jointly with others, conceived, developed or reduced to practice prior to the commencement of my employment with the Company that I consider to be my property or the property of third parties and that I wish to have excluded from the scope of this Agreement ("Prior Inventions"). If disclosure of any such Prior Invention would cause me to violate any prior confidentiality agreement, I understand that I am not to list such Prior Inventions in Exhibit A but am only to disclose a cursory name for each such invention, a listing of the party(ies) to whom it belongs

and the fact that full disclosure as to such inventions has not been made for that reason. I have also listed on Exhibit A all patents and patent applications in which I am named as an inventor, other than those which have been assigned to the Company ("Other Patent Rights"). If no such disclosure is attached, I represent that there are no Prior Inventions or Other Patent Rights. If, in the course of my employment with the Company, I incorporate a Prior Invention into a Company product, process or machine or other work done for the Company, I hereby grant to the Company a nonexclusive, royalty-free, paid-up, irrevocable, worldwide license (with the full right to sublicense) to make, have made, modify, use, sell, offer for sale and import such Prior Invention. Notwithstanding the foregoing, I will not incorporate, or permit to be incorporated, Prior Inventions in any Company-Related Development without the Company's prior written consent.

This Agreement does not obligate me to assign to the Company any Development which, in the sole judgment of the Company, reasonably exercised, is developed entirely on my own time and does not relate to the business efforts or research and development efforts in which, during the period of my employment, the Company actually is engaged or reasonably would be engaged, and does not result from the use of premises or equipment owned or leased by the Company. However, I will also promptly disclose to the Company any such Developments for the purpose of determining whether they qualify for such exclusion. I understand that to the extent this Agreement is required to be construed in accordance with the laws of any state which precludes a requirement in an employee agreement to assign certain classes of inventions made by an employee, this paragraph 5 will be interpreted not to apply to any invention which a court rules and/or the Company agrees falls within such classes. I also hereby waive all claims to any moral rights or other special rights which I may have or accrue in any Company-Related Developments.

6. **Documents and Other Materials.** I will keep and maintain adequate and current records of all Proprietary Information and Company-Related Developments developed by me during my employment, which records will be available to and remain the sole property of the Company at all times.

All files, letters, notes, memoranda, reports, records, data, sketches, drawings, notebooks, layouts, charts, quotations and proposals, specification sheets, program listings, blueprints, models, prototypes, or other written, photographic or other tangible material containing Proprietary Information, whether created by me or others, which come into my custody or possession, are the exclusive property of the Company to be used by me only in the performance of my duties for the Company. Any property situated on the Company's premises and owned by the Company, including without limitation computers, disks and other storage media, filing cabinets or other work areas, is subject to inspection by the Company at any time with or without notice. In the event of the termination of my employment for any reason, I will deliver to the Company all files, letters, notes, memoranda, reports, records, data, sketches, drawings, notebooks, layouts, charts, quotations and proposals, specification sheets, program listings, blueprints, models, prototypes, or other written, photographic or other tangible material containing Proprietary Information, and other materials of any nature pertaining to the Proprietary Information of the Company and to my work, and will not take or keep in my possession any of the foregoing or any copies.

7. **Enforcement of Intellectual Property Rights.** I will cooperate fully with the Company, both during and after my employment with the Company, with respect to the procurement, maintenance and enforcement of Intellectual Property Rights in Company-Related Developments. I will sign, both during and after the term of this Agreement, all papers, including without limitation copyright applications, patent applications, declarations, oaths, assignments of priority rights, and powers of attorney, which the Company may deem necessary or desirable in order to protect its rights and interests in any Company-Related Development. If the Company is unable, after reasonable effort, to secure my signature on any such papers, I hereby irrevocably designate and appoint each officer of the Company as my agent and attorney-in-fact to execute any such papers on my behalf, and to take any and all actions as the Company may deem necessary or desirable in order to protect its rights and interests in any Company-Related Development.

8. **Non-Competition and Non-Solicitation.** In order to protect the Company's Proprietary Information and good will, during my employment and for a period of twelve (12) months following the termination of my employment for any reason (the "Restricted Period"), I will not directly or indirectly, whether as owner, partner, shareholder, director, manager, consultant, agent, employee, co-venturer or otherwise, engage, participate or invest in any business activity anywhere in the world that develops, manufactures or markets any products, or performs any services, that are competitive with the products or services of the Company, or products or services that the Company or its affiliates, has under development or that are the subject of active planning at any time during my employment; provided that this shall not prohibit any possible investment in publicly traded stock of a company representing less than one percent of the stock of such company. In addition, during the Restricted Period, I will not, directly or indirectly, in any manner, other than for the benefit of the Company, (a) call upon, solicit, divert, take away, accept or conduct any business from or with any of the customers or prospective customers of the Company or any of its suppliers, and/or (b) solicit, entice, attempt to persuade any other employee or consultant of the Company to leave the Company for any reason or otherwise participate in or facilitate the hire, directly or through another entity, of any person who is employed or engaged by the Company or who was employed or engaged by the Company within six months of any attempt to hire such person. I acknowledge and agree that if I violate any of the provisions of this paragraph 8, the running of the Restricted Period will be extended by the time during which I engage in such violation(s). For purposes of this Agreement, a "prospective customer" means any potential customer of the Company which I knew or reasonably should have known that the Company was actively soliciting (other than through a general campaign) or actively considered soliciting (other than through a general campaign) at any time within the twelve (12) calendar months prior to the last day of my employment.

9. **Prior Agreements.** I hereby represent that, except as I have fully disclosed previously in writing to the Company, I am not bound by the terms of any agreement with any previous employer or other party to refrain from using or disclosing any trade secret or confidential or proprietary information in the course of my employment with the Company or to refrain from competing, directly or indirectly, with the business of such previous employer or any other party. I further represent that my performance of all the terms of this Agreement as an employee of the Company does not and will not breach any agreement to keep in confidence proprietary information, knowledge or data acquired by me in confidence or in trust prior to my employment with the Company. I will not disclose to the Company or induce the Company to use any confidential or proprietary information or material belonging to any previous employer or others.

10. **Remedies Upon Breach.** I understand that the restrictions contained in this Agreement are necessary for the protection of the business and goodwill of the Company and I consider them to be reasonable for such purpose. Any breach of this Agreement is likely to cause the Company substantial and irrevocable damage and therefore, in the event of such breach, the Company, in addition to such other remedies which may be available, will be entitled to specific performance and other injunctive relief, without the posting of a bond. If I violate this Agreement, in addition to all other remedies available to the Company at law, in equity, and under contract, I agree that I am obligated to pay all the Company's costs of enforcement of this Agreement, including attorneys' fees and expenses.

11. **Use of Voice, Image and Likeness.** I give the Company permission to use any and all of my voice, image and likeness, with or without using my name, in connection with the products and/or services of the Company, for the purposes of advertising and promoting such products and/or services and/or the Company, and/or for other purposes deemed appropriate by the Company in its reasonable discretion, except to the extent expressly prohibited by law.

12. **Publications and Public Statements.** I will obtain the Company's written approval before publishing or submitting for publication any material that relates to my work at the Company and/or incorporates any Proprietary Information. To ensure that the Company delivers a consistent message about its products, services and operations to the public, and further in recognition that even positive statements may have a detrimental effect on the Company in certain securities transactions and other contexts, any statement about the Company which I create, publish or post during my period of employment and for six (6) months thereafter, on any media accessible by the public, including but not limited to electronic bulletin boards and Internet-based chat rooms, must first be reviewed and approved by an officer of the Company before it is released in the public domain.

13. **No Employment Obligation.** I understand that this Agreement does not create an obligation on the Company or any other person to continue my employment. I acknowledge that, unless otherwise agreed in a formal written employment agreement signed on behalf of the Company by an authorized officer, my employment with the Company is at will and therefore may be terminated by the Company or me at any time and for any reason, with or without cause.

14. **Survival and Assignment by the Company.** I understand that my obligations under this Agreement will continue in accordance with its express terms regardless of any changes in my title, position, duties, salary, compensation or benefits or other terms and conditions of employment. I further understand that my obligations under this Agreement will continue following the termination of my employment regardless of the manner of such termination and will be binding upon my heirs, executors and administrators. The Company will have the right to assign this Agreement to its affiliates, successors and assigns. I expressly consent to be bound by the provisions of this Agreement for the benefit of the Company or any parent, subsidiary or affiliate to whose employ I may be transferred or successor who assumes my employment agreement with the Company without the necessity that this Agreement be resigned at the time of such transfer or assumption.

15. **Exit Interview.** If and when I depart from the Company, I may be required to attend an exit interview and sign an "Employee Exit Acknowledgement" to reaffirm my acceptance and acknowledgement of the obligations set forth in this Agreement. For twelve (12) months following termination of my employment, I will notify the Company of any change in my address and of each subsequent employment or business activity, including the name and address of my employer or other post-Company employment plans and the nature of my activities.

16. **Disclosure to Future Employers.** During the Restricted Period, I will provide a copy of this Agreement to any prospective employer, partner or coventurer prior to entering into an employment, partnership or other business relationship with such person or entity.

17. **Severability.** In case any provisions (or portions thereof) contained in this Agreement shall, for any reason, be held invalid, illegal or unenforceable in any respect, such invalidity, illegality or unenforceability shall not affect the other provisions of this Agreement, and this Agreement shall be construed as if such invalid, illegal or unenforceable provision had never been contained herein. If, moreover, any one or more of the provisions contained in this Agreement shall for any reason be held to be excessively broad as to duration, geographical scope, activity or subject, it shall be construed by limiting and reducing it, so as to be enforceable to the extent compatible with the applicable law as it shall then appear.

18. **Interpretation.** This Agreement will be deemed to be made and entered into in the Commonwealth of Massachusetts, and will in all respects be interpreted, enforced and governed under the laws of the Commonwealth of Massachusetts. I hereby agree to consent to personal jurisdiction of the state and federal courts situated within Suffolk County, Massachusetts for purposes of enforcing this Agreement, and waive any objection that I might have to personal jurisdiction or venue in those courts.

I UNDERSTAND THAT THIS AGREEMENT AFFECTS IMPORTANT RIGHTS. BY SIGNING BELOW, I CERTIFY THAT I HAVE READ IT CAREFULLY AND AM SATISFIED THAT I UNDERSTAND IT COMPLETELY.

IN WITNESS WHEREOF, the undersigned has executed this agreement as a sealed instrument as of the date set forth below.

Signed: _____

Type or print name:

Date:

EXHIBIT A

To: **bluebird bio, Inc.**

From: _____

Date: _____

SUBJECT: **Prior Inventions**

The following is a complete list of all inventions or improvements relevant to the subject matter of my employment by the Company that have been made or conceived or first reduced to practice by me alone or jointly with others prior to my engagement by the Company:

☐ No inventions or improvements

☐ See below:

_____

_____

_____

☐ Additional sheets attached

The following is a list of all patents and patent applications in which I have been named as an inventor:

☐ None

☐ See below:

_____

_____

_____

Exhibit 10.14

AMENDED AND RESTATED
EMPLOYMENT AGREEMENT

This Employment Agreement ("Agreement") is between bluebird bio, Inc., a Delaware corporation (the "Company"), and Mitchell Finer (the "Executive") and is made effective as of the closing of the Company's first underwritten public offering of its equity securities pursuant to an effective registration statement under the Securities Act of 1933, as amended (the "IPO"), provided the IPO is consummated prior to December 31, 2013 (the "Effective Date").

WHEREAS, the Company and the Executive previously entered in an offer letter agreement, dated February 23, 2011, as amended on July 28, 2011 (the "Offer Letter"), which the Company and the Executive intend to replace with this Agreement; and

WHEREAS, the Company desires to continue to employ the Executive and the Executive desires to continue to be employed by the Company on the new terms and conditions contained herein.

NOW, THEREFORE, in consideration of the mutual covenants and agreements herein contained and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties agree as follows:

1. Employment.

(a) Term. The term of this Agreement shall commence on the Effective Date and continue until terminated in accordance with the provisions of Section 3 (the "Term").

(b) Position and Duties. During the Term, the Executive shall serve as the Chief Science Officer of the Company, and shall have supervision and control over and responsibility for the day-to-day business and affairs of the Company and shall have such other powers and duties as may from time to time be prescribed by the Chairman of the Board of Directors of the Company (the "Board"), the Chief Executive Officer of the Company (the "CEO") or other authorized executive, provided that such duties are consistent with the Executive's position or other positions that he may hold from time to time. The Executive shall report to the CEO. The Executive shall devote his full working time and efforts to the business and affairs of the Company. Notwithstanding the foregoing, the Executive may serve on other boards of directors, with the approval of the Board, or engage in religious, charitable or other community activities as long as such services and activities are disclosed to the Board and do not materially interfere with the Executive's performance of his duties to the Company as provided in this Agreement.

2. Compensation and Related Matters.

(a) Base Salary. During the Term, the Executive's initial annual base salary shall be $306,000. The Executive's base salary shall be redetermined annually by the Board or the Compensation Committee. The annual base salary in effect at any given time is referred to herein as "Base Salary." The Base Salary shall be payable in a manner that is consistent with the Company's usual payroll practices for senior executives.

(b) Incentive Compensation. During the Term, the Executive shall be eligible to receive cash incentive compensation as determined by the Board or the Compensation Committee from time to time. The Executive's target annual incentive compensation shall be 35 percent (35%) of his Base Salary. To earn incentive compensation, the Executive must be employed by the Company on the day such incentive compensation is paid.

(c) Expenses. The Executive shall be entitled to receive prompt reimbursement for all reasonable expenses incurred by him during the Term in performing services hereunder, in accordance with the policies and procedures then in effect and established by the Company for its senior executive officers.

(d) Other Benefits. During the Term, the Executive shall be eligible to participate in or receive benefits under the Company's employee benefit plans in effect from time to time, subject to the terms of such plans.

(e) Vacations. During the Term, the Executive shall be entitled to accrue paid vacation in accordance with the Company's applicable policy.

3. Termination. During the Term, the Executive's employment hereunder may be terminated without any breach of this Agreement under the following circumstances:

(a) Death. The Executive's employment hereunder shall terminate upon his death.

(b) Disability. The Company may terminate the Executive's employment if he is disabled and unable to perform the essential functions of the Executive's then existing position or positions under this Agreement with or without reasonable accommodation for a period of 180 days (which need not be consecutive) in any 12-month period. If any question shall arise as to whether during any period the Executive is disabled so as to be unable to perform the essential functions of the Executive's then existing position or positions with or without reasonable accommodation, the Executive may, and at the request of the Company shall, submit to the Company a certification in reasonable detail by a physician selected by the Company to whom the Executive or the Executive's guardian has no reasonable objection as to whether the Executive is so disabled or how long such disability is expected to continue, and such certification shall for the purposes of this Agreement be conclusive of the issue. The Executive shall cooperate with any reasonable request of the physician in connection with such certification. If such question shall arise and the Executive shall fail to submit such certification, the Company's determination of such issue shall be binding on the Executive. Nothing in this Section 3(b) shall be construed to waive the Executive's rights, if any, under existing law including, without limitation, the Family and Medical Leave Act of 1993, 29 U.S.C. §2601 *et seq*. and the Americans with Disabilities Act, 42 U.S.C. §12101 *et seq*.

(c) Termination by Company for Cause. The Company may terminate the Executive's employment hereunder for Cause by a vote of the Board at a meeting of the Board called and held for such purpose. For purposes of this Agreement, "Cause" shall mean: (i) the Executive's dishonest statements or acts with respect to the Company, any affiliate of the Company or any of the Company's current or prospective customers, suppliers, vendors or other

third parties with which such entity does business; (ii) the Executive's commission of a felony or any misdemeanor involving moral turpitude, deceit, dishonesty or fraud; (iii) the Executive's failure to perform his assigned duties to the reasonable satisfaction of the Company, which failure continues, in the reasonable judgment of the Company, after written notice given to the Executive by the Company; (iv) the Executive's gross negligence, willful misconduct or insubordination with respect to the Company or any affiliate of the Company; or (v) the Executive's violation of any provision of any agreement(s) between the Executive and the Company relating to noncompetition, nondisclosure and/or assignment of inventions.

(d) Termination Without Cause. The Company may terminate the Executive's employment hereunder at any time without Cause. Any termination by the Company of the Executive's employment under this Agreement which does not constitute a termination for Cause under Section 3(c) and does not result from the death or disability of the Executive under Section 3(a) or (b) shall be deemed a termination without Cause.

(e) Termination by the Executive. The Executive may terminate his employment hereunder at any time for any reason, including but not limited to Good Reason. For purposes of this Agreement, "Good Reason" shall mean that the Executive has complied with the "Good Reason Process" (hereinafter defined) following the occurrence of any of the following events without the Executive's express written consent: (i) a material diminution in the Executive's responsibilities, authority and function; (ii) a material reduction in the Executive's Base Salary except pursuant to a salary reduction program affecting substantially all of the employees of the Company, provided, that it does not adversely affect the Executive to a greater extent than other similarly situated employees and, provided further, that any reduction in the Executive's Base Salary of more than ten percent (10%) shall constitute Good Reason; (iii) a material change of more than 30 miles in the geographic location at which the Executive must perform services for the Company (except for required travel on Company business to an extent substantially consistent with the Executive's usual business travel obligations); or (iv) the material breach by the Company of the Company's equity incentive plan or the stock option agreements governing certain stock options granted to the Executive (as described in the Offer Letter) or any other material agreement between the Executive and the Company, if any, concerning the terms and conditions of the Executive's employment, benefits or compensation. "Good Reason Process" shall mean that (i) the Executive reasonably determines in good faith that a "Good Reason" condition has occurred; (ii) the Executive notifies the Company in writing of the first occurrence of the Good Reason condition within 30 days of the first occurrence of such condition; (iii) the Executive cooperates in good faith with the Company's efforts, for a period not less than 30 days following such notice (the "Cure Period") to remedy the condition; (iv) notwithstanding such efforts, the Good Reason condition continues to exist; and (v) the Executive terminates his employment within 30 days after the end of the Cure Period. If the Company cures the Good Reason condition during the Cure Period, Good Reason shall be deemed not to have occurred.

(f) Notice of Termination. Except for termination as specified in Section 3(a), any termination of the Executive's employment by the Company or any such termination by the Executive shall be communicated by written Notice of Termination to the other party hereto. For purposes of this Agreement, a "Notice of Termination" shall mean a notice which shall indicate the specific termination provision in this Agreement relied upon.

(g) Date of Termination. "Date of Termination" shall mean: (i) if the Executive's employment is terminated by his death, the date of his death; (ii) if the Executive's employment is terminated on account of disability under Section 3(b) or by the Company for Cause under Section 3(c), the date on which Notice of Termination is given; (iii) if the Executive's employment is terminated by the Company under Section 3(d), the date on which a Notice of Termination is given; (iv) if the Executive's employment is terminated by the Executive under Section 3(e) without Good Reason, 30 days after the date on which a Notice of Termination is given, and (v) if the Executive's employment is terminated by the Executive under Section 3(e) with Good Reason, the date on which a Notice of Termination is given after the end of the Cure Period. Notwithstanding the foregoing, (A) in the event that the Executive gives a Notice of Termination to the Company, the Company may unilaterally accelerate the Date of Termination and such acceleration shall not result in a termination by the Company for purposes of this Agreement, and (B) in the event that the Company terminates the Executive's employment without Cause under Section 3(d), the Company may unilaterally accelerate the Date of Termination to any earlier effective date provided that the Company continues to pay the Executive the Base Salary for the 30-day period immediately following the date on which a Notice of Termination is given to the Executive.

4. Compensation Upon Termination.

(a) Termination Generally. If the Executive's employment with the Company is terminated for any reason, the Company shall pay or provide to the Executive (or to his authorized representative or estate) (i) any Base Salary earned through the Date of Termination, unpaid expense reimbursements (subject to, and in accordance with, Section 2(c) of this Agreement) and unused vacation that accrued through the Date of Termination on or before the time required by law but in no event more than 30 days after the Executive's Date of Termination; and (ii) any vested benefits the Executive may have under any employee benefit plan of the Company through the Date of Termination, which vested benefits shall be paid and/or provided in accordance with the terms of such employee benefit plans (collectively, the "Accrued Benefit").

(b) Termination by the Company Without Cause or by the Executive with Good Reason. During the Term, if the Executive's employment is terminated by the Company without Cause as provided in Section 3(d), or the Executive terminates his employment for Good Reason as provided in Section 3(e), then the Company shall pay the Executive his Accrued Benefit. In addition, subject to the Executive signing a separation agreement containing, among other provisions, a general release of claims in favor of the Company and related persons and entities, confidentiality, return of property and non-disparagement, in a form and manner satisfactory to the Company (the "Separation Agreement and Release") and the Separation Agreement and Release becoming fully effective, all within the time frame set forth in the Separation Agreement and Release:

(i) the Company shall pay the Executive an amount equal to one times the Executive's Base Salary the "Severance Amount"); and

(ii) if the Executive was participating in the Company's group health plan immediately prior to the Date of Termination and elects COBRA health continuation, then the Company shall pay to the Executive a monthly cash payment for 12 months or the Executive's COBRA health continuation period, whichever ends earlier, in an amount equal to the monthly employer contribution that the Company would have made to provide health insurance to the Executive if the Executive had remained employed by the Company; and

(iii) the amounts payable under this Section 4(b) shall be paid out in substantially equal installments in accordance with the Company's payroll practice over 12 months commencing within 60 days after the Date of Termination; provided, however, that if the 60-day period begins in one calendar year and ends in a second calendar year, the Severance Amount shall begin to be paid in the second calendar year by the last day of such 60-day period; provided, further, that the initial payment shall include a catch-up payment to cover amounts retroactive to the day immediately following the Date of Termination. Each payment pursuant to this Agreement is intended to constitute a separate payment for purposes of Treasury Regulation Section 1.409A-2(b)(2).

(iv) The receipt of any severance payments or benefits pursuant to Section 4 will be subject to Executive not violating the Restrictive Covenant Agreement referenced in Section 7 of this Agreement and attached hereto as Exhibit A, the terms of which are hereby incorporated by reference. In the event Executive breaches the Restrictive Covenant Agreement, in addition to all other legal and equitable remedies, the Company shall have the right to terminate or suspend all continuing payments and benefits to which Executive may otherwise be entitled pursuant to Section 4 without affecting the Executive's release or Executive's obligations under the Separation Agreement and Release.

5. Change in Control Payment. The provisions of this Section 5 set forth certain terms of an agreement reached between the Executive and the Company regarding the Executive's rights and obligations upon the occurrence of a Change in Control of the Company. These provisions are intended to assure and encourage in advance the Executive's continued attention and dedication to his assigned duties and his objectivity during the pendency and after the occurrence of any such event. These provisions shall apply in lieu of, and expressly supersede, the provisions of Section 4(b) regarding severance pay and benefits upon a termination of employment, if such termination of employment occurs within 12 months after the occurrence of the first event constituting a Change in Control. These provisions shall terminate and be of no further force or effect beginning 12 months after the occurrence of a Change in Control.

(a) Change in Control. During the Term, if within 12 months after a Change in Control, the Executive's employment is terminated by the Company without Cause as provided in Section 3(d) or the Executive terminates his employment for Good Reason as provided in Section 3(e), then, subject to the signing of the Separation Agreement and Release by the Executive and the Separation Agreement and Release becoming irrevocable, all within 60 days after the Date of Termination,

(i) the Company shall pay the Executive a lump sum in cash in an amount equal to one times the sum of (A) the Executive's current Base Salary (or the Executive's Base Salary in effect immediately prior to the Change in Control, if higher) plus (B) the Executive's Target Incentive Compensation. For purposes of this Agreement, "Target Incentive Compensation" shall mean the Executive's target annual incentive compensation as set forth in Section 2(b); and

(ii) notwithstanding anything to the contrary in any applicable option agreement or stock-based award agreement, all stock options and other stock-based awards granted to the Executive after the date of this Agreement shall immediately accelerate and become fully exercisable or nonforfeitable as of the Date of Termination. The treatment of stock options and other stock-based awards held by the Executive as of the date of this Agreement shall be governed by the terms of the applicable option agreement or other stock-based award agreement; and

(iii) if the Executive was participating in the Company's group health plan immediately prior to the Date of Termination and elects COBRA health continuation, then the Company shall pay to the Executive a monthly cash payment for 12 months or the Executive's COBRA health continuation period, whichever ends earlier, in an amount equal to the monthly employer contribution that the Company would have made to provide health insurance to the Executive if the Executive had remained employed by the Company; and

(iv) The amounts payable under this Section 5(a) shall be paid or commence to be paid within 60 days after the Date of Termination; provided, however, that if the 60-day period begins in one calendar year and ends in a second calendar year, such payment shall be paid or commence to be paid in the second calendar year by the last day of such 60-day period.

(b) Additional Limitation.

(i) Anything in this Agreement to the contrary notwithstanding, in the event that the amount of any compensation, payment or distribution by the Company to or for the benefit of the Executive, whether paid or payable or distributed or distributable pursuant to the terms of this Agreement or otherwise, calculated in a manner consistent with Section 280G of the Internal Revenue Code of 1986, as amended (the "Code") and the applicable regulations thereunder (the "Severance Payments"), would be subject to the excise tax imposed by Section 4999 of the Code, the following provisions shall apply:

(A) If the Severance Payments, reduced by the sum of (1) the Excise Tax and (2) the total of the federal, state, and local income and employment taxes payable by the Executive on the amount of the Severance Payments which are in excess of the Threshold Amount, are greater than or equal to the Threshold Amount, the Executive shall be entitled to the full benefits payable under this Agreement.

(B) If the Threshold Amount is less than (x) the Severance Payments, but greater than (y) the Severance Payments reduced by the sum of (1) the Excise Tax and (2) the total of the federal, state, and local income and

employment taxes on the amount of the Severance Payments which are in excess of the Threshold Amount, then the Severance Payments shall be reduced (but not below zero) to the extent necessary so that the sum of all Severance Payments shall not exceed the Threshold Amount. In such event, the Severance Payments shall be reduced in the following order: (1) cash payments not subject to Section 409A of the Code; (2) cash payments subject to Section 409A of the Code; (3) equity-based payments and acceleration; and (4) non-cash forms of benefits. To the extent any payment is to be made over time (e.g., in installments, etc.), then the payments shall be reduced in reverse chronological order.

(ii) For the purposes of this Section 5(b), "Threshold Amount" shall mean three times the Executive's "base amount" within the meaning of Section 280G(b)(3) of the Code and the regulations promulgated thereunder less one dollar ($1.00); and "Excise Tax" shall mean the excise tax imposed by Section 4999 of the Code, and any interest or penalties incurred by the Executive with respect to such excise tax.

(iii) The determination as to which of the alternative provisions of Section 5(b)(i) shall apply to the Executive shall be made by a nationally recognized accounting firm selected by the Company (the "Accounting Firm"), which shall provide detailed supporting calculations both to the Company and the Executive within 15 business days of the Date of Termination, if applicable, or at such earlier time as is reasonably requested by the Company or the Executive. For purposes of determining which of the alternative provisions of Section 5(b)(i) shall apply, the Executive shall be deemed to pay federal income taxes at the highest marginal rate of federal income taxation applicable to individuals for the calendar year in which the determination is to be made, and state and local income taxes at the highest marginal rates of individual taxation in the state and locality of the Executive's residence on the Date of Termination, net of the maximum reduction in federal income taxes which could be obtained from deduction of such state and local taxes. Any determination by the Accounting Firm shall be binding upon the Company and the Executive.

(b) Definitions. For purposes of this Section 5, the following terms shall have the following meanings:

"Change in Control" shall mean "Sale Event," as such term is defined in the Company's 2013 Stock Option and Incentive Plan.

6. Section 409A.

(a) Anything in this Agreement to the contrary notwithstanding, if at the time of the Executive's separation from service within the meaning of Section 409A of the Code, the Company determines that the Executive is a "specified employee" within the meaning of Section 409A(a)(2)(B)(i) of the Code, then to the extent any payment or benefit that the Executive becomes entitled to under this Agreement on account of the Executive's separation from service would be considered deferred compensation otherwise subject to the 20 percent additional tax imposed pursuant to Section 409A(a) of the Code as a result of the application of Section

409A(a)(2)(B)(i) of the Code, such payment shall not be payable and such benefit shall not be provided until the date that is the earlier of (A) six months and one day after the Executive's separation from service, or (B) the Executive's death. If any such delayed cash payment is otherwise payable on an installment basis, the first payment shall include a catch-up payment covering amounts that would otherwise have been paid during the six-month period but for the application of this provision, and the balance of the installments shall be payable in accordance with their original schedule.

(b) All in-kind benefits provided and expenses eligible for reimbursement under this Agreement shall be provided by the Company or incurred by the Executive during the time periods set forth in this Agreement. All reimbursements shall be paid as soon as administratively practicable, but in no event shall any reimbursement be paid after the last day of the taxable year following the taxable year in which the expense was incurred. The amount of in-kind benefits provided or reimbursable expenses incurred in one taxable year shall not affect the in-kind benefits to be provided or the expenses eligible for reimbursement in any other taxable year (except for any lifetime or other aggregate limitation applicable to medical expenses). Such right to reimbursement or in-kind benefits is not subject to liquidation or exchange for another benefit.

(c) To the extent that any payment or benefit described in this Agreement constitutes "non-qualified deferred compensation" under Section 409A of the Code, and to the extent that such payment or benefit is payable upon the Executive's termination of employment, then such payments or benefits shall be payable only upon the Executive's "separation from service." The determination of whether and when a separation from service has occurred shall be made in accordance with the presumptions set forth in Treasury Regulation Section 1.409A-1(h).

(d) The parties intend that this Agreement will be administered in accordance with Section 409A of the Code. To the extent that any provision of this Agreement is ambiguous as to its compliance with Section 409A of the Code, the provision shall be read in such a manner so that all payments hereunder comply with Section 409A of the Code. Each payment pursuant to this Agreement is intended to constitute a separate payment for purposes of Treasury Regulation Section 1.409A-2(b)(2). The parties agree that this Agreement may be amended, as reasonably requested by either party, and as may be necessary to fully comply with Section 409A of the Code and all related rules and regulations in order to preserve the payments and benefits provided hereunder without additional cost to either party.

(e) The Company makes no representation or warranty and shall have no liability to the Executive or any other person if any provisions of this Agreement are determined to constitute deferred compensation subject to Section 409A of the Code but do not satisfy an exemption from, or the conditions of, such Section.

7. Confidential Information, Noncompetition and Cooperation. The Executive agrees to terms of the Assignment of Invention, Nondisclosure and Noncompetition Agreement ("Restrictive Covenant Agreement") attached hereto as Exhibit A, the terms of which are hereby incorporated by reference as material terms of this Agreement.

8. Consent to Jurisdiction. The parties hereby consent to the jurisdiction of the Superior Court of the Commonwealth of Massachusetts and the United States District Court for the District of Massachusetts. Accordingly, with respect to any such court action, the Executive (a) submits to the personal jurisdiction of such courts; (b) consents to service of process; and (c) waives any other requirement (whether imposed by statute, rule of court, or otherwise) with respect to personal jurisdiction or service of process.

9. Integration. This Agreement constitutes the entire agreement between the parties with respect to the subject matter hereof and supersedes all prior agreements between the parties concerning such subject matter.

10. Withholding. All payments made by the Company to the Executive under this Agreement shall be net of any tax or other amounts required to be withheld by the Company under applicable law.

11. Successor to the Executive. This Agreement shall inure to the benefit of and be enforceable by the Executive's personal representatives, executors, administrators, heirs, distributees, devisees and legatees. In the event of the Executive's death after his termination of employment but prior to the completion by the Company of all payments due him under this Agreement, the Company shall continue such payments to the Executive's beneficiary designated in writing to the Company prior to his death (or to his estate, if the Executive fails to make such designation).

12. Enforceability. If any portion or provision of this Agreement (including, without limitation, any portion or provision of any section of this Agreement) shall to any extent be declared illegal or unenforceable by a court of competent jurisdiction, then the remainder of this Agreement, or the application of such portion or provision in circumstances other than those as to which it is so declared illegal or unenforceable, shall not be affected thereby, and each portion and provision of this Agreement shall be valid and enforceable to the fullest extent permitted by law.

13. Survival. The provisions of this Agreement shall survive the termination of this Agreement and/or the termination of the Executive's employment to the extent necessary to effectuate the terms contained herein.

14. Waiver. No waiver of any provision hereof shall be effective unless made in writing and signed by the waiving party. The failure of any party to require the performance of any term or obligation of this Agreement, or the waiver by any party of any breach of this Agreement, shall not prevent any subsequent enforcement of such term or obligation or be deemed a waiver of any subsequent breach.

15. Notices. Any notices, requests, demands and other communications provided for by this Agreement shall be sufficient if in writing and delivered in person or sent by a nationally recognized overnight courier service or by registered or certified mail, postage prepaid, return receipt requested, to the Executive at the last address the Executive has filed in writing with the Company or, in the case of the Company, at its main offices, attention of the Board.

16. Amendment. This Agreement may be amended or modified only by a written instrument signed by the Executive and by a duly authorized representative of the Company.

17. Governing Law. This is a Massachusetts contract and shall be construed under and be governed in all respects by the laws of the Commonwealth of Massachusetts, without giving effect to the conflict of laws principles of such Commonwealth. With respect to any disputes concerning federal law, such disputes shall be determined in accordance with the law as it would be interpreted and applied by the United States Court of Appeals for the First Circuit.

18. Counterparts. This Agreement may be executed in any number of counterparts, each of which when so executed and delivered shall be taken to be an original; but such counterparts shall together constitute one and the same document.

19. Successor to Company. The Company shall require any successor (whether direct or indirect, by purchase, merger, consolidation or otherwise) to all or substantially all of the business or assets of the Company expressly to assume and agree to perform this Agreement to the same extent that the Company would be required to perform it if no succession had taken place. Failure of the Company to obtain an assumption of this Agreement at or prior to the effectiveness of any succession shall be a material breach of this Agreement.

20. Gender Neutral. Wherever used herein, a pronoun in the masculine gender shall be considered as including the feminine gender unless the context clearly indicates otherwise.

IN WITNESS WHEREOF, the parties have executed this Agreement effective on the date and year first above written.

BLUEBIRD BIO, INC.

By: /s/ Nick Leschly
Its: President and Chief Executive Officer

/s/ Mitchell Finer
Mitchell Finer

Exhibit A

Restrictive Covenant Agreement

EXHIBIT A

bluebird bio, Inc.

Form of Assignment of Invention, Nondisclosure and Noncompetition Agreement

In consideration and as a material condition of my employment by bluebird bio, Inc. (along with its subsidiaries and affiliates the "Company"), I agree as follows:

1. **Proprietary Information.** I agree that all information, whether or not in writing, concerning the Company's business, technology, business relationships or financial affairs which the Company has not released to the general public (collectively, "Proprietary Information") is and will be the exclusive property of the Company. By way of illustration, Proprietary Information may include information or material which has not been made generally available to the public, such as: (a) *corporate information*, including plans, strategies, methods, policies, resolutions, negotiations or litigation; (b) *marketing information*, including strategies, methods, customer identities or other information about customers, prospect identities or other information about prospects, or market analyses or projections; (c) *financial information*, including cost and performance data, debt arrangements, equity structure, investors and holdings, purchasing and sales data and price lists; and (d) *operational and technological information*, including plans, specifications, manuals, forms, templates, software, designs, methods, procedures, formulas, discoveries, inventions, improvements, concepts and ideas; and (e) *personnel information*, including personnel lists, reporting or organizational structure, resumes, personnel data, compensation structure, performance evaluations and termination arrangements or documents. Proprietary Information also includes information received in confidence by the Company from its customers or suppliers or other third parties.

2. **Recognition of Company's Rights.** I will not, at any time, without the Company's prior written permission, either during or after my employment, disclose any Proprietary Information to anyone outside of the Company, or use or permit to be used any Proprietary Information for any purpose other than in connection with the performance of my duties as an employee of the Company. I will cooperate with the Company and use my best efforts to prevent the unauthorized disclosure of all Proprietary Information. I will deliver to the Company all copies of Proprietary Information in my possession or control upon the earlier of a request by the Company or termination of my employment.

3. **Rights of Others.** I understand that the Company is now and may hereafter be subject to non-disclosure or confidentiality agreements with third persons which require the Company to protect or refrain from use of proprietary information. I agree to be bound by the terms of such of those agreements as to which I have knowledge in the event I have access to such proprietary information.

4. **Commitment to Company; Avoidance of Conflict of Interest.** Subject to the express terms of my employment agreement with the Company, while an employee of the Company, I will devote my full-time efforts to the Company's business and I will not engage in any other business activity that conflicts with my duties to the Company. I will advise the president of the Company or his or her nominee at such time as any activity of either the Company or another business presents me with a conflict of interest or the appearance of a conflict of interest as an employee of the Company. I will take whatever action is requested of me by the Company to resolve any conflict or appearance of conflict which it finds to exist.

5. **Developments.** I will make full and prompt disclosure to the Company of all inventions, discoveries, designs, developments, methods, modifications, improvements, processes, algorithms, databases, computer programs, formulae, techniques, trade secrets, graphics or images, and audio or visual works and other works of authorship related to the business of the Company (collectively "Developments"), whether or not patentable or copyrightable, that are created, made, conceived or reduced to practice by me (alone or jointly with others) or under my direction during the period of my employment. I acknowledge that all work performed by me for the Company is on a "work for hire" basis, and I hereby do assign and transfer and, to the extent any such assignment cannot be made at present, will assign and transfer, to the Company and its successors and assigns all my right, title and interest in all Developments made, conceived or reduced to practice by me (alone or jointly with others) that (a) relate to the business of the Company or any customer of or supplier to the Company or any of the products or services being researched, developed, manufactured or sold by the Company or which may be used with such products or services; or (b) result from tasks assigned to me by the Company; or (c) result from the use of premises or personal property (whether tangible or intangible) owned, leased or contracted for by the Company ("Company-Related Developments"), and all related patents, patent applications, trademarks and trademark applications, copyrights and copyright applications, and other intellectual property rights in all countries and territories worldwide and under any international conventions ("Intellectual Property Rights").

To preclude any possible uncertainty, I have set forth on Exhibit A attached hereto a complete list of Developments that I have, alone or jointly with others, conceived, developed or reduced to practice prior to the commencement of my employment with the Company that I consider to be my property or the property of third parties and that I wish to have excluded from the scope of this Agreement ("Prior Inventions"). If disclosure of any such Prior Invention would cause me to violate any prior confidentiality agreement, I understand that I am not to list such Prior Inventions in Exhibit A but am only to disclose a cursory name for each such invention, a listing of the party(ies) to whom it belongs

and the fact that full disclosure as to such inventions has not been made for that reason. I have also listed on Exhibit A all patents and patent applications in which I am named as an inventor, other than those which have been assigned to the Company ("Other Patent Rights"). If no such disclosure is attached, I represent that there are no Prior Inventions or Other Patent Rights. If, in the course of my employment with the Company, I incorporate a Prior Invention into a Company product, process or machine or other work done for the Company, I hereby grant to the Company a nonexclusive, royalty-free, paid-up, irrevocable, worldwide license (with the full right to sublicense) to make, have made, modify, use, sell, offer for sale and import such Prior Invention. Notwithstanding the foregoing, I will not incorporate, or permit to be incorporated, Prior Inventions in any Company-Related Development without the Company's prior written consent.

This Agreement does not obligate me to assign to the Company any Development which, in the sole judgment of the Company, reasonably exercised, is developed entirely on my own time and does not relate to the business efforts or research and development efforts in which, during the period of my employment, the Company actually is engaged or reasonably would be engaged, and does not result from the use of premises or equipment owned or leased by the Company. However, I will also promptly disclose to the Company any such Developments for the purpose of determining whether they qualify for such exclusion. I understand that to the extent this Agreement is required to be construed in accordance with the laws of any state which precludes a requirement in an employee agreement to assign certain classes of inventions made by an employee, this paragraph 5 will be interpreted not to apply to any invention which a court rules and/or the Company agrees falls within such classes. I also hereby waive all claims to any moral rights or other special rights which I may have or accrue in any Company-Related Developments.

6. **Documents and Other Materials.** I will keep and maintain adequate and current records of all Proprietary Information and Company-Related Developments developed by me during my employment, which records will be available to and remain the sole property of the Company at all times.

All files, letters, notes, memoranda, reports, records, data, sketches, drawings, notebooks, layouts, charts, quotations and proposals, specification sheets, program listings, blueprints, models, prototypes, or other written, photographic or other tangible material containing Proprietary Information, whether created by me or others, which come into my custody or possession, are the exclusive property of the Company to be used by me only in the performance of my duties for the Company. Any property situated on the Company's premises and owned by the Company, including without limitation computers, disks and other storage media, filing cabinets or other work areas, is subject to inspection by the Company at any time with or without notice. In the event of the termination of my employment for any reason, I will deliver to the Company all files, letters, notes, memoranda, reports, records, data, sketches, drawings, notebooks, layouts, charts, quotations and proposals, specification sheets, program listings, blueprints, models, prototypes, or other written, photographic or other tangible material containing Proprietary Information, and other materials of any nature pertaining to the Proprietary Information of the Company and to my work, and will not take or keep in my possession any of the foregoing or any copies.

7. **Enforcement of Intellectual Property Rights.** I will cooperate fully with the Company, both during and after my employment with the Company, with respect to the procurement, maintenance and enforcement of Intellectual Property Rights in Company-Related Developments. I will sign, both during and after the term of this Agreement, all papers, including without limitation copyright applications, patent applications, declarations, oaths, assignments of priority rights, and powers of attorney, which the Company may deem necessary or desirable in order to protect its rights and interests in any Company-Related Development. If the Company is unable, after reasonable effort, to secure my signature on any such papers, I hereby irrevocably designate and appoint each officer of the Company as my agent and attorney-in-fact to execute any such papers on my behalf, and to take any and all actions as the Company may deem necessary or desirable in order to protect its rights and interests in any Company-Related Development.

8. **Non-Competition and Non-Solicitation.** In order to protect the Company's Proprietary Information and good will, during my employment and for a period of twelve (12) months following the termination of my employment for any reason (the "Restricted Period"), I will not directly or indirectly, whether as owner, partner, shareholder, director, manager, consultant, agent, employee, co-venturer or otherwise, engage, participate or invest in any business activity anywhere in the world that develops, manufactures or markets any products, or performs any services, that are competitive with the products or services of the Company, or products or services that the Company or its affiliates, has under development or that are the subject of active planning at any time during my employment; provided that this shall not prohibit any possible investment in publicly traded stock of a company representing less than one percent of the stock of such company. In addition, during the Restricted Period, I will not, directly or indirectly, in any manner, other than for the benefit of the Company, (a) call upon, solicit, divert, take away, accept or conduct any business from or with any of the customers or prospective customers of the Company or any of its suppliers, and/or (b) solicit, entice, attempt to persuade any other employee or consultant of the Company to leave the Company for any reason or otherwise participate in or facilitate the hire, directly or through another entity, of any person who is employed or engaged by the Company or who was employed or engaged by the Company within six months of any attempt to hire such person. I acknowledge and agree that if I violate any of the provisions of this paragraph 8, the running of the Restricted Period will be extended by the time during which I engage in such violation(s). For purposes of this Agreement, a "prospective customer" means any potential customer of the Company which I knew or reasonably should have known that the Company was actively soliciting (other than through a general campaign) or actively considered soliciting (other than through a general campaign) at any time within the twelve (12) calendar months prior to the last day of my employment.

9. **Prior Agreements.** I hereby represent that, except as I have fully disclosed previously in writing to the Company, I am not bound by the terms of any agreement with any previous employer or other party to refrain from using or disclosing any trade secret or confidential or proprietary information in the course of my employment with the Company or to refrain from competing, directly or indirectly, with the business of such previous employer or any other party. I further represent that my performance of all the terms of this Agreement as an employee of the Company does not and will not breach any agreement to keep in confidence proprietary information, knowledge or data acquired by me in confidence or in trust prior to my employment with the Company. I will not disclose to the Company or induce the Company to use any confidential or proprietary information or material belonging to any previous employer or others.

10. **Remedies Upon Breach.** I understand that the restrictions contained in this Agreement are necessary for the protection of the business and goodwill of the Company and I consider them to be reasonable for such purpose. Any breach of this Agreement is likely to cause the Company substantial and irrevocable damage and therefore, in the event of such breach, the Company, in addition to such other remedies which may be available, will be entitled to specific performance and other injunctive relief, without the posting of a bond. If I violate this Agreement, in addition to all other remedies available to the Company at law, in equity, and under contract, I agree that I am obligated to pay all the Company's costs of enforcement of this Agreement, including attorneys' fees and expenses.

11. **Use of Voice, Image and Likeness.** I give the Company permission to use any and all of my voice, image and likeness, with or without using my name, in connection with the products and/or services of the Company, for the purposes of advertising and promoting such products and/or services and/or the Company, and/or for other purposes deemed appropriate by the Company in its reasonable discretion, except to the extent expressly prohibited by law.

12. **Publications and Public Statements.** I will obtain the Company's written approval before publishing or submitting for publication any material that relates to my work at the Company and/or incorporates any Proprietary Information. To ensure that the Company delivers a consistent message about its products, services and operations to the public, and further in recognition that even positive statements may have a detrimental effect on the Company in certain securities transactions and other contexts, any statement about the Company which I create, publish or post during my period of employment and for six (6) months thereafter, on any media accessible by the public, including but not limited to electronic bulletin boards and Internet-based chat rooms, must first be reviewed and approved by an officer of the Company before it is released in the public domain.

13. **No Employment Obligation.** I understand that this Agreement does not create an obligation on the Company or any other person to continue my employment. I acknowledge that, unless otherwise agreed in a formal written employment agreement signed on behalf of the Company by an authorized officer, my employment with the Company is at will and therefore may be terminated by the Company or me at any time and for any reason, with or without cause.

14. **Survival and Assignment by the Company.** I understand that my obligations under this Agreement will continue in accordance with its express terms regardless of any changes in my title, position, duties, salary, compensation or benefits or other terms and conditions of employment. I further understand that my obligations under this Agreement will continue following the termination of my employment regardless of the manner of such termination and will be binding upon my heirs, executors and administrators. The Company will have the right to assign this Agreement to its affiliates, successors and assigns. I expressly consent to be bound by the provisions of this Agreement for the benefit of the Company or any parent, subsidiary or affiliate to whose employ I may be transferred or successor who assumes my employment agreement with the Company without the necessity that this Agreement be resigned at the time of such transfer or assumption.

15. **Exit Interview.** If and when I depart from the Company, I may be required to attend an exit interview and sign an "Employee Exit Acknowledgement" to reaffirm my acceptance and acknowledgement of the obligations set forth in this Agreement. For twelve (12) months following termination of my employment, I will notify the Company of any change in my address and of each subsequent employment or business activity, including the name and address of my employer or other post-Company employment plans and the nature of my activities.

16. **Disclosure to Future Employers.** During the Restricted Period, I will provide a copy of this Agreement to any prospective employer, partner or coventurer prior to entering into an employment, partnership or other business relationship with such person or entity.

17. **Severability.** In case any provisions (or portions thereof) contained in this Agreement shall, for any reason, be held invalid, illegal or unenforceable in any respect, such invalidity, illegality or unenforceability shall not affect the other provisions of this Agreement, and this Agreement shall be construed as if such invalid, illegal or unenforceable provision had never been contained herein. If, moreover, any one or more of the provisions contained in this Agreement shall for any reason be held to be excessively broad as to duration, geographical scope, activity or subject, it shall be construed by limiting and reducing it, so as to be enforceable to the extent compatible with the applicable law as it shall then appear.

18. **Interpretation.** This Agreement will be deemed to be made and entered into in the Commonwealth of Massachusetts, and will in all respects be interpreted, enforced and governed under the laws of the Commonwealth of Massachusetts. I hereby agree to consent to personal jurisdiction of the state and federal courts situated within Suffolk County, Massachusetts for purposes of enforcing this Agreement, and waive any objection that I might have to personal jurisdiction or venue in those courts.

I UNDERSTAND THAT THIS AGREEMENT AFFECTS IMPORTANT RIGHTS. BY SIGNING BELOW, I CERTIFY THAT I HAVE READ IT CAREFULLY AND AM SATISFIED THAT I UNDERSTAND IT COMPLETELY.

IN WITNESS WHEREOF, the undersigned has executed this agreement as a sealed instrument as of the date set forth below.

Signed: _____

Type or print name:

Date:

EXHIBIT A

To: **bluebird bio, Inc.**

From: _____

Date: _____

SUBJECT: **Prior Inventions**

The following is a complete list of all inventions or improvements relevant to the subject matter of my employment by the Company that have been made or conceived or first reduced to practice by me alone or jointly with others prior to my engagement by the Company:

☐ No inventions or improvements

☐ See below:

_____

_____

_____

☐ Additional sheets attached

The following is a list of all patents and patent applications in which I have been named as an inventor:

☐ None

☐ See below:

_____

_____

_____

Exhibit 10.15

AMENDED AND RESTATED
EMPLOYMENT AGREEMENT

This Employment Agreement ("Agreement") is between bluebird bio, Inc., a Delaware corporation (the "Company"), and David M. Davidson, M.D. (the "Executive") and is made effective as of the closing of the Company's first underwritten public offering of its equity securities pursuant to an effective registration statement under the Securities Act of 1933, as amended (the "IPO"), provided the IPO is consummated prior to December 31, 2013 (the "Effective Date").

WHEREAS, the Company and the Executive previously entered in an offer letter agreement, dated January 16, 2012 (the "Offer Letter"), which the Company and the Executive intend to replace with this Agreement; and

WHEREAS, the Company desires to continue to employ the Executive and the Executive desires to continue to be employed by the Company on the new terms and conditions contained herein.

NOW, THEREFORE, in consideration of the mutual covenants and agreements herein contained and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties agree as follows:

1. Employment.

(a) Term. The term of this Agreement shall commence on the Effective Date and continue until terminated in accordance with the provisions of Section 3 (the "Term").

(b) Position and Duties. During the Term, the Executive shall serve as the Chief Medical Officer of the Company, and shall have supervision and control over and responsibility for the day-to-day business and affairs of the Company and shall have such other powers and duties as may from time to time be prescribed by the Chairman of the Board of Directors of the Company (the "Board"), the Chief Executive Officer of the Company (the "CEO") or other authorized executive, provided that such duties are consistent with the Executive's position or other positions that he may hold from time to time. The Executive shall report to the CEO. The Executive shall devote his full working time and efforts to the business and affairs of the Company. Notwithstanding the foregoing, the Executive may serve on other boards of directors, with the approval of the Board, or engage in religious, charitable or other community activities as long as such services and activities are disclosed to the Board and do not materially interfere with the Executive's performance of his duties to the Company as provided in this Agreement.

2. Compensation and Related Matters.

(a) Base Salary. During the Term, the Executive's initial annual base salary shall be $315,000. The Executive's base salary shall be redetermined annually by the Board or the Compensation Committee. The annual base salary in effect at any given time is referred to herein as "Base Salary." The Base Salary shall be payable in a manner that is consistent with the Company's usual payroll practices for senior executives.

(b) Incentive Compensation. During the Term, the Executive shall be eligible to receive cash incentive compensation as determined by the Board or the Compensation Committee from time to time. The Executive's target annual incentive compensation shall be 35 percent (35%) of his Base Salary. To earn incentive compensation, the Executive must be employed by the Company on the day such incentive compensation is paid.

(c) Expenses. The Executive shall be entitled to receive prompt reimbursement for all reasonable expenses incurred by him during the Term in performing services hereunder, in accordance with the policies and procedures then in effect and established by the Company for its senior executive officers.

(d) Other Benefits. During the Term, the Executive shall be eligible to participate in or receive benefits under the Company's employee benefit plans in effect from time to time, subject to the terms of such plans.

(e) Vacations. During the Term, the Executive shall be entitled to accrue paid vacation in accordance with the Company's applicable policy.

3. Termination. During the Term, the Executive's employment hereunder may be terminated without any breach of this Agreement under the following circumstances:

(a) Death. The Executive's employment hereunder shall terminate upon his death.

(b) Disability. The Company may terminate the Executive's employment if he is disabled and unable to perform the essential functions of the Executive's then existing position or positions under this Agreement with or without reasonable accommodation for a period of 180 days (which need not be consecutive) in any 12-month period. If any question shall arise as to whether during any period the Executive is disabled so as to be unable to perform the essential functions of the Executive's then existing position or positions with or without reasonable accommodation, the Executive may, and at the request of the Company shall, submit to the Company a certification in reasonable detail by a physician selected by the Company to whom the Executive or the Executive's guardian has no reasonable objection as to whether the Executive is so disabled or how long such disability is expected to continue, and such certification shall for the purposes of this Agreement be conclusive of the issue. The Executive shall cooperate with any reasonable request of the physician in connection with such certification. If such question shall arise and the Executive shall fail to submit such certification, the Company's determination of such issue shall be binding on the Executive. Nothing in this Section 3(b) shall be construed to waive the Executive's rights, if any, under existing law including, without limitation, the Family and Medical Leave Act of 1993, 29 U.S.C. §2601 *et seq*. and the Americans with Disabilities Act, 42 U.S.C. §12101 *et seq*.

(c) Termination by Company for Cause. The Company may terminate the Executive's employment hereunder for Cause by a vote of the Board at a meeting of the Board called and held for such purpose. For purposes of this Agreement, "Cause" shall mean: (i) the Executive's dishonest statements or acts with respect to the Company, any affiliate of the Company or any of the Company's current or prospective customers, suppliers, vendors or other

third parties with which such entity does business; (ii) the Executive's commission of a felony or any misdemeanor involving moral turpitude, deceit, dishonesty or fraud; (iii) the Executive's failure to perform his assigned duties to the reasonable satisfaction of the Company, which failure continues, in the reasonable judgment of the Company, after written notice given to the Executive by the Company; (iv) the Executive's gross negligence, willful misconduct or insubordination with respect to the Company or any affiliate of the Company; or (v) the Executive's violation of any provision of any agreement(s) between the Executive and the Company relating to noncompetition, nondisclosure and/or assignment of inventions; provided, however, with respect to clause (iii) above, the Executive shall have 30 days to cure after receiving written notice from the Company.

(d) Termination Without Cause. The Company may terminate the Executive's employment hereunder at any time without Cause. Any termination by the Company of the Executive's employment under this Agreement which does not constitute a termination for Cause under Section 3(c) and does not result from the death or disability of the Executive under Section 3(a) or (b) shall be deemed a termination without Cause.

(e) Termination by the Executive. The Executive may terminate his employment hereunder at any time for any reason, including but not limited to Good Reason. For purposes of this Agreement, "Good Reason" shall mean that the Executive has complied with the "Good Reason Process" (hereinafter defined) following the occurrence of any of the following events without the Executive's express written consent: (i) a material diminution in the Executive's responsibilities, authority and function; (ii) a material reduction in the Executive's Base Salary except pursuant to a salary reduction program affecting all senior executives of the Company, provided, that it does not adversely affect the Executive to a greater extent than other similarly situated employees and, provided further, that any reduction in the Executive's Base Salary of more than ten percent (10%) shall constitute Good Reason; (iii) a material change in the geographic location at which the Executive must provide services to the Company (except for required travel on Company business to an extent substantially consistent with the Executive's usual business travel obligations); or (iv) the material breach by the Company of the Company's equity incentive plan or the restricted stock agreement governing the restricted stock granted to the Executive in connection with his hire (as described in the Offer Letter) or any other material agreement between the Executive and the Company, if any, concerning the terms and conditions of the Executive's employment, benefits or compensation. "Good Reason Process" shall mean that (i) the Executive reasonably determines in good faith that a "Good Reason" condition has occurred; (ii) the Executive notifies the Company in writing of the first occurrence of the Good Reason condition within 30 days of the first occurrence of such condition; (iii) the Executive cooperates in good faith with the Company's efforts, for a period not less than 30 days following such notice (the "Cure Period") to remedy the condition; (iv) notwithstanding such efforts, the Good Reason condition continues to exist; and (v) the Executive terminates his employment within 30 days after the end of the Cure Period. If the Company cures the Good Reason condition during the Cure Period, Good Reason shall be deemed not to have occurred.

(f) Notice of Termination. Except for termination as specified in Section 3(a), any termination of the Executive's employment by the Company or any such termination by the Executive shall be communicated by written Notice of Termination to the other party hereto. For purposes of this Agreement, a "Notice of Termination" shall mean a notice which shall indicate the specific termination provision in this Agreement relied upon.

(g) Date of Termination. "Date of Termination" shall mean: (i) if the Executive's employment is terminated by his death, the date of his death; (ii) if the Executive's employment is terminated on account of disability under Section 3(b) or by the Company for Cause under Section 3(c), the date on which Notice of Termination is given; (iii) if the Executive's employment is terminated by the Company under Section 3(d), the date on which a Notice of Termination is given; (iv) if the Executive's employment is terminated by the Executive under Section 3(e) without Good Reason, 30 days after the date on which a Notice of Termination is given, and (v) if the Executive's employment is terminated by the Executive under Section 3(e) with Good Reason, the date on which a Notice of Termination is given after the end of the Cure Period. Notwithstanding the foregoing, (A) in the event that the Executive gives a Notice of Termination to the Company, the Company may unilaterally accelerate the Date of Termination and such acceleration shall not result in a termination by the Company for purposes of this Agreement, and (B) in the event that the Company terminates the Executive's employment without Cause under Section 3(d), the Company may unilaterally accelerate the Date of Termination to any earlier effective date provided that the Company continues to pay the Executive the Base Salary for the 30-day period immediately following the date on which a Notice of Termination is given to the Executive.

4. Compensation Upon Termination.

(a) Termination Generally. If the Executive's employment with the Company is terminated for any reason, the Company shall pay or provide to the Executive (or to his authorized representative or estate) (i) any Base Salary earned through the Date of Termination, unpaid expense reimbursements (subject to, and in accordance with, Section 2(c) of this Agreement) and unused vacation that accrued through the Date of Termination on or before the time required by law but in no event more than 30 days after the Executive's Date of Termination; and (ii) any vested benefits the Executive may have under any employee benefit plan of the Company through the Date of Termination, which vested benefits shall be paid and/or provided in accordance with the terms of such employee benefit plans (collectively, the "Accrued Benefit").

(b) Termination by the Company Without Cause or by the Executive with Good Reason. During the Term, if the Executive's employment is terminated by the Company without Cause as provided in Section 3(d), or the Executive terminates his employment for Good Reason as provided in Section 3(e), then the Company shall pay the Executive his Accrued Benefit. In addition, subject to the Executive signing a separation agreement containing, among other provisions, a general release of claims in favor of the Company and related persons and entities, confidentiality, return of property and non-disparagement, in a form and manner satisfactory to the Company (the "Separation Agreement and Release") and the Separation Agreement and Release becoming fully effective, all within the time frame set forth in the Separation Agreement and Release:

(i) the Company shall pay the Executive an amount equal to one times the Executive's Base Salary the "Severance Amount"); and

(ii) if the Executive was participating in the Company's group health plan immediately prior to the Date of Termination and elects COBRA health continuation, then the Company shall pay to the Executive a monthly cash payment for 12 months or the Executive's COBRA health continuation period, whichever ends earlier, in an amount equal to the monthly employer contribution that the Company would have made to provide health insurance to the Executive if the Executive had remained employed by the Company; and

(iii) the amounts payable under this Section 4(b) shall be paid out in substantially equal installments in accordance with the Company's payroll practice over 12 months commencing within 60 days after the Date of Termination; provided, however, that if the 60-day period begins in one calendar year and ends in a second calendar year, the Severance Amount shall begin to be paid in the second calendar year by the last day of such 60-day period; provided, further, that the initial payment shall include a catch-up payment to cover amounts retroactive to the day immediately following the Date of Termination. Each payment pursuant to this Agreement is intended to constitute a separate payment for purposes of Treasury Regulation Section 1.409A-2(b)(2).

(iv) The receipt of any severance payments or benefits pursuant to Section 4 will be subject to Executive not violating the Restrictive Covenant Agreement referenced in Section 7 of this Agreement and attached hereto as Exhibit A, the terms of which are hereby incorporated by reference. In the event Executive breaches the Restrictive Covenant Agreement, in addition to all other legal and equitable remedies, the Company shall have the right to terminate or suspend all continuing payments and benefits to which Executive may otherwise be entitled pursuant to Section 4 without affecting the Executive's release or Executive's obligations under the Separation Agreement and Release.

5. Change in Control Payment. The provisions of this Section 5 set forth certain terms of an agreement reached between the Executive and the Company regarding the Executive's rights and obligations upon the occurrence of a Change in Control of the Company. These provisions are intended to assure and encourage in advance the Executive's continued attention and dedication to his assigned duties and his objectivity during the pendency and after the occurrence of any such event. These provisions shall apply in lieu of, and expressly supersede, the provisions of Section 4(b) regarding severance pay and benefits upon a termination of employment, if such termination of employment occurs within 12 months after the occurrence of the first event constituting a Change in Control. These provisions shall terminate and be of no further force or effect beginning 12 months after the occurrence of a Change in Control.

(a) Change in Control. During the Term, if within 12 months after a Change in Control, the Executive's employment is terminated by the Company without Cause as provided in Section 3(d) or the Executive terminates his employment for Good Reason as provided in Section 3(e), then, subject to the signing of the Separation Agreement and Release by the Executive and the Separation Agreement and Release becoming irrevocable, all within 60 days after the Date of Termination,

(i) the Company shall pay the Executive a lump sum in cash in an amount equal to one times the sum of (A) the Executive's current Base Salary (or the Executive's Base Salary in effect immediately prior to the Change in Control, if higher) plus (B) the Executive's Target Incentive Compensation. For purposes of this Agreement, "Target Incentive Compensation" shall mean the Executive's target annual incentive compensation as set forth in Section 2(b); and

(ii) notwithstanding anything to the contrary in any applicable option agreement or stock-based award agreement, all stock options and other stock-based awards granted to the Executive after the date of this Agreement shall immediately accelerate and become fully exercisable or nonforfeitable as of the Date of Termination. The treatment of stock options and other stock-based awards held by the Executive as of the date of this Agreement shall be governed by the terms of the applicable option agreement or other stock-based award agreement; and

(iii) if the Executive was participating in the Company's group health plan immediately prior to the Date of Termination and elects COBRA health continuation, then the Company shall pay to the Executive a monthly cash payment for 12 months or the Executive's COBRA health continuation period, whichever ends earlier, in an amount equal to the monthly employer contribution that the Company would have made to provide health insurance to the Executive if the Executive had remained employed by the Company; and

(iv) The amounts payable under this Section 5(a) shall be paid or commence to be paid within 60 days after the Date of Termination; provided, however, that if the 60-day period begins in one calendar year and ends in a second calendar year, such payment shall be paid or commence to be paid in the second calendar year by the last day of such 60-day period.

(b) Additional Limitation.

(i) Anything in this Agreement to the contrary notwithstanding, in the event that the amount of any compensation, payment or distribution by the Company to or for the benefit of the Executive, whether paid or payable or distributed or distributable pursuant to the terms of this Agreement or otherwise, calculated in a manner consistent with Section 280G of the Internal Revenue Code of 1986, as amended (the "Code") and the applicable regulations thereunder (the "Severance Payments"), would be subject to the excise tax imposed by Section 4999 of the Code, the following provisions shall apply:

(A) If the Severance Payments, reduced by the sum of (1) the Excise Tax and (2) the total of the federal, state, and local income and employment taxes payable by the Executive on the amount of the Severance Payments which are in excess of the Threshold Amount, are greater than or equal to the Threshold Amount, the Executive shall be entitled to the full benefits payable under this Agreement.

(B) If the Threshold Amount is less than (x) the Severance Payments, but greater than (y) the Severance Payments reduced by the sum of (1) the Excise Tax and (2) the total of the federal, state, and local income and employment taxes on the amount of the Severance Payments which are in excess of the Threshold Amount, then the Severance Payments shall be reduced (but not below zero) to the extent necessary so that the sum of all Severance Payments shall not exceed the Threshold Amount. In such event, the Severance Payments shall be reduced in the following order: (1) cash payments not subject to Section 409A of the Code; (2) cash payments subject to Section 409A of the Code; (3) equity-based payments and acceleration; and (4) non-cash forms of benefits. To the extent any payment is to be made over time (e.g., in installments, etc.), then the payments shall be reduced in reverse chronological order.

(ii) For the purposes of this Section 5(b), "Threshold Amount" shall mean three times the Executive's "base amount" within the meaning of Section 280G(b)(3) of the Code and the regulations promulgated thereunder less one dollar ($1.00); and "Excise Tax" shall mean the excise tax imposed by Section 4999 of the Code, and any interest or penalties incurred by the Executive with respect to such excise tax.

(iii) The determination as to which of the alternative provisions of Section 5(b)(i) shall apply to the Executive shall be made by a nationally recognized accounting firm selected by the Company (the "Accounting Firm"), which shall provide detailed supporting calculations both to the Company and the Executive within 15 business days of the Date of Termination, if applicable, or at such earlier time as is reasonably requested by the Company or the Executive. For purposes of determining which of the alternative provisions of Section 5(b)(i) shall apply, the Executive shall be deemed to pay federal income taxes at the highest marginal rate of federal income taxation applicable to individuals for the calendar year in which the determination is to be made, and state and local income taxes at the highest marginal rates of individual taxation in the state and locality of the Executive's residence on the Date of Termination, net of the maximum reduction in federal income taxes which could be obtained from deduction of such state and local taxes. Any determination by the Accounting Firm shall be binding upon the Company and the Executive.

(b) Definitions. For purposes of this Section 5, the following terms shall have the following meanings:

"Change in Control" shall mean "Sale Event," as such term is defined in the Company's 2013 Stock Option and Incentive Plan.

6. Section 409A.

(a) Anything in this Agreement to the contrary notwithstanding, if at the time of the Executive's separation from service within the meaning of Section 409A of the Code, the Company determines that the Executive is a "specified employee" within the meaning of Section 409A(a)(2)(B)(i) of the Code, then to the extent any payment or benefit that the Executive

becomes entitled to under this Agreement on account of the Executive's separation from service would be considered deferred compensation otherwise subject to the 20 percent additional tax imposed pursuant to Section 409A(a) of the Code as a result of the application of Section 409A(a)(2)(B)(i) of the Code, such payment shall not be payable and such benefit shall not be provided until the date that is the earlier of (A) six months and one day after the Executive's separation from service, or (B) the Executive's death. If any such delayed cash payment is otherwise payable on an installment basis, the first payment shall include a catch-up payment covering amounts that would otherwise have been paid during the six-month period but for the application of this provision, and the balance of the installments shall be payable in accordance with their original schedule.

(b) All in-kind benefits provided and expenses eligible for reimbursement under this Agreement shall be provided by the Company or incurred by the Executive during the time periods set forth in this Agreement. All reimbursements shall be paid as soon as administratively practicable, but in no event shall any reimbursement be paid after the last day of the taxable year following the taxable year in which the expense was incurred. The amount of in-kind benefits provided or reimbursable expenses incurred in one taxable year shall not affect the in-kind benefits to be provided or the expenses eligible for reimbursement in any other taxable year (except for any lifetime or other aggregate limitation applicable to medical expenses). Such right to reimbursement or in-kind benefits is not subject to liquidation or exchange for another benefit.

(c) To the extent that any payment or benefit described in this Agreement constitutes "non-qualified deferred compensation" under Section 409A of the Code, and to the extent that such payment or benefit is payable upon the Executive's termination of employment, then such payments or benefits shall be payable only upon the Executive's "separation from service." The determination of whether and when a separation from service has occurred shall be made in accordance with the presumptions set forth in Treasury Regulation Section 1.409A-1(h).

(d) The parties intend that this Agreement will be administered in accordance with Section 409A of the Code. To the extent that any provision of this Agreement is ambiguous as to its compliance with Section 409A of the Code, the provision shall be read in such a manner so that all payments hereunder comply with Section 409A of the Code. Each payment pursuant to this Agreement is intended to constitute a separate payment for purposes of Treasury Regulation Section 1.409A-2(b)(2). The parties agree that this Agreement may be amended, as reasonably requested by either party, and as may be necessary to fully comply with Section 409A of the Code and all related rules and regulations in order to preserve the payments and benefits provided hereunder without additional cost to either party.

(e) The Company makes no representation or warranty and shall have no liability to the Executive or any other person if any provisions of this Agreement are determined to constitute deferred compensation subject to Section 409A of the Code but do not satisfy an exemption from, or the conditions of, such Section.

7. Confidential Information, Noncompetition and Cooperation. The Executive agrees to terms of the Assignment of Invention, Nondisclosure and Noncompetition Agreement ("Restrictive Covenant Agreement") attached hereto as Exhibit A, the terms of which are hereby incorporated by reference as material terms of this Agreement.

8. Consent to Jurisdiction. The parties hereby consent to the jurisdiction of the Superior Court of the Commonwealth of Massachusetts and the United States District Court for the District of Massachusetts. Accordingly, with respect to any such court action, the Executive (a) submits to the personal jurisdiction of such courts; (b) consents to service of process; and (c) waives any other requirement (whether imposed by statute, rule of court, or otherwise) with respect to personal jurisdiction or service of process.

9. Integration. This Agreement constitutes the entire agreement between the parties with respect to the subject matter hereof and supersedes all prior agreements between the parties concerning such subject matter.

10. Withholding. All payments made by the Company to the Executive under this Agreement shall be net of any tax or other amounts required to be withheld by the Company under applicable law.

11. Successor to the Executive. This Agreement shall inure to the benefit of and be enforceable by the Executive's personal representatives, executors, administrators, heirs, distributees, devisees and legatees. In the event of the Executive's death after his termination of employment but prior to the completion by the Company of all payments due him under this Agreement, the Company shall continue such payments to the Executive's beneficiary designated in writing to the Company prior to his death (or to his estate, if the Executive fails to make such designation).

12. Enforceability. If any portion or provision of this Agreement (including, without limitation, any portion or provision of any section of this Agreement) shall to any extent be declared illegal or unenforceable by a court of competent jurisdiction, then the remainder of this Agreement, or the application of such portion or provision in circumstances other than those as to which it is so declared illegal or unenforceable, shall not be affected thereby, and each portion and provision of this Agreement shall be valid and enforceable to the fullest extent permitted by law.

13. Survival. The provisions of this Agreement shall survive the termination of this Agreement and/or the termination of the Executive's employment to the extent necessary to effectuate the terms contained herein.

14. Waiver. No waiver of any provision hereof shall be effective unless made in writing and signed by the waiving party. The failure of any party to require the performance of any term or obligation of this Agreement, or the waiver by any party of any breach of this Agreement, shall not prevent any subsequent enforcement of such term or obligation or be deemed a waiver of any subsequent breach.

15. Notices. Any notices, requests, demands and other communications provided for by this Agreement shall be sufficient if in writing and delivered in person or sent by a nationally recognized overnight courier service or by registered or certified mail, postage prepaid, return receipt requested, to the Executive at the last address the Executive has filed in writing with the Company or, in the case of the Company, at its main offices, attention of the Board.

16. Amendment. This Agreement may be amended or modified only by a written instrument signed by the Executive and by a duly authorized representative of the Company.

17. Governing Law. This is a Massachusetts contract and shall be construed under and be governed in all respects by the laws of the Commonwealth of Massachusetts, without giving effect to the conflict of laws principles of such Commonwealth. With respect to any disputes concerning federal law, such disputes shall be determined in accordance with the law as it would be interpreted and applied by the United States Court of Appeals for the First Circuit.

18. Counterparts. This Agreement may be executed in any number of counterparts, each of which when so executed and delivered shall be taken to be an original; but such counterparts shall together constitute one and the same document.

19. Successor to Company. The Company shall require any successor (whether direct or indirect, by purchase, merger, consolidation or otherwise) to all or substantially all of the business or assets of the Company expressly to assume and agree to perform this Agreement to the same extent that the Company would be required to perform it if no succession had taken place. Failure of the Company to obtain an assumption of this Agreement at or prior to the effectiveness of any succession shall be a material breach of this Agreement.

20. Gender Neutral. Wherever used herein, a pronoun in the masculine gender shall be considered as including the feminine gender unless the context clearly indicates otherwise.

IN WITNESS WHEREOF, the parties have executed this Agreement effective on the date and year first above written.

BLUEBIRD BIO, INC.

By: /s/ Nick Leschly
Its: President and Chief Executive Officer

/s/ David M. Davidson
David M. Davidson, M.D.

[Signature Page to the Amended and Restated Employment Agreement]

Exhibit A

Restrictive Covenant Agreement

EXHIBIT A

bluebird bio, Inc.

Form of Assignment of Invention, Nondisclosure and Noncompetition Agreement

In consideration and as a material condition of my employment by bluebird bio, Inc. (along with its subsidiaries and affiliates the "Company"), I agree as follows:

1. **Proprietary Information.** I agree that all information, whether or not in writing, concerning the Company's business, technology, business relationships or financial affairs which the Company has not released to the general public (collectively, "Proprietary Information") is and will be the exclusive property of the Company. By way of illustration, Proprietary Information may include information or material which has not been made generally available to the public, such as: (a) *corporate information*, including plans, strategies, methods, policies, resolutions, negotiations or litigation; (b) *marketing information*, including strategies, methods, customer identities or other information about customers, prospect identities or other information about prospects, or market analyses or projections; (c) *financial information*, including cost and performance data, debt arrangements, equity structure, investors and holdings, purchasing and sales data and price lists; and (d) *operational and technological information*, including plans, specifications, manuals, forms, templates, software, designs, methods, procedures, formulas, discoveries, inventions, improvements, concepts and ideas; and (e) *personnel information*, including personnel lists, reporting or organizational structure, resumes, personnel data, compensation structure, performance evaluations and termination arrangements or documents. Proprietary Information also includes information received in confidence by the Company from its customers or suppliers or other third parties.

2. **Recognition of Company's Rights.** I will not, at any time, without the Company's prior written permission, either during or after my employment, disclose any Proprietary Information to anyone outside of the Company, or use or permit to be used any Proprietary Information for any purpose other than in connection with the performance of my duties as an employee of the Company. I will cooperate with the Company and use my best efforts to prevent the unauthorized disclosure of all Proprietary Information. I will deliver to the Company all copies of Proprietary Information in my possession or control upon the earlier of a request by the Company or termination of my employment.

3. **Rights of Others.** I understand that the Company is now and may hereafter be subject to non-disclosure or confidentiality agreements with third persons which require the Company to protect or refrain from use of proprietary information. I agree to be bound by the terms of such of those agreements as to which I have knowledge in the event I have access to such proprietary information.

4. **Commitment to Company; Avoidance of Conflict of Interest.** Subject to the express terms of my employment agreement with the Company, while an employee of the Company, I will devote my full-time efforts to the Company's business and I will not engage in any other business activity that conflicts with my duties to the Company. I will advise the president of the Company or his or her nominee at such time as any activity of either the Company or another business presents me with a conflict of interest or the appearance of a conflict of interest as an employee of the Company. I will take whatever action is requested of me by the Company to resolve any conflict or appearance of conflict which it finds to exist.

5. **Developments.** I will make full and prompt disclosure to the Company of all inventions, discoveries, designs, developments, methods, modifications, improvements, processes, algorithms, databases, computer programs, formulae, techniques, trade secrets, graphics or images, and audio or visual works and other works of authorship related to the business of the Company (collectively "Developments"), whether or not patentable or copyrightable, that are created, made, conceived or reduced to practice by me (alone or jointly with others) or under my direction during the period of my employment. I acknowledge that all work performed by me for the Company is on a "work for hire" basis, and I hereby do assign and transfer and, to the extent any such assignment cannot be made at present, will assign and transfer, to the Company and its successors and assigns all my right, title and interest in all Developments made, conceived or reduced to practice by me (alone or jointly with others) that (a) relate to the business of the Company or any customer of or supplier to the Company or any of the products or services being researched, developed, manufactured or sold by the Company or which may be used with such products or services; or (b) result from tasks assigned to me by the Company; or (c) result from the use of premises or personal property (whether tangible or intangible) owned, leased or contracted for by the Company ("Company-Related Developments"), and all related patents, patent applications, trademarks and trademark applications, copyrights and copyright applications, and other intellectual property rights in all countries and territories worldwide and under any international conventions ("Intellectual Property Rights").

To preclude any possible uncertainty, I have set forth on Exhibit A attached hereto a complete list of Developments that I have, alone or jointly with others, conceived, developed or reduced to practice prior to the commencement of my employment with the Company that I consider to be my property or the property of third parties and that I wish to have excluded from the scope of this Agreement ("Prior Inventions"). If disclosure of any such Prior Invention would cause me to violate any prior confidentiality agreement, I understand that I am not to list such Prior Inventions in Exhibit A but am only to disclose a cursory name for each such invention, a listing of the party(ies) to whom it belongs

and the fact that full disclosure as to such inventions has not been made for that reason. I have also listed on Exhibit A all patents and patent applications in which I am named as an inventor, other than those which have been assigned to the Company ("Other Patent Rights"). If no such disclosure is attached, I represent that there are no Prior Inventions or Other Patent Rights. If, in the course of my employment with the Company, I incorporate a Prior Invention into a Company product, process or machine or other work done for the Company, I hereby grant to the Company a nonexclusive, royalty-free, paid-up, irrevocable, worldwide license (with the full right to sublicense) to make, have made, modify, use, sell, offer for sale and import such Prior Invention. Notwithstanding the foregoing, I will not incorporate, or permit to be incorporated, Prior Inventions in any Company-Related Development without the Company's prior written consent.

This Agreement does not obligate me to assign to the Company any Development which, in the sole judgment of the Company, reasonably exercised, is developed entirely on my own time and does not relate to the business efforts or research and development efforts in which, during the period of my employment, the Company actually is engaged or reasonably would be engaged, and does not result from the use of premises or equipment owned or leased by the Company. However, I will also promptly disclose to the Company any such Developments for the purpose of determining whether they qualify for such exclusion. I understand that to the extent this Agreement is required to be construed in accordance with the laws of any state which precludes a requirement in an employee agreement to assign certain classes of inventions made by an employee, this paragraph 5 will be interpreted not to apply to any invention which a court rules and/or the Company agrees falls within such classes. I also hereby waive all claims to any moral rights or other special rights which I may have or accrue in any Company-Related Developments.

6. **Documents and Other Materials.** I will keep and maintain adequate and current records of all Proprietary Information and Company-Related Developments developed by me during my employment, which records will be available to and remain the sole property of the Company at all times.

All files, letters, notes, memoranda, reports, records, data, sketches, drawings, notebooks, layouts, charts, quotations and proposals, specification sheets, program listings, blueprints, models, prototypes, or other written, photographic or other tangible material containing Proprietary Information, whether created by me or others, which come into my custody or possession, are the exclusive property of the Company to be used by me only in the performance of my duties for the Company. Any property situated on the Company's premises and owned by the Company, including without limitation computers, disks and other storage media, filing cabinets or other work areas, is subject to inspection by the Company at any time with or without notice. In the event of the termination of my employment for any reason, I will deliver to the Company all files, letters, notes, memoranda, reports, records, data, sketches, drawings, notebooks, layouts, charts, quotations and proposals, specification sheets, program listings, blueprints, models, prototypes, or other written, photographic or other tangible material containing Proprietary Information, and other materials of any nature pertaining to the Proprietary Information of the Company and to my work, and will not take or keep in my possession any of the foregoing or any copies.

7. **Enforcement of Intellectual Property Rights.** I will cooperate fully with the Company, both during and after my employment with the Company, with respect to the procurement, maintenance and enforcement of Intellectual Property Rights in Company-Related Developments. I will sign, both during and after the term of this Agreement, all papers, including without limitation copyright applications, patent applications, declarations, oaths, assignments of priority rights, and powers of attorney, which the Company may deem necessary or desirable in order to protect its rights and interests in any Company-Related Development. If the Company is unable, after reasonable effort, to secure my signature on any such papers, I hereby irrevocably designate and appoint each officer of the Company as my agent and attorney-in-fact to execute any such papers on my behalf, and to take any and all actions as the Company may deem necessary or desirable in order to protect its rights and interests in any Company-Related Development.

8. **Non-Competition and Non-Solicitation.** In order to protect the Company's Proprietary Information and good will, during my employment and for a period of twelve (12) months following the termination of my employment for any reason (the "Restricted Period"), I will not directly or indirectly, whether as owner, partner, shareholder, director, manager, consultant, agent, employee, co-venturer or otherwise, engage, participate or invest in any business activity anywhere in the world that develops, manufactures or markets any products, or performs any services, that are competitive with the products or services of the Company, or products or services that the Company or its affiliates, has under development or that are the subject of active planning at any time during my employment; provided that this shall not prohibit any possible investment in publicly traded stock of a company representing less than one percent of the stock of such company. In addition, during the Restricted Period, I will not, directly or indirectly, in any manner, other than for the benefit of the Company, (a) call upon, solicit, divert, take away, accept or conduct any business from or with any of the customers or prospective customers of the Company or any of its suppliers, and/or (b) solicit, entice, attempt to persuade any other employee or consultant of the Company to leave the Company for any reason or otherwise participate in or facilitate the hire, directly or through another entity, of any person who is employed or engaged by the Company or who was employed or engaged by the Company within six months of any attempt to hire such person. I acknowledge and agree that if I violate any of the provisions of this paragraph 8, the running of the Restricted Period will be extended by the time during which I engage in such violation(s). For purposes of this Agreement, a "prospective customer" means any potential customer of the Company which I knew or reasonably should have known that the Company was actively soliciting (other than through a general campaign) or actively considered soliciting (other than through a general campaign) at any time within the twelve (12) calendar months prior to the last day of my employment.

9. **Prior Agreements.** I hereby represent that, except as I have fully disclosed previously in writing to the Company, I am not bound by the terms of any agreement with any previous employer or other party to refrain from using or disclosing any trade secret or confidential or proprietary information in the course of my employment with the Company or to refrain from competing, directly or indirectly, with the business of such previous employer or any other party. I further represent that my performance of all the terms of this Agreement as an employee of the Company does not and will not breach any agreement to keep in confidence proprietary information, knowledge or data acquired by me in confidence or in trust prior to my employment with the Company. I will not disclose to the Company or induce the Company to use any confidential or proprietary information or material belonging to any previous employer or others.

10. **Remedies Upon Breach.** I understand that the restrictions contained in this Agreement are necessary for the protection of the business and goodwill of the Company and I consider them to be reasonable for such purpose. Any breach of this Agreement is likely to cause the Company substantial and irrevocable damage and therefore, in the event of such breach, the Company, in addition to such other remedies which may be available, will be entitled to specific performance and other injunctive relief, without the posting of a bond. If I violate this Agreement, in addition to all other remedies available to the Company at law, in equity, and under contract, I agree that I am obligated to pay all the Company's costs of enforcement of this Agreement, including attorneys' fees and expenses.

11. **Use of Voice, Image and Likeness.** I give the Company permission to use any and all of my voice, image and likeness, with or without using my name, in connection with the products and/or services of the Company, for the purposes of advertising and promoting such products and/or services and/or the Company, and/or for other purposes deemed appropriate by the Company in its reasonable discretion, except to the extent expressly prohibited by law.

12. **Publications and Public Statements.** I will obtain the Company's written approval before publishing or submitting for publication any material that relates to my work at the Company and/or incorporates any Proprietary Information. To ensure that the Company delivers a consistent message about its products, services and operations to the public, and further in recognition that even positive statements may have a detrimental effect on the Company in certain securities transactions and other contexts, any statement about the Company which I create, publish or post during my period of employment and for six (6) months thereafter, on any media accessible by the public, including but not limited to electronic bulletin boards and Internet-based chat rooms, must first be reviewed and approved by an officer of the Company before it is released in the public domain.

13. **No Employment Obligation.** I understand that this Agreement does not create an obligation on the Company or any other person to continue my employment. I acknowledge that, unless otherwise agreed in a formal written employment agreement signed on behalf of the Company by an authorized officer, my employment with the Company is at will and therefore may be terminated by the Company or me at any time and for any reason, with or without cause.

14. **Survival and Assignment by the Company.** I understand that my obligations under this Agreement will continue in accordance with its express terms regardless of any changes in my title, position, duties, salary, compensation or benefits or other terms and conditions of employment. I further understand that my obligations under this Agreement will continue following the termination of my employment regardless of the manner of such termination and will be binding upon my heirs, executors and administrators. The Company will have the right to assign this Agreement to its affiliates, successors and assigns. I expressly consent to be bound by the provisions of this Agreement for the benefit of the Company or any parent, subsidiary or affiliate to whose employ I may be transferred or successor who assumes my employment agreement with the Company without the necessity that this Agreement be resigned at the time of such transfer or assumption.

15. **Exit Interview.** If and when I depart from the Company, I may be required to attend an exit interview and sign an "Employee Exit Acknowledgement" to reaffirm my acceptance and acknowledgement of the obligations set forth in this Agreement. For twelve (12) months following termination of my employment, I will notify the Company of any change in my address and of each subsequent employment or business activity, including the name and address of my employer or other post-Company employment plans and the nature of my activities.

16. **Disclosure to Future Employers.** During the Restricted Period, I will provide a copy of this Agreement to any prospective employer, partner or coventurer prior to entering into an employment, partnership or other business relationship with such person or entity.

17. **Severability.** In case any provisions (or portions thereof) contained in this Agreement shall, for any reason, be held invalid, illegal or unenforceable in any respect, such invalidity, illegality or unenforceability shall not affect the other provisions of this Agreement, and this Agreement shall be construed as if such invalid, illegal or unenforceable provision had never been contained herein. If, moreover, any one or more of the provisions contained in this Agreement shall for any reason be held to be excessively broad as to duration, geographical scope, activity or subject, it shall be construed by limiting and reducing it, so as to be enforceable to the extent compatible with the applicable law as it shall then appear.

18. **Interpretation.** This Agreement will be deemed to be made and entered into in the Commonwealth of Massachusetts, and will in all respects be interpreted, enforced and governed under the laws of the Commonwealth of Massachusetts. I hereby agree to consent to personal jurisdiction of the state and federal courts situated within Suffolk County, Massachusetts for purposes of enforcing this Agreement, and waive any objection that I might have to personal jurisdiction or venue in those courts.

I UNDERSTAND THAT THIS AGREEMENT AFFECTS IMPORTANT RIGHTS. BY SIGNING BELOW, I CERTIFY THAT I HAVE READ IT CAREFULLY AND AM SATISFIED THAT I UNDERSTAND IT COMPLETELY.

IN WITNESS WHEREOF, the undersigned has executed this agreement as a sealed instrument as of the date set forth below.

Signed: _____

Type or print name:

Date:

EXHIBIT A

To: **bluebird bio, Inc.**

From: _____

Date: _____

SUBJECT: **Prior Inventions**

The following is a complete list of all inventions or improvements relevant to the subject matter of my employment by the Company that have been made or conceived or first reduced to practice by me alone or jointly with others prior to my engagement by the Company:

☐ No inventions or improvements

☐ See below:

_____

_____

_____

☐ Additional sheets attached

The following is a list of all patents and patent applications in which I have been named as an inventor:

☐ None

☐ See below:

_____

_____

_____

Exhibit 10.16

September 27, 2011

Personal and Confidential

Ms. Linda Bain
68 Hancock Street
Lexington, MA 02420

Dear Linda;

I am very pleased to provide you with a summary of the terms and conditions of your anticipated employment by bluebird bio, Inc. (the "Company"). The following outlines the terms and conditions of your offer of employment. We hope that you will help further build a meaningful company that helps the lives of many patients in need!

Your position will be Vice President, Finance and Business Operations, reporting to Jeff Walsh, Chief Operating Officer. As our employee, we expect that you will devote substantially all of your working time to the performance of your duties to the Company, and you will perform any and all duties and responsibilities normally associated with your position in a satisfactory manner and to the best of your abilities at all times. If you accept this offer, your employment with the Company will begin on Wednesday, October 19, 2011 (the "Commencement Date").

Please note, however, that no provision of this letter shall be construed to create an express or implied employment contract, or a promise of employment for any specific period of time. Your employment with the Company is at-will employment which may be terminated by you or the company at any time for any reason with or without advance notice. Here is a summary of the terms:

- Your initial salary will be $8,269.23 paid on a bi-weekly basis, which is an annualized rate of $215,000 and payable in substantially equal periodic installments in accordance with Company's normal payroll practices as in effect from time to time (the "Base Salary"). The Company will deduct from each such installment of the Base Salary all amounts required to be deducted or withheld under applicable law or under any employee benefit plan in which you participate. You understand and agree that the annualized base rate described above is set forth as a matter of convenience and does not constitute nor will be deemed to constitute an agreement by the Company to employ you for any specific period of time.

- Subject to approval by the Company's Board of Directors (or an appropriate Committee appointed by the Board of Directors), the Company will grant you options to purchase 1,242,650 shares of common stock in the Company at the then-current fair market value, pursuant to the terms of the Company's Third Amended and Restated Employee, Director and Consultant Stock Plan.

- You will also be eligible to participate fully in employee benefit plans that the Company provides or may establish for the benefit of its employees generally. Your eligibility to participate in these plans and receive benefits thereunder will be subject to the plan documents governing such benefits. Notwithstanding the foregoing, you understand and agree that nothing contained herein will require the Company to establish or maintain any fringe benefits and any such benefits may be modified, amended, terminated or cancelled at any time by the Company in its sole and absolute discretion.

Because your employment with the Company is on an "at-will" basis, either you or the Company may terminate the employment relationship at any time, for any or no reason. As a condition of your employment, you certify to the Company that you are free to enter into and fully perform the duties of your position and that you are not subject to any employment, confidentiality, non-competition or other agreement that would restrict your performance for the Company. You further certify that your signing this letter of employment does not violate any order, judgment or injunction applicable to you, or conflict with or breach any agreement to which you are a party or by which you are bound. If you are subject to any such agreement or order, please forward it to Nick Leschly along with a copy of this letter.

Additionally, as a condition of your employment, you also certify that all facts you have presented to the Company are accurate and true. This includes, but is not limited to, all oral and written statements you have made (including those pertaining to your education, training, qualifications, licensing and prior work experience), resume or c.v., or in any interview or discussion with the Company

The Company considers the protection of its confidential information, proprietary materials and goodwill to be extremely important. Accordingly, you will be required to sign and return an agreement relating to confidentiality, non-competition and work product on or before your first day of work, as a condition of this offer of employment (the "Assignment of Invention, Nondisclosure and Noncompetition Agreement"). A copy of the Assignment of Invention, Nondisclosure and Noncompetition Agreement is enclosed for your consideration and signature.

Your employment with the Company is also conditioned on your eligibility to work in the United States. On your first day, you must complete an I-9 Form and provide us with any of the accepted forms of identification specified on the I-9 Form. A copy of an I-9 Form is enclosed for your information.

This letter constitutes our entire offer regarding the terms and conditions of your prospective employment with the Company. It supersedes any prior agreements, or other promises or statements (whether oral or written) regarding the offered terms of employment.

The terms of your employment shall be governed by the law of Massachusetts. By accepting this offer of employment, you agree that any action, demand, claim or counterclaim in connection with any aspect of your employment with the Company, or any separation of employment (whether voluntary or involuntary) from the Company, shall be resolved in a court of competent jurisdiction in Massachusetts by a judge alone, and you waive and forever renounce your right to a trial before a civil jury.

You may accept this offer of employment and the terms and conditions hereof by signing the enclosed additional copy of this letter. Your signature on the copy of this letter and your submission of the signed copy to me will evidence your agreement with the terms and conditions set forth herein. This offer will expire on Friday, September 30, 2011 unless accepted by you prior to such date by directing the signed offer letter to my attention with two signed copies of the Assignment of Invention, Nondisclosure and Noncompetition Agreement.

Linda, we are pleased to offer you the opportunity to join the Company, and we look forward to having you aboard. We are confident that you will continue to make important contributions to our unique and exciting opportunity to make a difference in bringing important new therapies to patients who need them.

Sincerely,

/s/ Jeffrey T. Walsh
Jeff Walsh
Chief Operating Officer

Acknowledged And Agreed:

/s/ Linda Bain
Linda Bain

9/28/11
Date

Enclosures: Copy of Offer Letter
I-9 Form
Assignment of Invention, Nondisclosure and Noncompetition Agreement (2)
Employee Benefits Summary

Exhibit 10.17

BLUEBIRD BIO, INC.

2013 EMPLOYEE STOCK PURCHASE PLAN

The purpose of the bluebird bio, Inc. 2013 Employee Stock Purchase Plan ("the Plan") is to provide eligible employees of bluebird bio, Inc. (the "Company") and each Designated Subsidiary (as defined in Section 11) with opportunities to purchase shares of the Company's common stock, par value $0.01 per share (the "Common Stock"). Two hundred thirty-eight thousand (238,000) shares of Common Stock in the aggregate have been approved and reserved for this purpose. The Plan is intended to constitute an "employee stock purchase plan" within the meaning of Section 423(b) of the Internal Revenue Code of 1986, as amended (the "Code"), and shall be interpreted in accordance with that intent.

1. Administration. The Plan will be administered by the person or persons (the "Administrator") appointed by the Company's Board of Directors (the "Board") for such purpose. The Administrator has authority at any time to: (i) adopt, alter and repeal such rules, guidelines and practices for the administration of the Plan and for its own acts and proceedings as it shall deem advisable; (ii) interpret the terms and provisions of the Plan; (iii) make all determinations it deems advisable for the administration of the Plan; (iv) decide all disputes arising in connection with the Plan; and (v) otherwise supervise the administration of the Plan. All interpretations and decisions of the Administrator shall be binding on all persons, including the Company and the Participants. No member of the Board or individual exercising administrative authority with respect to the Plan shall be liable for any action or determination made in good faith with respect to the Plan or any option granted hereunder.

2. Offerings. The Company will make one or more offerings to eligible employees to purchase Common Stock under the Plan ("Offerings"). Unless otherwise determined by the Administrator, the initial Offering will begin on January 1st of the year designated by the Administrator and will end on the following June 30th (the "Initial Offering"). Thereafter, unless otherwise determined by the Administrator, an Offering will begin on the first business day occurring on or after each January 1st and July 1st and will end on the last business day occurring on or before the following June 30th and December 31st, respectively. The Administrator may, in its discretion, designate a different period for any Offering, provided that no Offering shall exceed six months in duration or overlap any other Offering.

3. Eligibility. All individuals classified as employees on the payroll records of the Company and each Designated Subsidiary are eligible to participate in any one or more of the Offerings under the Plan, provided that as of the first day of the applicable Offering (the "Offering Date") they are customarily employed by the Company or a Designated Subsidiary for more than 20 hours a week and have completed at least six months of employment. Notwithstanding any other provision herein, individuals who are not contemporaneously classified as employees of the Company or a Designated Subsidiary for purposes of the Company's or applicable Designated Subsidiary's payroll system are not considered to be eligible employees of the Company or any Designated Subsidiary and shall not be eligible to participate in the Plan. In the event any such individuals are reclassified as employees of the Company or a Designated Subsidiary for any purpose, including, without limitation, common law or statutory employees, by any action of any third party, including, without limitation, any government agency, or as a result of any private lawsuit, action or administrative proceeding, such individuals shall, notwithstanding such reclassification, remain ineligible for participation.

Notwithstanding the foregoing, the exclusive means for individuals who are not contemporaneously classified as employees of the Company or a Designated Subsidiary on the Company's or Designated Subsidiary's payroll system to become eligible to participate in this Plan is through an amendment to this Plan, duly executed by the Company, which specifically renders such individuals eligible to participate herein.

4. Participation.

(a) An eligible employee who is not a Participant on any Offering Date may participate in such Offering by submitting an enrollment form to his or her appropriate payroll location at least 15 business days before the Offering Date (or by such other deadline as shall be established by the Administrator for the Offering).

(b) Enrollment. The enrollment form will (a) state a whole percentage to be deducted from an eligible employee's Compensation (as defined in Section 11) per pay period, (b) authorize the purchase of Common Stock in each Offering in accordance with the terms of the Plan and (c) specify the exact name or names in which shares of Common Stock purchased for such individual are to be issued pursuant to Section 10. An employee who does not enroll in accordance with these procedures will be deemed to have waived the right to participate. Unless a Participant files a new enrollment form or withdraws from the Plan, such Participant's deductions and purchases will continue at the same percentage of Compensation for future Offerings, provided he or she remains eligible.

(c) Notwithstanding the foregoing, participation in the Plan will neither be permitted nor be denied contrary to the requirements of the Code.

5. Employee Contributions. Each eligible employee may authorize payroll deductions at a minimum of 1 percent up to a maximum of 10 percent of such employee's Compensation for each pay period. The Company will maintain book accounts showing the amount of payroll deductions made by each Participant for each Offering. No interest will accrue or be paid on payroll deductions.

6. Deduction Changes. Except as may be determined by the Administrator in advance of an Offering, a Participant may not increase or decrease his or her payroll deduction during any Offering, but may increase or decrease his or her payroll deduction with respect to the next Offering (subject to the limitations of Section 5) by filing a new enrollment form at least 15 business days before the next Offering Date (or by such other deadline as shall be established by the Administrator for the Offering). The Administrator may, in advance of any Offering, establish rules permitting a Participant to increase, decrease or terminate his or her payroll deduction during an Offering.

7. Withdrawal. A Participant may withdraw from participation in the Plan by delivering a written notice of withdrawal to his or her appropriate payroll location. The Participant's withdrawal will be effective as of the next business day. Following a Participant's withdrawal, the Company will promptly refund such individual's entire account balance under the Plan to him or her (after payment for any Common Stock purchased before the effective date of withdrawal). Partial withdrawals are not permitted. Such an employee may not begin participation again during the remainder of the Offering, but may enroll in a subsequent Offering in accordance with Section 4.

8. Grant of Options. On each Offering Date, the Company will grant to each eligible employee who is then a Participant in the Plan an option ("Option") to purchase on the last day of such Offering (the "Exercise Date"), at the Option Price hereinafter provided for, the lowest of (a) a number of shares of Common Stock determined by dividing such Participant's accumulated

payroll deductions on such Exercise Date by the Option Price (as defined herein), (b) one thousand (1,000) shares; or (c) such other lesser maximum number of shares as shall have been established by the Administrator in advance of the Offering; provided, however, that such Option shall be subject to the limitations set forth below. Each Participant's Option shall be exercisable only to the extent of such Participant's accumulated payroll deductions on the Exercise Date. The purchase price for each share purchased under each Option (the "Option Price") will be 85 percent of the Fair Market Value of the Common Stock on the Offering Date or the Exercise Date, whichever is less.

Notwithstanding the foregoing, no Participant may be granted an Option hereunder if such Participant, immediately after the Option was granted, would be treated as owning stock possessing five percent or more of the total combined voting power or value of all classes of stock of the Company or any Parent or Subsidiary (as defined in Section 11). For purposes of the preceding sentence, the attribution rules of Section 424(d) of the Code shall apply in determining the stock ownership of a Participant, and all stock which the Participant has a contractual right to purchase shall be treated as stock owned by the Participant. In addition, no Participant may be granted an Option which permits his or her rights to purchase stock under the Plan, and any other employee stock purchase plan of the Company and its Parents and Subsidiaries, to accrue at a rate which exceeds $25,000 of the fair market value of such stock (determined on the Option grant date or dates) for each calendar year in which the Option is outstanding at any time. The purpose of the limitation in the preceding sentence is to comply with Section 423(b)(8) of the Code and shall be applied taking Options into account in the order in which they were granted.

9. Exercise of Option and Purchase of Shares. Each employee who continues to be a Participant in the Plan on the Exercise Date shall be deemed to have exercised his or her Option on such date and shall acquire from the Company such number of whole shares of Common Stock reserved for the purpose of the Plan as his or her accumulated payroll deductions on such date will purchase at the Option Price, subject to any other limitations contained in the Plan. Any amount remaining in a Participant's account at the end of an Offering solely by reason of the inability to purchase a fractional share will be carried forward to the next Offering; any other balance remaining in a Participant's account at the end of an Offering will be refunded to the Participant promptly.

10. Issuance of Certificates. Certificates representing shares of Common Stock purchased under the Plan may be issued only in the name of the employee, in the name of the employee and another person of legal age as joint tenants with rights of survivorship, or in the name of a broker authorized by the employee to be his, her or their, nominee for such purpose.

11. Definitions.

The term "Compensation" means the amount of base pay, prior to salary reduction pursuant to Sections 125, 132(f) or 401(k) of the Code, but excluding overtime, commissions, incentive or bonus awards, allowances and reimbursements for expenses such as relocation allowances or travel expenses, income or gains on the exercise of Company stock options, and similar items.

The term "Designated Subsidiary" means any present or future Subsidiary (as defined below) that has been designated by the Board to participate in the Plan. The Board may so designate any Subsidiary, or revoke any such designation, at any time and from time to time, either before or after the Plan is approved by the stockholders.

The term "Fair Market Value of the Common Stock" on any given date means the fair market value of the Common Stock determined in good faith by the Administrator; provided, however, that if the Common Stock is admitted to quotation on the National Association of Securities Dealers Automated Quotation System ("NASDAQ"), NASDAQ Global Market or another national securities exchange, the determination shall be made by reference to the closing price on such date. If there is no closing price for such date, the determination shall be made by reference to the last date preceding such date for which there is a closing price.

The term "Initial Public Offering" means the consummation of the first underwritten firm commitment public offering pursuant to an effective registration statement under the Securities Act of 1933, as amended, covering the offer and sale by the Company of its Common Stock.

The term "Parent" means a "parent corporation" with respect to the Company, as defined in Section 424(e) of the Code.

The term "Participant" means an individual who is eligible as determined in Section 3 and who has complied with the provisions of Section 4.

The term "Subsidiary" means a "subsidiary corporation" with respect to the Company, as defined in Section 424(f) of the Code.

12. Rights on Termination of Employment. If a Participant's employment terminates for any reason before the Exercise Date for any Offering, no payroll deduction will be taken from any pay due and owing to the Participant and the balance in the Participant's account will be paid to such Participant or, in the case of such Participant's death, to his or her designated beneficiary as if such Participant had withdrawn from the Plan under Section 7. An employee will be deemed to have terminated employment, for this purpose, if the corporation that employs him or her, having been a Designated Subsidiary, ceases to be a Subsidiary, or if the employee is transferred to any corporation other than the Company or a Designated Subsidiary. An employee will not be deemed to have terminated employment for this purpose, if the employee is on an approved leave of absence for military service or sickness or for any other purpose approved by the Company, if the employee's right to reemployment is guaranteed either by a statute or by contract or under the policy pursuant to which the leave of absence was granted or if the Administrator otherwise provides in writing.

13. Special Rules. Notwithstanding anything herein to the contrary, the Administrator may adopt special rules applicable to the employees of a particular Designated Subsidiary, whenever the Administrator determines that such rules are necessary or appropriate for the implementation of the Plan in a jurisdiction where such Designated Subsidiary has employees; provided that such rules are consistent with the requirements of Section 423(b) of the Code. Any special rules established pursuant to this Section 13 shall, to the extent possible, result in the employees subject to such rules having substantially the same rights as other Participants in the Plan.

14. Optionees Not Stockholders. Neither the granting of an Option to a Participant nor the deductions from his or her pay shall constitute such Participant a holder of the shares of Common Stock covered by an Option under the Plan until such shares have been purchased by and issued to him or her.

15. Rights Not Transferable. Rights under the Plan are not transferable by a Participant other than by will or the laws of descent and distribution, and are exercisable during the Participant's lifetime only by the Participant.

16. Application of Funds. All funds received or held by the Company under the Plan may be combined with other corporate funds and may be used for any corporate purpose.

17. Adjustment in Case of Changes Affecting Common Stock . In the event of a subdivision of outstanding shares of Common Stock, the payment of a dividend in Common Stock or any other change affecting the Common Stock, the number of shares approved for the Plan and the share limitation set forth in Section 8 shall be equitably or proportionately adjusted to give proper effect to such event.

18. Amendment of the Plan. The Board may at any time and from time to time amend the Plan in any respect, except that without the approval within 12 months of such Board action by the stockholders, no amendment shall be made increasing the number of shares approved for the Plan or making any other change that would require stockholder approval in order for the Plan, as amended, to qualify as an "employee stock purchase plan" under Section 423(b) of the Code.

19. Insufficient Shares. If the total number of shares of Common Stock that would otherwise be purchased on any Exercise Date plus the number of shares purchased under previous Offerings under the Plan exceeds the maximum number of shares issuable under the Plan, the shares then available shall be apportioned among Participants in proportion to the amount of payroll deductions accumulated on behalf of each Participant that would otherwise be used to purchase Common Stock on such Exercise Date.

20. Termination of the Plan. The Plan may be terminated at any time by the Board. Upon termination of the Plan, all amounts in the accounts of Participants shall be promptly refunded.

21. Governmental Regulations. The Company's obligation to sell and deliver Common Stock under the Plan is subject to obtaining all governmental approvals required in connection with the authorization, issuance, or sale of such stock.

22. Governing Law. This Plan and all Options and actions taken thereunder shall be governed by, and construed in accordance with, the laws of the State of Delaware, applied without regard to conflict of law principles.

23. Issuance of Shares. Shares may be issued upon exercise of an Option from authorized but unissued Common Stock, from shares held in the treasury of the Company, or from any other proper source.

24. Tax Withholding. Participation in the Plan is subject to any minimum required tax withholding on income of the Participant in connection with the Plan. Each Participant agrees, by entering the Plan, that the Company and its Subsidiaries shall have the right to deduct any such taxes from any payment of any kind otherwise due to the Participant, including shares issuable under the Plan.

25. Notification Upon Sale of Shares. Each Participant agrees, by entering the Plan, to give the Company prompt notice of any disposition of shares purchased under the Plan where such disposition occurs within two years after the date of grant of the Option pursuant to which such shares were purchased.

26. Effective Date and Approval of Shareholders. The Plan shall take effect on the date of the Company's Initial Public Offering, subject to approval by the holders of a majority of the votes cast at a meeting of stockholders at which a quorum is present or by written consent of the stockholders.

Exhibit 10.19

LEASE

Between

150 SECOND STREET, LLC

as Landlord,

and

BLUEBIRD BIO, INC.

as Tenant,

For Premises located at:

150 Second Street
Cambridge, Massachusetts

TABLE OF CONTENTS

LEASE AGREEMENT

THIS LEASE AGREEMENT (this "**Lease**") is made as of the 3rd day of June, 2013 ("**Effective Date**"), between **150 SECOND STREET, LLC**, a Delaware limited liability company ("**Landlord**"), and **BLUEBIRD BIO, INC.**, a Delaware corporation ("**Tenant**").

ARTICLE 1
BASIC LEASE PROVISIONS; DEFINITIONS

1.1 Basic Lease Provisions.

Landlord:	150 Second Street, LLC, a Delaware limited liability company
Landlord's Address:	c/o Skanska USA Commercial Development Inc. 253 Summer Street Boston, MA 02210 Attn: Charles Leatherbee
Tenant:	Bluebird Bio, Inc., a Delaware corporation
Tenant's Original Address:	840 Memorial Drive Cambridge, MA 02139
Address:	150 Second Street, Cambridge, Massachusetts
Premises:	That portion of the Project known as Suite 300, containing 43,586 rentable square feet, comprising the entire third floor of the Building, including the Shared Space allocated to Tenant for Tenant's mechanical, PH and lab related storage located in the penthouse, first floor and lower level of the Building as shown on **Exhibit A**.
Project:	The real property on which the building (the "**Building**") in which the Premises are located at 150 Second Street, Cambridge, Massachusetts, together with all improvements thereon and appurtenances thereto as described on **Exhibit B**.
Base Rent:	$57.50 per rentable square foot of the Premises per annum with annual escalations as set forth in the following table:

Period	Rate per RSF	Annual Base Rent	Monthly Base Rent
Months 1(from Lease Commencement Date) through 12*	$ 57.50	$ 2,506,195.00	$ 208,849.58
Months 13 through 24*	$ 59.23	$2,581,598.78	$ 215,133.23
Months 25 through 36	$ 61.00	$ 2,658,746.00	$ 221,562.17
Months 37 through 48	$ 62.83	$ 2,738,508.38	$ 228,209.03
Months 49 through 60	$ 64.72	$ 2,820,885.92	$ 235,073.83
Months 61 through 72	$ 66.66	$ 2,905,442.76	$ 242,120.23
Months 73 through 84	$ 68.66	$2,992,614.76	$ 249,384.56
Months 85 through 96	$ 70.72	$ 3,082,401.92	$256,866.83
Months 97 through 108	$ 72.84	$ 3,174,804.24	$ 264,567.02

*** Notwithstanding anything in this Section of the Lease to the contrary, Tenant shall be entitled to an abatement of Base Rent in the amount of $208,849.58 per month for six (6) consecutive full calendar months of the Base Term beginning on the Lease Commencement Date, subject to the terms and conditions set forth in Section 4.2.**

Rent Commencement Date:	The date following the Lease Commencement Date on which the full amount of the Rent Abatement has been fully applied to the Base Rent under this Lease subject to the terms and conditions set forth in Section 4.2.
Rentable Area of Premises:	43,586 rentable square feet
Rentable Area of Project:	123,210 square feet
Tenant's Share of Operating Expenses:	35.38%
Lease Commencement Date:	The earlier of: (i) the Substantial Completion of Tenant's Work (as set forth in Section 5.4) and Tenant's occupancy of the Premises for purposes of conducting Tenant's business operations; or (ii) January 1, 2014.

Base Term:	Beginning on the Lease Commencement Date and ending on the last day of the one hundred eighth (108 th) month thereafter.
Extension Term:	One option for five (5) years as set forth in Section 28.
Landlord's Contribution:	Subject to Section 5.4 below, $150 per RSF of the Premises calculated to equal $6,537,900 based on Premises containing 43,586 RSF plus up to an additional $4,358.60 ($.10 per RSF) for out of pocket costs incurred in preparing the initial test fit of the Premises.
Permitted Use:	General office, research and development, laboratory and other related uses, including the use of a vivarium, consistent with the character of the Project and otherwise in compliance with the provisions of Section 6 hereof.
Wiring and ACH Instructions for Rent Payment:	Bank: Bank of America Account Name: 150 Second Street LLC Account Number: 4427702408 ACH Routing /ABA Number: 111000012 Wire Routing /ABA Number: 026009593 Bank Address: Mail Code: GA1-006-09-10 Atlanta Plaza Building 600 Peachtree St NE Atlanta, GA 30308-2265
Parking:	As set forth in Section 7.
Security Deposit:	$1,253,097.48 subject to the terms and conditions set forth in Section 27.
General Liability Insurance:	$2,000,000.00 per occurrence/$3,000,000.00 aggregate (combined single limit) for property damage, bodily injury and death.
Right of First Offer:	As set forth in Section 29.
Landlord's Notice Address:	c/o Skanska USA Commercial Development Inc. 253 Summer Street Boston, MA 02210 Attn: Charles Leatherbee

Tenant's Notice Address:	Prior to the Lease Commencement Date: 840 Memorial Drive Cambridge, MA 02139 Attention: Linda Bain After the Lease Commencement Date: 150 Second Street Cambridge, MA 02139 Attention: Linda Bain
Brokers:	Jones Lang LaSalle and Colliers International New England LLC

The following Exhibits and Addenda are attached hereto and incorporated herein by this reference:

EXHIBIT A - PLAN OF PREMISES, STORAGE SPACES AND SHARED SPACES
EXHIBIT B - DESCRIPTION OF PROJECT
EXHIBIT C - ACKNOWLEDGMENT OF LEASE COMMENCEMENT DATE
EXHIBIT D - RENT CERTIFICATE
EXHIBIT E - BASE BUILDING SPECIFICATIONS
EXHIBIT F - LANDLORD TENANT MATRIX
EXHIBIT G - TENANT'S CONCEPT PLAN
EXHIBIT H - TENANT DESIGN AND CONSTRUCTION GUIDELINES
EXHIBIT I - PARKING PLAN
EXHIBIT J - RULES AND REGULATIONS

1.2 Definitions.

"**Abated Base Rent**" shall have the meaning set forth in **Section 4.2** hereof.

"**ADA**" shall mean the Americans With Disabilities Act, 42 U.S.C. § 12101, et seq., together with the regulations promulgated pursuant thereto.

"**Additional Rent**" shall have the meaning set forth in **Section 4.3** hereof.

"**AIA**" shall mean the American Institute of Architects.

"**Alterations**" shall have the meaning set forth in **Section 9.1** hereof.

"**Annual Estimate**" shall have the meaning set forth in **Section 4.4** hereof.

"**Annual Statement**" shall have the meaning set forth in **Section 4.4** hereof.

"**Arbitrator**" shall mean any person appointed by or on behalf of either party or appointed pursuant to the provisions hereof and: (i) shall be (A) a member of the American Institute of Real Estate Appraisers with not less than 10 years of experience in the appraisal of improved office and high tech and life sciences laboratory real estate in the greater Boston, Massachusetts metropolitan area, or (B) a licensed commercial real estate broker with not less than 15 years experience representing landlords and/or tenants in the leasing of high tech or life sciences laboratory space in the greater Boston, Massachusetts metropolitan area, (ii) devoting substantially all of their time to professional appraisal or brokerage work, as applicable, at the time of appointment and (iii) be in all respects impartial and disinterested.

"**Assignment Date**" shall have the meaning set forth in **Section 17.2** hereof.

"**Assignment Notice**" shall have the meaning set forth in **Section 17.2** hereof.

"**Assignment Termination**" shall have the meaning set forth in **Section 17.2** hereof.

"**Base Rent**" shall have the meaning set forth in **Section 1.1** hereof.

"**Base Rent Abatement Period**" shall have the meaning set forth in **Section 4.2** hereof.

"**Base Term**" shall have the meaning set forth in **Section 1.1** hereof.

"**Business Day**" shall mean any day other than (a) a Saturday or Sunday and (b) any Federal holiday or (c) a day on which banks are not open for business generally in the Commonwealth of Massachusetts.

"**Broker**" shall have the meaning set forth in **Section 1.1** hereof.

"**Building Systems**" shall mean the structural, exterior, parking and other Common Areas of the Project, including HVAC, plumbing, fire sprinklers, electrical, elevators and all other building systems serving the Premises and other portions of the Project.

"**Claims**" shall have the meaning set forth in **Section 6.1** hereof.

"**Common Areas**" shall mean the portions of the Project which are for the non-exclusive use of tenants of the Project.

"**Default Rate**" shall mean an annual rate equal to the lesser of 12% per annum or the highest rate permitted by law.

"**Default**" shall have the meaning set forth in **Section 16.1** hereof.

"**Environmental Claims**" shall have the meaning set forth in **Section 21.1**.

"**Environmental Requirements**" shall have the meaning set forth in **Section 21.8** hereof.

"**Excess Rent**" shall have the meaning set forth in **Section 17.4** hereof.

"**Expense Information**" shall have the meaning set forth in **Section 4.4** hereof.

"**Extension Proposal**" shall have the meaning set forth in **Section 28.2** hereof.

"**Extension Right**" shall have the meaning set forth in **Section 28.1** hereof.

"**Extension Term**" shall have the meaning set forth in **Section 28.1** hereof.

"**Force Majeure**" shall have the meaning set forth in **Section 30.20** hereof.

"**Governmental Authority**" shall have the meaning set forth in **Section 4.6** hereof.

"**Haz Mat Documents**" shall have the meaning set forth in **Section 21.2** hereof.

"**Hazardous Materials Clearances**" shall have the meaning set forth in **Section 14.1** hereof.

"**Hazardous Materials List**" shall have the meaning set forth in **Section 21.2** hereof.

"**Hazardous Materials**" shall have the meaning set forth in **Section 21.8** hereof.

"**Holder**" shall have the meaning set forth in **Section 19.1** hereof.

"**Independent Review**" shall have the meaning set forth in **Section 4.4** hereof.

"**Installations**" shall have the meaning set forth in **Section 9.1** hereof.

"**Landlord's Work**" shall have the meaning set forth in **Section 5.1** hereof.

"**Legal Requirement(s)**" shall mean all laws, orders, judgments, ordinances, regulations, codes, directives, permits, licenses, covenants and restrictions now or hereafter applicable to the Project, and to the use and occupancy thereof, including, without limitation, the ADA.

"**Letter of Credit**" shall have the meaning set forth in **Section 27.1** hereof.

"**Market Rate**" shall have the meaning set forth in **Section 28.1** hereof.

"**Maximum Restoration Period**" shall have the meaning set forth in **Section 14.1** hereof.

"**Memorial Drive Lease**" shall have the meaning set forth in **Section 4.2** hereof.

"**Memorial Drive Rent Savings Event**" shall have the meaning set forth in **Section 4.2** hereof.

"**Mortgage**" shall have the meaning set forth in **Section 19.1** hereof.

"**OFAC**" shall mean the Office of Foreign Assets Control of the U.S. Department of Treasury.

"**OFAC Rules**" shall mean the rules of OFAC and any statute, executive order, or regulation relating thereto.

"**Operating Expenses**" shall have the meaning set forth in **Section 4.4** hereof.

"**Permitted Assignment**" shall have the meaning set forth in **Section 17.2** hereof.

"**Permitted Use**" shall have the meaning set forth in **Section 1.1** hereof.

"**Premises**" shall have the meaning set forth in **Section 1.1** hereof.

"**Proceeding for Relief**" shall have the meaning set forth in **Section 16.1(f)** hereof.

"**Project**" shall have the meaning set forth in **Section 1.1** hereof.

"**Related Parties**" shall have the meaning set forth in **Section 13.1** hereof.

"**Removable Installations**" shall have the meaning set forth in **Section 9.1** hereof.

"**Rent**" shall mean Base Rent, Tenant's Share of Operating Expenses and all other amounts payable by Tenant to Landlord hereunder.

"**Rent Abatement**" shall have the meaning set forth in **Section 4.2** hereof.

"**Rent Abatement Conditions**" shall have the meaning set forth in **Section 4.2** hereof.

"**Rentable Area of the Premises**" shall have the meaning set forth in **Section 1.1** hereof.

"**Rentable Area of the Project**" shall have the meaning set forth in **Section 1.1** hereof.

"**Rent Adjustment Percentage**" shall mean three percent (3%).

"Rent Certificate" shall have the meaning set forth in **Section 4.2** hereof.

"**Security Deposit**" shall have the meaning set forth in **Section 27.1** hereof.

"**Substantial Completion**" or "**Substantially Complete**" shall have the meaning set forth in **Section 5.4**.

"**Surrender Plan**" shall have the meaning set forth in **Section 20.1** hereof.

"**Taking**" and "**Taken**" shall have the meaning set forth in **Section 15.1** hereof.

"**Taxes**" shall have the meaning set forth in **Section 4.5** hereof.

"**Tenant HazMat Operations**" shall have the meaning set forth in **Section 20.1** hereof.

"**Tenant Parties**" shall have the meaning set forth in **Section 10.1** hereof.

"**Tenant's Property**" shall have the meaning set forth in **Section 9.1** hereof.

"**Tenant's Share of Operating Expenses**" shall have the meaning set forth in **Section 1.1** hereof.

"**Tenant's Share**" shall mean the percentage set forth in the Basic Lease Provisions as Tenant's Share as reasonably adjusted by Landlord for changes in the physical size of the Premises or the Project occurring thereafter.

"**Tenant's Work**" shall have the meaning set forth in **Section 5.2**.

"**Utilities**" shall have the meaning set forth in **Section 8.1** hereof.

"**Restoration Period**" shall have the meaning set forth in **Section 14.1** hereof.

ARTICLE 2
PREMISES; APPURTENANT RIGHTS; RESERVATIONS

2.1 Lease of Premises. Upon and subject to all of the terms and conditions hereof, Landlord hereby leases the Premises to Tenant and Tenant hereby leases the Premises from Landlord.

Excepted and excluded from the Premises and the Common Areas (as defined below) are the ceiling, floor, perimeter walls and exterior windows (except the inner surface of each thereof), and any space in the Premises used for shafts, stacks, pipes, conduits, fan rooms, ducts, electric or other utilities, sinks or other Building facilities, but the entry doors to the Premises are a part thereof, together with related glass and finish work. Landlord shall have the right to place in the Premises interior sun control devices, utility lines, cables and wiring, equipment, stacks, pipes, conduits, ducts and the like, provided that any such installations shall be located above the ceiling or within the walls (except for the interior sun control devices which shall be located in or near the windows) and shall not otherwise materially interfere with Tenant's use, or materially reduce the rentable square footage of the Premises.

2.2 Appurtenant Rights. Subject to the matters set forth in the following paragraph, Tenant shall have, as appurtenant to the Premises, the non-exclusive right to use, and permit its invitees to use in common with Landlord and others, the following areas of the Property (collectively, the **"Common Areas"**) (i) public or common lobbies, hallways, stairways, elevators (including but not limited to freight elevators) and common walkways necessary for access to the Building and the Premises, and if the portion of the Premises on any floor includes less than the entire floor, any common toilets, any corridors required for access to the Premises and any elevator lobby of such floor; and (ii) the access roads, driveways, parking areas (as the same may be designated or modified by Landlord from time to time), loading areas, pedestrian sidewalks, landscaped areas, trash enclosures (including but not limited to dumpsters maintained on the premises by Landlord), if any, and other areas or facilities, if any, which are located in or on the Property and designated by Landlord from time to time for the non-exclusive use of tenants and other occupants of the Building.

Landlord has designated certain areas located on the penthouse, ground level and garage level of the Building for Storage Space and Shared Space, as shown on the plan attached hereto as **Exhibit A**, for use by the tenants of the Building. Tenant shall be allocated Tenant's Share of the Storage Space and Shared Space, the location and use of which shall be reasonably determined by Landlord and Tenant subject to applicable Legal Requirements, circulation requirements and Landlord's reasonable requirements and conditions (including, without limitation, consideration for the utility of the unused portions of the Storage Space and Shared Space by other tenants of the Building). The Storage Space and Shared Space shall be leased to Tenant on all of the terms and conditions of this Lease which are applicable to the Premises except as follows: (i) the rent for Tenant's Share of the Storage Space shall be the then applicable market rate (currently $18.00 per RSF); (ii) Landlord shall not have any obligation to make any improvements or alterations to the Storage Space and Shared Space to prepare such space for Tenant's use; (iii) Tenant shall use Tenant's Share of the Storage Space and Shared Space solely for the storage or use of Tenant's property or equipment and for no other purpose and in accordance with all applicable Legal Requirements; (iv) Tenant, at its sole expense, shall keep Tenant's Share of the Storage Space and Shared Space clean and in good condition; and (vi) Landlord shall not be required to provide any services for the Storage Space and Shared Space. Notwithstanding the foregoing, as of the Effective Date, Tenant shall be deemed to have elected to lease the entire amount of Storage Space allocated to Tenant at the rate of $18.00 per RSF (gross) for the Term. If Tenant subsequently elects to surrender any or all of such Storage Space to Landlord, Landlord may offer the surrendered Storage Space to other tenants in the Building and Tenant's right to lease such surrendered Storage Space thereafter will be subject to availability at such future time and Tenant's payment at the then applicable market rental rate.

Notwithstanding any provision herein to the contrary, Tenant's rights under this Lease shall always be subject to (a) reservations, restrictions, easements and encumbrances of record, as amended from time to time, (b) such reasonable rules and regulations from time to time established by Landlord with respect to the Property pursuant to **Section 30.18** (the **"Rules and Regulations"**), and (c) Landlord's reservations set forth in **Section 2.3** below or elsewhere in this Lease.

2.3 Landlord Reservations. Notwithstanding any provision herein to the contrary, Landlord reserves the right to: (i) grant, modify and terminate easements and other encumbrances so long as the same do not materially and adversely interfere with the Permitted Use by Tenant, (ii) designate and change from time to time areas and facilities so to be used; provided however, that Landlord shall be responsible for any costs incurred in moving any of Tenant's personnel, furniture, fixtures or equipment, (iii) make additions to the Building, (iv) construct other buildings and improvements at the Property, (v) post "For Sale" and "For Lease" signs on the Property at any time during the Term, and (vi) change the name and street address of the Building (provided, in such event, Landlord shall reimburse Tenant for its costs to implement such changes). Landlord reserves the right, at any time and from time to time, to make such changes, alterations, additions, improvements, repairs or replacements in or to the Project (including the Premises but, with respect to the Premises, only for purposes of repairs, maintenance, replacements and other rights expressly reserved to Landlord herein) and the fixtures and equipment therein, as well as in or to the street entrances and/or the Common Areas, as it may reasonably deem necessary or desirable, provided, however, that there be no material obstruction or modification of access to, or material interference with the use or enjoyment of, the Premises or parking spaces by Tenant. Subject to the foregoing, provided reasonable prior written notice is given to Tenant and Tenant's access to the Premises is not prohibited, Landlord shall have the right to temporarily close all, or any portion, of the Common Areas for the purpose of making repairs or changes thereto.

ARTICLE 3
DELIVERY OF PREMISES; ACCEPTANCE

3.1 Delivery of Premises; Acceptance of Premises. Landlord shall deliver the Premises to Tenant upon the Effective Date provided that Tenant has delivered the Security Deposit to Landlord and complied with the requirements of Article 13. Except as set forth in this Section 3.1 and Section 5.1(a), if applicable: (i) Tenant shall accept the Premises in their condition as of the time of delivery, subject to all applicable Legal Requirements (as defined in **Article 6** hereof); (ii) Landlord shall have no obligation for any defects in the Premises; and (iii) Tenant's taking possession of the Premises shall be conclusive evidence that Tenant accepts the Premises with Landlord's Work completed pursuant to Section 5.1(a).

Tenant agrees and acknowledges that, except as otherwise set forth in this Lease, neither Landlord nor any agent of Landlord has made any representation or warranty with respect to the condition of all or any portion of the Premises or the Project, and/or the suitability of the Premises or the Project for the conduct of Tenant's business, and Tenant waives any implied warranty that the Premises or the Project are suitable for the Permitted Use. Notwithstanding the foregoing, Landlord represents to its knowledge that general office, research and development and laboratory uses are permitted uses pertaining to the Building under the Zoning Ordinance of the City of Cambridge. This Lease constitutes the complete agreement of Landlord and Tenant with respect to the subject matter hereof and supersedes any and all prior representations, inducements, promises, agreements, understandings and negotiations which are not contained herein. Landlord in executing this Lease does so in reliance upon Tenant's representations, warranties, acknowledgments and agreements contained herein.

3.2 Acknowledgment of Lease Commencement Date. Upon request of Landlord, Tenant shall execute and deliver a written acknowledgment of the Lease Commencement Date, Rent Commencement Date and the expiration date of the Term when such dates are established in accordance with the requirements of this Lease substantially in the form of the "Acknowledgement

of Lease Commencement Date" attached to this Lease as **Exhibit C**; provided, however, Tenant's failure to execute and deliver such acknowledgment shall not affect Landlord's rights hereunder. The "**Term**" of this Lease shall be the Base Term, as defined above on the first page of this Lease and, if applicable, the Extension Term which Tenant may elect pursuant to **Article 28** hereof.

ARTICLE 4
RENT

4.1 Base Rent. The first month's Base Rent shall be due and payable on the Lease Commencement Date and the Security Deposit shall be due and payable on delivery of an executed copy of this Lease to Landlord. Tenant shall pay to Landlord in advance, without demand, abatement, deduction or set-off, equal monthly installments of Base Rent on or before the first day of each calendar month during the Term hereof, in lawful money of the United States of America, at the office of Landlord for payment of Rent set forth above, or to such other person or at such other place as Landlord may from time to time designate in writing. Payments of Base Rent for any fractional calendar month shall be prorated. The obligation of Tenant to pay Base Rent and other sums to Landlord and the obligations of Landlord under this Lease are independent obligations. Tenant shall have no right at any time to abate, reduce, or set-off any Rent (as defined in Section 1.2) due hereunder except for any abatement, reduction or set-off as may be expressly provided in this Lease.

4.2 Base Rent Abatement Period. Notwithstanding anything in this Section of the Lease to the contrary, so long as Tenant is not in Default (as defined in Section 16.1) under this Lease, Tenant shall be entitled to an abatement of Base Rent in the amount of $208,849.58 per month for six (6) consecutive full calendar months of the Base Term beginning on the Lease Commencement Date (" **Rent Abatement**"). The period during which the foregoing Base Rent abatement rights are in effect shall be referred to as the " **Base Rent Abatement Period**" and the amount of Base Rent permitted to be abated shall be referred to as the "**Abated Base Rent**". During the Base Rent Abatement Period, only Base Rent shall be abated as provided in this Section, and all Additional Rent and other costs and charges specified in this Lease shall remain as due and payable pursuant to the provisions of this Lease.

As an inducement to Tenant's entering into this Lease, Landlord offers the Rent Abatement in order to offset Tenant's rent obligation under its current lease pertaining to the premises located at 840 Memorial Drive, Cambridge, Massachusetts (" **Memorial Drive Lease**"), a true, accurate and complete copy of which Tenant shall provide to Landlord prior to the Effective Date of this Lease. Accordingly, Landlord and Tenant agree that if Tenant's out of pocket rent obligation under the Memorial Drive Lease is reduced or eliminated by virtue of entering into an assignment or sublease, termination agreement or suffering a recapture of such premises or other such means (each, a " **Memorial Drive Rent Savings Event**"), Landlord and Tenant shall split Tenant's rent savings under the Memorial Drive Lease on a 60% to Landlord and 40% to Tenant basis after the deduction of reasonable documented transaction costs, including, but not limited to legal and brokerage fees and tenant improvement allowances.

In order to receive the Rent Abatement and to account for the occurrence of a Memorial Drive Rent Savings Event, Tenant shall comply with the following requirements (collectively, the "**Rent Abatement Conditions**"):

i. Upon the Lease Commencement Date and the first day of each successive month thereafter until the expiration or earlier termination of the term of the Memorial Drive Lease, Tenant shall deliver to Landlord a Rent Certificate substantially in the form attached hereto as **Exhibit D** ("**Rent Certificate**") whereby Tenant certifies to Landlord, among other things, the amount of Tenant's actual out of pocket rent payment under the Memorial Drive Lease for the applicable monthly period.

ii. Upon Landlord's receipt of the Rent Certificate, Tenant's obligation to pay the Base Rent for the applicable month shall abate.

If the Rent Certificate indicates that a Memorial Drive Rent Savings Event has occurred, the amount of the Rent Abatement that may be applied to Base Rent hereunder shall be reduced by the portion of the rent savings allocated to Landlord as Tenant realizes the actual rent savings under the Memorial Drive Lease. If a Memorial Drive Rent Savings Event has occurred and the amount of the rent savings under the Memorial Drive Lease is greater than the remaining amount of the Rent Abatement at such time, then Tenant shall pay Landlord, as additional rent, the rent savings allocated to Landlord amortized over the remainder of the stated term of the Memorial Drive Lease. The following examples illustrate three (but not all) possible scenarios that may arise in any given month during the Base Rent Abatement Period under this Section:

(a) No Memorial Drive Rent Savings Event Occurs Before the Expiration of the Base Rent Abatement Period :

1. Tenant submits a Rent Certificate to Landlord evidencing that no Memorial Drive Rent Savings Event has occurred.
2. Tenant pays the monthly base rent of approximately $35.290.60 to landlord under the Memorial Drive Lease.
3. The Monthly Base Rent of $208,849.58 due to Landlord pursuant to Section 1.1 hereof is abated.

(b) Memorial Drive Rent Savings Event Occurs Before the Expiration of the Base Rent Abatement Period :

1. Tenant submits a Rent Certificate to Landlord evidencing that Tenant and the landlord under the Memorial Drive Lease have entered into a lease termination agreement (i.e. a Memorial Drive Rent Savings Event) yielding a rent savings of $500,000 (after deduction of Tenant's reasonable documented transaction costs).
2. Landlord's share of the rent savings is $300,000 and Tenant's share of the rent savings is $200,000.
3. Tenant pays the net monthly rent (or no monthly rent, as the case may be) due to landlord under the Memorial Drive Lease after accounting for the rent savings under the Memorial Drive Lease.

4. The amount of Rent Abatement that may be applied to Base Rent is reduced by $300,000 (the amount of Landlord's share of the rent savings). Therefore, Tenant pays Base Rent of $208,849.58 to Landlord plus additional rent of $91,150.42 ($208,849.58 + $91,150.42 = $300,000 rent savings due Landlord).

(c) Memorial Drive Rent Savings Event Occurs After the Expiration of the Base Rent Abatement Period :

1. Tenant submits a Rent Certificate to Landlord evidencing that Tenant and the landlord under the Memorial Drive Lease have entered into a lease termination agreement (i.e. a Memorial Drive Rent Savings Event) yielding a rent savings of $500,000 (after deduction of Tenant's reasonable documented transaction costs).
2. Landlord's share of the rent savings is $300,000 and Tenant's share of the rent savings is $200,000.
3. Tenant pays the net monthly rent (or no monthly rent, as the case may be) due to landlord under the Memorial Drive Lease after accounting for the rent savings under the Memorial Drive Lease.
4. Assuming five months remaining in the term under the Memorial Drive Lease, the monthly amount of the Landlord's share of the rent savings amortized on a straight line basis over the unexpired portion of the term under the Memorial Drive Lease is $60,000 ($300,000 ÷ 5 months).
5. Tenant pays the applicable monthly Rent to Landlord due under this Lease plus additional rent of $60,000 for five consecutive months.

In the event of any inconsistency or conflict between the numeric examples provided above and the written provisions set forth in this Section, the written text shall govern.

If Tenant fails to comply with the requirements set forth in this Section 4.2, Tenant shall be obligated to pay the applicable Base Rent. If a Rent Certificate is inaccurate or if Tenant and Landlord have failed to properly account for a previously-occurring Memorial Drive Rent Savings Event, then Tenant shall be obligated to prepare and deliver a Rent Certificate addressing such inaccuracy or failure and shall pay to Landlord the Landlord's share of any previously Abated Base Rent.

4.3 Additional Rent. In addition to Base Rent, commencing on the Lease Commencement Date, Tenant agrees to pay to Landlord as additional rent ("**Additional Rent**"): (i) Tenant's Share of "Operating Expenses" (as defined in Section 4.5), and (ii) any and all other amounts Tenant assumes or agrees to pay to Landlord under the provisions of this Lease, including, without limitation, any and all other sums that may become due by reason of any default of Tenant or failure to comply with the agreements, terms, covenants and conditions of this Lease to be performed by Tenant, after any applicable notice and cure period.

4.4 Intentionally Omitted.

4.5 Operating Expense Payments. Landlord shall deliver to Tenant a written estimate of Operating Expenses for each calendar year during the Term (the "**Annual Estimate**") which may be revised by Landlord from time to time during such calendar year. During each month of the Term commencing on the Lease Commencement Date, on the same date that Base Rent is due, Tenant shall pay Landlord an amount equal to 1/12th of Tenant's Share of the Annual Estimate. Payments for any fractional calendar month shall be prorated. If Landlord fails to give Tenant the Annual Estimate prior to the beginning of any calendar year, Tenant shall continue to pay Operating Expenses in accordance with the previous Annual Estimate, until Tenant receives a new statement from Landlord.

The term "**Operating Expenses**" means all costs and expenses of any kind or description whatsoever incurred or accrued each calendar year by Landlord in operating, maintaining, repairing, and managing the Building and the Project including, without duplication, Taxes (as defined in **Section 4.5**), capital repairs and improvements (1) reasonably projected to reduce the amount of Operating Expenses payable by Tenant, or (2) required to comply with any Legal Requirements that first become effective and applicable to the Project after the date of this Lease, amortized over-the useful life of such capital items as determined in accordance with generally accepted accounting principles, costs for transportation services for the benefit of the tenants of the Building and a property management fee at fair market rates not to exceed 3.0% of Base Rent, excluding only:

(a) the original construction costs of the Project and renovation prior to the date of the Lease and costs of correcting defects in such original construction or renovation (including Landlord's Work);

(b) capital expenses for the Project except as expressly permitted above;

(c) interest, principal and other payments pursuant to a Mortgage (as defined in **Section 19.1**) debts of Landlord, ground rent, financing costs and amortization of funds borrowed by Landlord, whether secured or unsecured;

(d) depreciation of the Project (except for capital improvements, the cost of which are includable in Operating Expenses);

(e) advertising, promotional, legal and space planning expenses and leasing commissions and other costs and expenses incurred in procuring and leasing space to tenants for the Project, including any leasing office maintained in the Project, free rent and construction allowances for tenants;

(f) legal and other expenses incurred in the negotiation or enforcement of leases;

(g) completing, fixturing, improving, renovating, painting, redecorating or other work, which Landlord pays for or performs for other tenants within their premises, and costs of correcting defects in such work;

(h) costs to be reimbursed by other tenants of the Project or Taxes to be paid directly by Tenant or other tenants of the Project, whether or not actually paid;

(i) The cost of any work or services performed for any other property other than the Project, including, without limitation, salaries, wages, benefits and other compensation paid to employees of Landlord who are not assigned in whole or in part to the operation, management, maintenance or repair of the Project;

(j) salaries, wages, benefits and other compensation paid to officers and executives of Landlord and administrative employees above the grade of property manager or building supervisor and Landlord's general overhead;

(k) general organizational, administrative and overhead costs relating to maintaining Landlord's existence, either as a corporation, partnership, or other entity, including general corporate, legal and accounting expenses;

(l) costs (including attorneys' fees and costs of settlement, judgments and payments in lieu thereof) incurred in connection with disputes with tenants, other occupants, or prospective tenants, and costs and expenses, including legal fees, incurred in connection with negotiations or disputes with employees, consultants, management agents, leasing agents, purchasers or mortgagees of the Building;

(m) costs incurred by Landlord due to the violation by Landlord, its employees, agents or contractors or any tenant of the terms and conditions of any lease of space in the Project or any Legal Requirement (as defined in **Section 1.2**);

(n) penalties, fines or interest incurred as a result of Landlord's inability or failure to make payment of Taxes and/or to file any tax or informational returns when due, or from Landlord's failure to make any payment of Taxes required to be made by Landlord hereunder before delinquency;

(o) overhead and profit increment paid to Landlord or to subsidiaries or affiliates of Landlord for goods and/or services in or to the Project to the extent the same exceeds the costs of such goods and/or services rendered by unaffiliated third parties on a competitive basis;

(p) costs of Landlord's charitable or political contributions, or of fine art maintained at the Project;

(q) costs in connection with services (including electricity), items or other benefits of a type which are not standard for the Project and which are not available to Tenant without specific charges therefor, but which are provided to another tenant or occupant of the Project, whether or not such other tenant or occupant is specifically charged therefor by Landlord;

(r) costs incurred in the sale or refinancing of the Project;

(s) costs for remediation, abatement, removal or encapsulation of Hazardous Materials at the Project other than routine cleaning and maintenance which may involve the same;

(t) net income taxes of Landlord or the owner of any interest in the Project, franchise, capital stock, gift, estate or inheritance taxes or any federal, state or local documentary taxes imposed against the Project or any portion thereof or interest therein; and

(u) any expenses otherwise includable within Operating Expenses to the extent actually reimbursed by persons other than tenants of the Project under leases for space in the Project.

Within 90 days after the end of each calendar year (or such longer period as may be reasonably required), Landlord shall furnish to Tenant a statement (an "**Annual Statement**") showing in reasonable detail: (a) the total and Tenant's Share of actual Operating Expenses for the previous calendar year, and (b) the total of Tenant's payments in respect of Operating Expenses for such year. If Tenant's Share of actual Operating Expenses for such year exceeds Tenant's payments of Operating Expenses for such year, the excess shall be due and payable by Tenant as Rent within 30 days after delivery of such Annual Statement to Tenant. If Tenant's payments of Operating Expenses for such year exceed Tenant's Share of actual Operating Expenses for such year, the excess shall be credited against the next due amounts of Rent, provided that any overpayment shall be paid to Tenant within thirty (30) days if the Term has ended, provided that if Tenant is delinquent in its obligation to pay Base Rent or Additional Rent, Landlord shall pay the excess to Tenant after deducting all other amounts due Landlord.

The Annual Statement shall be final and binding upon Tenant unless Tenant, within 90 days after Tenant's receipt thereof, shall contest any item therein by giving written notice to Landlord, specifying each item contested and the reason therefor. If, during such 90 day period, Tenant reasonably and in good faith questions or contests the accuracy of Landlord's statement of Tenant's Share of Operating Expenses, provided that Tenant pays any amount due on the Annual Statement if applicable, Landlord will provide Tenant with access to Landlord's books and records relating to the operation of the Project and such information as Landlord reasonably determines to be responsive to Tenant's questions (the "**Expense Information**"). If Landlord and Tenant cannot agree upon the amount of Tenant's Share of Operating Expenses within thirty (30) days after Tenant's review of such Expense Information, then Tenant shall have the right to have an independent public accounting firm selected by Tenant, working pursuant to a fee arrangement other than a contingent fee (at Tenant's sole cost and expense) and approved by Landlord (which approval shall not be unreasonably withheld, conditioned or delayed), audit and/or review the Expense Information for the year in question (the "**Independent Review**"). The results of any such Independent Review shall be binding on Landlord and Tenant. If the Independent Review shows that the payments actually made by Tenant with respect to Operating Expenses for the calendar year in question exceeded Tenant's Share of Operating Expenses for such calendar year, Landlord shall at Landlord's option either (i) credit the excess amount to the next succeeding installments of estimated Operating Expenses or (ii) pay the excess to Tenant within 30 days after delivery of such statement, except that after the expiration or earlier termination of this Lease or if Tenant is delinquent in its obligation to pay Rent, Landlord shall pay the excess to Tenant after deducting all other amounts due Landlord. If the Independent Review shows that Tenant's payments with respect to Operating Expenses for such calendar year were less than Tenant's Share of Operating Expenses for the calendar year, Tenant shall pay the deficiency to Landlord within 30 days after delivery of such statement. If the Independent Review shows that Tenant has overpaid with respect to Operating Expenses stated in the Annual Statement or any adjustments made

thereafter by more than 5% then Landlord shall reimburse Tenant for all costs incurred by Tenant for the Independent Review. Operating Expenses for the calendar years in which Tenant's obligation to share therein begins and ends shall be prorated. Notwithstanding anything set forth herein to the contrary, if the Project is not at least 95% occupied on average during any year of the Term, Tenant's Share of Operating Expenses that vary according to occupancy of the Project for such year shall be computed as though the Project had been 95% occupied on average during such year.

"**Tenant's Share**" shall be the percentage set forth on the first page of this Lease as Tenant's Share as reasonably adjusted by Landlord for changes in the physical size of the Premises or the Project occurring thereafter. Landlord may equitably adjust Tenant's Share for any item of expense or cost reimbursable by Tenant that relates to a repair, replacement, or service that benefits only the Premises or only a portion of the Project that includes the Premises, which adjustment may be reviewed by Tenant as part of the Independent Review. Base Rent, Tenant's Share of Operating Expenses and all other amounts payable by Tenant to Landlord hereunder are collectively referred to herein as "**Rent**."

4.6 Taxes. Tenant shall pay, as part of Operating Expenses, all taxes, levies, fees, assessments and governmental charges of any kind, existing as of the Lease Commencement Date or thereafter enacted (collectively referred to as "**Taxes**"), imposed by any federal, state, regional, municipal, local or other governmental authority or agency, including, without limitation, quasi-public agencies (collectively, "**Governmental Authority**") during the Term, including, without limitation, all Taxes: (i) imposed on or measured by or based, in whole or in part, on rent payable to (or gross receipts received by) Landlord under this Lease and/or from the rental by Landlord of the Project or any portion thereof, or (ii) based on the square footage, assessed value or other measure or evaluation of any kind of the Premises or the Project, or (iii) assessed or imposed by or on the operation or maintenance of any portion of the Premises or the Project, including parking, or (iv) assessed or imposed by, or at the direction of, or resulting from Legal Requirements, or interpretations thereof, promulgated by any Governmental Authority, or (v) imposed as a license or other fee, charge, tax, or assessment on Landlord's business or occupation of leasing space in the Project. The prorated portion of any Taxes that are due and payable pertaining to periods prior to the Lease Commencement Date or after the expiration of the Term shall not be Tenant's obligation to pay hereunder. Landlord may contest by appropriate legal proceedings the amount, validity, or application of any Taxes or liens securing Taxes. If a change in Taxes is obtained for any year of the Term during which Tenant paid Tenant's Share of Taxes, then Taxes for that year will be retroactively adjusted and Landlord shall provide Tenant with a credit, if any, based on the adjustment. Taxes shall not include any net income taxes imposed on Landlord except to the extent such net income taxes are in substitution for any Taxes payable hereunder. If any such Tax is levied or assessed directly against Tenant, then Tenant shall be responsible for and shall pay the same at such times and in such manner as the taxing authority shall require. Tenant shall pay, prior to delinquency, any and all Taxes levied or assessed against any personal property or trade fixtures placed by Tenant in the Premises, whether levied or assessed against Landlord or Tenant. If any Taxes on Tenant's personal property or trade fixtures are levied against Landlord or Landlord's property, or if the assessed valuation of the Project is expressly increased by the taxing authority by a value attributable to improvements in or alterations to the Premises, whether owned by Landlord or Tenant and whether or not affixed to the real property so as to become a part thereof, higher than the base valuation on which Landlord

from time-to-time allocates Taxes to all tenants in the Project, Landlord shall have the right, but not the obligation, to pay such Taxes. Landlord's determination of any excess assessed valuation shall be binding and conclusive, absent manifest error. The amount of any such payment by Landlord shall constitute Additional Rent due from Tenant to Landlord within thirty (30) days.

ARTICLE 5
CONDITION OF PREMISES; CONSTRUCTION

5.1 Base Building Work.

(a) Landlord shall deliver the Premises to Tenant upon the Effective Date with the work ("**Landlord's Work**") more particularly described in the base building specifications attached hereto as **Exhibit E** ("**Base Building Specifications**") completed. Landlord's Work shall comply with the Legal Requirements and shall be consistent with Class A standards for laboratory and office space, and substantially in conformance with, and not materially inconsistent with, the Base Building Specifications. Landlord shall deliver the Premises to Tenant with all base building systems, including, but not limited to, HVAC, electrical, life safety and plumbing systems in good working order, in compliance with applicable Legal Requirements and suitable for laboratory purposes. The allocation of the responsibilities between the Landlord's Work and Tenant's Work is set forth on the Landlord/Tenant Matrix attached hereto as **Exhibit F** ("**Landlord/Tenant Matrix**").

(b) Tenant agrees, except as otherwise provided herein to the contrary, (i) to accept possession of the Premises in the condition described in the Base Building Specifications and otherwise in "as is" condition, (ii) that neither Landlord nor Landlord's agents have made any representations or warranties with respect to the Premises or the Building except as provided herein, and (iii) Landlord has no obligation to perform any work, supply any materials, incur any expense or make any alterations, additions or improvements to the Premises to prepare the Premises for Tenant's use and occupancy except as provided herein.

5.2 Tenant's Work.

(a) Tenant shall prepare, at its sole cost and expense (against which the Landlord's Contribution may be applied), a set of design/development plans in substantial conformity with the concept plan approved by Landlord (subject to Landlord's review of further details regarding access and maintenance of the tel/data room and access, maintenance and ventilation issues in connection with components located on the third floor along the window line) and attached hereto as **Exhibit G**, Tenant Design and Construction Guidelines attached hereto as **Exhibit H** ("**Tenant Design and Construction Guidelines**") and the allocation of responsibilities set forth in the Landlord/Tenant Matrix sufficient for Landlord to approve Tenant's proposed design of the Premises ("**Design/Development Plans**"), and a full set of final permit-ready construction drawings ("**Final Construction Drawings**") for the interior finish and layout of the initial improvements (**"Tenant's Work"**) which Tenant desires to have performed in the Premises. The Design/ Development Plans and the Final Construction Drawings are collectively referred to herein as the "**Plans**." Provided that no Default has occurred and remains outstanding, Landlord shall reimburse Tenant up to $4,358.60 ($.10 per RSF) for out of pocket costs incurred in preparing the initial test fit of the Premises.

(b) The Plans shall be submitted to Landlord, together with a construction budget setting forth the anticipated costs for the Tenant's Work, and Landlord shall approve or disapprove of the Plans, which approval shall not be unreasonably withheld, conditioned or delayed, and Landlord shall respond in any event within fifteen (15) days of receiving them. No work shall be conducted by or on behalf of Tenant until the Final Construction Drawings have been approved for such work in writing by Landlord. At Tenant's sole cost and expense (against which the Landlord's Contribution may be applied), Tenant shall cause the Plans to be revised in a manner sufficient to remedy the Landlord's objections and/or respond to the Landlord's concerns and for such revised Plans to be redelivered to Landlord, and Landlord shall approve or disapprove such portions of the Plans to which Landlord previously commented within seven (7) Business Days following the date of resubmission. Landlord's failure to timely respond to Tenant's submitted Plans or revised Plans shall be deemed to be approval thereof provided that upon submitting such plans, Tenant provides written notice to Landlord stating " **IF LANDLORD FAILS TO RESPOND TO THE ENCLOSED PLANS WITHIN 15 DAYS (OR 7 BUSINESS DAYS AS APPLICABLE), LANDLORD'S APPROVAL SHALL BE DEEMED GIVEN PURSUANT TO SECTION 5.2(b) OF THE LEASE**" in upper case boldface type in the top margin of such notice. Landlord's approval is solely given for the benefit of Landlord and Tenant under this Section and neither Tenant nor any third party shall have the right to rely upon Landlord's approval of the Plans for any other purpose whatsoever.

(c) Landlord shall not charge Tenant any coordination, overhead or contractor supervision fees in connection with Tenant's Work; provided, however that Landlord shall be reimbursed from the Landlord's Contribution for any third-party, out of pocket expenses incurred by Landlord in connection with the review and approval of Tenant's Work.

(d) The Plans shall be stamped by a Massachusetts registered architect and engineer, such architect and engineer and Tenant's general contractor and subcontractors, being subject to Landlord's prior approval, which shall not be unreasonably withheld, conditioned or delayed, and shall comply with the Legal Requirements and the requirements of the Tenant Design and Construction Guidelines. The final approved Plans shall be in a form satisfactory to appropriate governmental authorities responsible for issuing permits, approvals and licenses required for Tenant's Work.

(e) Tenant's Work shall be completed in accordance with the Plans and no material changes to Tenant's Work shall occur without Landlord's approval as set forth herein. All of the Tenant's Work shall be performed in accordance with the requirements set forth in the Tenant Design and Construction Guidelines and completed in a first class workmanlike manner. Tenant shall be solely responsible for the effect of the Tenant's Work on the Building's structure and systems, whether or not Landlord has consented to the Alterations, and shall reimburse Landlord on demand for any costs incurred by Landlord by reason of any faulty work done by Tenant or its contractors. All of Tenant's Work shall be performed in such manner as to maintain harmonious labor relations and to minimize any material interference with Building operations or other construction work being performed within the Building.

(f) Tenant shall use diligent efforts to keep the Project and Tenant's leasehold interest therein free of any liens or claims of liens arising from acts or omissions of Tenant, or its subtenants, contractors or others claiming by, through or under Tenant, and shall discharge or bond

any such liens within ten (10) Business Days following notice to Tenant of their filing. Before commencement of any work, upon Landlord's request, Tenant's contractor shall provide a payment, performance and lien indemnity bond required by Landlord. Tenant shall provide evidence of such insurance as Landlord may reasonably require, naming Landlord as an additional insured. Tenant shall indemnify Landlord and hold it harmless from and against any cost, claim, or liability arising from any work done by or at the direction of Tenant.

(g) All alterations affixed to the Premises shall become part thereof and remain therein at the end of the Term unless otherwise agreed to by Landlord and Tenant. However, if Landlord gives Tenant a notice, at the time Landlord approves the Plans, to remove any alterations, Tenant shall do so and shall pay the cost of removal and any repair required by such removal.

(h) All of Tenant's personal property, trade fixtures, equipment, furniture, movable partitions, and any alterations not affixed to the Premises shall remain Tenant's property, removable at any time. If Tenant fails to remove any such materials at the end of the Term, Landlord may do so and store them at Tenant's expense, without liability to Tenant, and may sell them at public or private sale and apply the proceeds to any amounts due hereunder, including costs of removal, storage and sale.

5.3 Intentionally Deleted.

5.4 Landlord's Contribution. **(a)** As an inducement to Tenant's entering into this Lease, Landlord shall, subject to the terms set forth in this Section, provide to Tenant a special tenant improvement allowance for the actual costs incurred with respect to the design and hard construction costs pertaining to Tenant's Work up to a maximum aggregate amount of Six Million Five Hundred Thirty Seven Thousand Nine Hundred and 00/100 Dollars ($6,537,900.00) [$150.00 per RSF] less any past due expenses owed to Landlord by Tenant under this Lease (" **Initial Allowance**").

(b) Landlord shall pay to Tenant an amount not to exceed Landlord's Contribution to the extent permitted pursuant to this Section, provided that as of the date on which Landlord is required to make payment thereof pursuant to this Section: (i) this Lease is in full force and effect, and (ii) no Event of Default then exists. Tenant shall pay all costs of the Tenant's Work in excess of Landlord's Contribution. Before Tenant submits a requisition request for any hard construction costs, Landlord agrees to fund up to fifty percent (50%) of Tenant's early design fees from Landlord's Contribution, with the balance of such design fees to be funded on a dollar for dollar basis as the hard construction costs are funded. Thereafter, each funded requisition for Landlord's Contribution shall be applied first on account of any hard construction costs and labor directly related to the Tenant's Work and materials delivered to the Building in connection with the Tenant's Work, and then, second on account of any design fees. If, following the expiration of the six (6) month period following the completion of the Tenant's Work and satisfaction of the conditions set forth in this Section, any amount of Landlord's Contribution has not been requisitioned by Tenant, such remainder shall be retained by Landlord and Tenant shall have no further right to claim thereto.

(c) Landlord shall make progress payments on account of Landlord's Contribution to Tenant on a monthly basis, for the work performed during the previous month, less such retainage ("**Retainage**") as is provided for in Tenant's construction contract(s) and contracts for the purchase and delivery of furniture, fixtures and equipment, provided that such contracts shall require Retainage of not less than five percent (5%) of the total contract price (in the aggregate) (which 5% Retainage shall not be in addition to the amounts retained under such contracts).

(d) Landlord shall pay Landlord's Proportion (hereinafter defined) of the cost shown on each requisition submitted by Tenant to Landlord until the entirety of Landlord's Contribution has been exhausted. "**Landlord's Proportion**" shall be a fraction, the numerator of which is Landlord's Contribution and the denominator of which is the total contract price for Tenant's Work (as evidenced by reasonably detailed documentation delivered to Landlord with the requisition first submitted by Tenant).

Landlord's progress payments shall be made payable directly to Tenant or, upon Tenant's written request, to Tenant's general contractor, within thirty (30) days following the delivery to Landlord of requisitions therefor. Landlord shall have the right, upon reasonable advance notice to Tenant, to inspect Tenant's books and records relating to each requisition in order to verify the amount thereof. Tenant shall submit requisition(s) no more often than monthly. Each such requisition shall be executed by a duly authorized officer of Tenant, and shall be accompanied by (i) with the exception of the first requisition, copies of partial waivers of lien from all contractors, subcontractors, and material suppliers covering all work and materials which were the subject of previous progress payments by Landlord and Tenant, (ii) a certification from Tenant's architect on a completed AIA Form G702, and (iii) a requisition certificate on a completed AIA Form G703. Landlord shall hold such Retainage and disburse the Retainage, or portions thereof as requisitioned by Tenant from time to time on account of subcontractors who have completed their respective portions of the job, upon submission by Tenant to Landlord of Tenant's requisition therefor accompanied by all documentation required under the foregoing provisions of this Section, together with (A) proof of the satisfactory completion of all required inspections and issuance of any required approvals, permits and sign offs for the work of such subcontractor, or with respect to the work of the Tenant's general contractor, the Tenant's Work, by Governmental Authorities having jurisdiction thereover (including issuance of the Certificate of Occupancy) ("**Substantial Completion of Tenant's Work**"), and (B) issuance of final lien waivers by all contractors, subcontractors and material suppliers covering all of the Tenant's Work or the portion thereof as applicable (which final lien waivers may be conditioned upon, or delivered concurrent with, payment of such Retainage). If Tenant fails to pay to Tenant's contractors the amounts paid by Landlord to Tenant in connection with any previous requisition(s), Landlord shall thereafter have the right to have Landlord's Contribution paid directly to Tenant's contractors. In addition, concurrent with the final requisition for the Retainage, Tenant shall submit "as-built" plans and specifications for the Tenant's Work. The right to receive Landlord's Contribution is for the exclusive benefit of Tenant, and in no event shall such right be assigned to or be enforceable by or for the benefit of any third party, including any contractor, subcontractor, materialman, laborer, architect, engineer, attorney or other person or entity (excepting only to a permitted assignee of this Lease pursuant to Article 17).

ARTICLE 6
USE

6.1 Use. The Premises shall be used solely for the Permitted Use set forth in the basic lease provisions in **Section 1.1** of this Lease, and in compliance with all Legal Requirements now or hereafter applicable to the Premises, and to the use and occupancy thereof, including, without limitation, the Americans With Disabilities Act, 42 U.S.C. § 12101, et seq. (together with the regulations promulgated pursuant thereto, "**ADA**"). Tenant shall, upon 5 days' written notice from Landlord, discontinue any use of the Premises which is declared by any Governmental Authority (as defined in **Section 4.6**) having jurisdiction to be a violation of a Legal Requirement. Tenant will not use or permit the Premises to be used for any purpose or in any manner that would void Tenant's or Landlord's insurance, increase the insurance cost, or cause the disallowance of any sprinkler or other credits. Tenant shall reimburse Landlord promptly upon demand for any additional premium charged for any such insurance policy by reason of Tenant's failure to comply with the provisions of this Section or otherwise caused by Tenant's use and/or occupancy of the Premises. Tenant will use the Premises in a careful, safe and proper manner and will not commit or permit waste, overload the floor or structure of the Premises, subject the Premises to use that would damage the Premises or obstruct or interfere with the rights of Landlord or other tenants or occupants of the Project, including conducting or giving notice of any auction, liquidation, or going out of business sale on the Premises, or using or allowing the Premises to be used for any unlawful purpose. Tenant shall cause any equipment or machinery to be installed in the Premises so as to reasonably prevent sounds or vibrations from the Premises from extending into Common Areas, or other space in the Project. Tenant shall not, without the prior written consent of Landlord use the Premises in any manner which will require ventilation, air exchange, heating, gas, steam, electricity or water beyond the capacity of the Project as set forth in this Lease.

Tenant, at its sole expense, shall make any alterations or modifications to the interior or the exterior of the Premises or the Project that are required by Legal Requirements (including, without limitation, compliance of the Premises with the ADA) related to Tenant's use or occupancy of the Premises. Notwithstanding any other provision herein to the contrary, Tenant shall be responsible for any and all demands, claims, liabilities, losses, costs, expenses, actions, causes of action, damages or judgments, and all reasonable expenses incurred in investigating or resisting the same (including, without limitation, reasonable attorneys' fees, charges and disbursements and costs of suit) (collectively, "**Claims**") arising out of or in connection with Legal Requirements related to Tenant's use or occupancy of the Premises, and Tenant shall indemnify, defend, hold and save Landlord harmless from and against any and all Claims arising out of or in connection with any failure of the Premises to comply with any Legal Requirement (to the extent that such Claims do not arise from the failure of Landlord's Work to comply with any Legal Requirements).

ARTICLE 7
PARKING

7.1 Parking. Subject to all matters of record, Force Majeure, a Taking and the exercise by Landlord of its rights hereunder, Tenant shall have the right, in common with other tenants of the Project to use Tenant's pro rata share of the non-reserved parking spaces at the Project at the then-current prevailing rate equal to (a) .65 parking spaces per 1,000 rentable square feet of the Premises (or 28 spaces based on 43,586 RSF) for the parking spaces located in the Building garage

at the current monthly fee of $225 per space, and (b) .35 parking spaces per 1,000 rentable square feet of the Premises (or 15 spaces based on 43,586 RSF) for surface parking spaces located on the adjacent lot at the current monthly fee of $175 per space, as such rates may vary from time to time to reflect current fair market parking rates in East Cambridge and Kendall Square, as shown on the parking plan attached hereto as **EXHIBIT I** ("**Parking Plan**"). Subject to Landlord's reasonable requirements or conditions and any applicable Legal Requirements and the rights of Foundation Medicine, Inc. and its successors and assigns ("**Foundation Medicine**"), Tenant may designate and mark (by virtue of signage reasonably approved by Landlord) at Tenant's cost a portion of Tenant's allocated parking spaces for visitor parking on a reserved basis in locations to be reasonably agreed upon by Landlord and Tenant.

The parking spaces shall be subject to such reasonable rules and regulations as may be in effect for the use of the parking garage/areas from time to time (including, without limitation, Landlord's right, without additional charge to Tenant above the prevailing fair market rate for parking spaces, to institute a valet or attendant-managed parking system) provided that access to the parking spaces by Tenant's employees shall be on a 24/7 basis. Landlord shall not be liable to Tenant, and this Lease shall not be affected, if any parking rights of Tenant hereunder are impaired by Applicable Law. Notwithstanding anything to the contrary contained herein, Landlord shall have the right to relocate the surface parking spaces to the following garages in order of priority: (1) the CambridgeSide Galleria Parking Garage located at 100 CambridgeSide Place in Cambridge; (2) the First Street Garage located on Spring Street in Cambridge; and (3) the common parking facility that serves the buildings located at 350 Kendall Street, 650 East Kendall Street, 675 West Kendall Street, 500 Kendall Street and 350 3rd Street (Watermark Cambridge), each located in Cambridge. If parking spaces are not available in such garages, then Landlord shall have the right to relocate the surface parking spaces to an alternate public parking facility of comparable quality located no further than one third mile from the Project and located within the City of Cambridge. Tenant shall be responsible for the actual fee for such offsite parking spaces which fee shall not to exceed the published parking rates for monthly parking for the respective parking garage from time to time and shall not include any mark-up of such fee by Landlord or the owner or operator of the parking garage.

Within thirty (30) days after the Effective Date and each anniversary of the Lease Commencement Date, Tenant shall provide Landlord written notice of the number of parking spaces allocated to Tenant that Tenant is committed to using each year. If the number of parking spaces requested by Tenant is less than the 28 garage spaces and 15 surface spaces allocated to Tenant, then Landlord reserves the right to allocate the excess parking spaces to other occupants in the Building on monthly basis. Upon sixty (60) days notice from Tenant, Landlord shall arrange for such reallocated parking spaces to be restored for Tenant's non-exclusive use.

Tenant shall have no right to hypothecate or encumber the parking spaces, and shall not sublet, assign, or otherwise transfer the parking spaces other than to employees of Tenant occupying the Premises or to a permitted transferee pursuant to Section 17 of this Lease.

Tenant shall, at Tenant's sole expense, for so long as the Parking and Traffic Demand Management Plan dated April 2008 as approved by the City of Cambridge on April 28, 2008, including the conditions set forth in such approval (as amended from time to time, the " **PTDM**"), remains applicable to the Project, (i) offer to subsidize mass transit monthly passes for all of its

employees; (ii) implement a Commuter Choice Program; (iii) discourage single-occupant vehicle use by its employees; (iv) promote alternative modes of transportation and use of alternative work hours; (v) meet with Landlord and/or its representatives no more than quarterly to discuss transportation programs and initiatives; (vi) participate in annual surveys monitoring transportation programs and initiatives; (vii) cooperate with Landlord in connection with transportation programs and initiatives promulgated pursuant to the PTDM; (viii) provide alternative work programs (such as telecommuting, flex-time and compressed work weeks) to its employees in order to reduce traffic impacts in Cambridge during peak commuter hours; and (ix) otherwise cooperate with Landlord in encouraging employees to seek alternate modes of transportation.

ARTICLE 8
UTILITIES; SERVICES

8.1 Utilities; Services. Landlord shall provide, subject to the terms of this Section, hot and cold water for restrooms, drinking and office kitchen purposes, sewer connection, heated and chilled water for the HVAC system serving the Premises, electricity in an amount at least equal to 12 watts per usable square foot, gas service for the HVAC system and water for sprinklers (collectively, "**Utilities**") as more particularly set forth in the Base Building Specifications. Landlord shall pay, as Operating Expenses or subject to Tenant's reimbursement obligation, for all Utilities used on the Premises, all maintenance charges for Utilities, and any storm sewer charges or other similar charges for Utilities imposed by any Governmental Authority or Utility provider, and any taxes, penalties, surcharges or similar charges thereon. Utilities will be separately metered or charged directly to Tenant by the provider as provided in the Landlord/Tenant Matrix attached hereto as **Exhibit F**. Tenant shall pay directly to the Utility provider, prior to delinquency, any separately metered Utilities and services which may be furnished to Tenant or the Premises during the Term. Tenant shall pay, as part of Operating Expenses, its share of all charges for jointly metered Utilities based upon consumption, as reasonably determined by Landlord. No interruption or failure of Utilities, from any cause whatsoever other than Landlord's negligence or willful misconduct, shall result in eviction or constructive eviction of Tenant, termination of this Lease or the abatement of Rent. Tenant agrees to limit use of water and sewer with respect to Common Areas to normal restroom use. Tenant shall supply its own cleaning and rubbish removal service. Landlord at Landlord's cost shall supply a dumpster or compactor at the loading dock for Tenant's use for the disposal of non-hazardous, non-controlled substances.

8.2 Shafts and Risers. During the Term, Landlord grants to Tenant a non-exclusive license to use a portion (reasonably specified by Landlord based on Tenant's Plans and generally based on Tenant's Share) of the Building risers and other Building communications pathways reasonably designated by Landlord ("**Communications Pathways**") for the installation, maintenance, operation, replacement and/or removal at Tenant's sole expense of certain cables, conduits, innerducts and connecting hardware approved by Landlord (any such cables, conduits, innerducts and connecting hardware installed within the Communications Pathways, as the same may be modified, altered or replaced during the Term, are collectively referred to herein as the " **Connecting Cables**"). Any such approvals shall be granted, and installation performed, in accordance with the terms of Section 11 below. With respect to each cable placed in the Communications Pathways from and after the Execution Date, Tenant shall label such cable (at the floor of the Building where the cable originates and the floor where such cable terminates and at

each access point in between at which such cable is pulled) with identification information as reasonably required by Landlord which shall be consistent with commercial practice in the Cambridge/Kendall Square submarket. Landlord makes no warranties or representations to Tenant as to the suitability of the Communications Pathways for the installation and operation of the Connecting Cables and Tenant hereby accepts the same in their as is, where is condition with all faults on the date hereof, provided, however, Landlord shall ensure that such Communications Pathways are dry and free of interference from electrical cables and other base building devices likely to interfere with the operation of such Connecting Cables. In the event that at any time during the Term, Landlord reasonably determines, that the operation and/or periodic testing of the Connecting Cables interferes with the operation of the Building or the business operations of any of the occupants of the Building, then Tenant shall, upon reasonable notice from Landlord attempt to correct such interference in accordance with commercially reasonable approaches. Tenant is expressly forbidden to serve other tenants or occupants of the Building, to serve any locations outside the Building, or to resell any communications services without the prior written consent of Landlord, which consent may be granted in Landlord's sole discretion. Upon the expiration or earlier termination of this license, Tenant shall remove the Connecting Cables from the Communications Pathways and restore any damage to the Building related to the removal of the Connecting Cables caused by Tenant, which obligations shall survive the expiration or earlier termination of this Lease. In addition, Landlord may, upon reasonable prior written notice (which notice shall not be required in the event of an emergency), suspend this license and/or relocate the Connecting Cables in the event of any repair or construction affecting the Communications Pathways, provided, however, prior to making any such repair or construction, Landlord shall ensure that Tenant has an alternative means of communicating in a manner consistent with the operation and standards of the Connecting Cables at the time of such license suspension and at Landlord's sole cost and expense. After the completion of such repair and/or construction, this license shall be reinstated with such reasonable modifications as Landlord may require and for which Landlord shall reimburse Tenant to ensure consistency with the new use of the Communications Pathways. Subject to earlier termination pursuant to the provisions of this Section, this license shall be coterminous with the Lease.

8.3 Rooftop Premises. During the Term, Tenant shall have the right to use a portion of the rooftop of the Building reasonably designated by Landlord (the "**Rooftop Premises**") at no additional rental cost for the installation of HVAC equipment, antennas, satellite dishes or other communications device and certain mechanical devices necessary for the operation of Tenant's business in the Premises, all of which shall have been approved by Landlord (any devices and/or equipment installed within the Rooftop Premises, as the same may be modified, altered or replaced during the Term, is collectively referred to herein as "**Tenant's Rooftop Equipment**"). Landlord's approval of such devices and/or equipment shall not be unreasonably withheld, conditioned or delayed provided Tenant demonstrates to Landlord's reasonable satisfaction that the proposed devices and/or equipment (i) do not interfere with any base building equipment operated by Landlord on the roof; (ii) will not affect the structural integrity of the Building or void the warranty for the roof or the roof membrane; (iii) shall be adequately screened so as to minimize the visibility of such devices and/or equipment; and (iv) shall be adequately sound-proofed to meet all requirements of Legal Requirements. Tenant shall not install or operate Tenant's Rooftop Equipment until Tenant has obtained and submitted to Landlord copies of all required governmental permits, licenses, and authorizations necessary for the installation and operation thereof. In addition, Tenant shall comply with all reasonable construction rules and regulations

promulgated by Landlord in connection with the installation, maintenance and operation of Tenant's Rooftop Equipment. Landlord shall provide reasonable utility service (at Tenant's reasonable cost) to the Rooftop Premises or to Tenant's Rooftop Equipment. Tenant shall be responsible for the cost of repairing and maintaining Tenant's Rooftop Equipment in good order, condition and repair and for the cost of repairing any damage to the Building, or the cost of any necessary improvements to the Building, caused by or as a result of the installation, replacement and/or removal of Tenant's Rooftop Equipment. Landlord makes no warranties or representations to Tenant as to the suitability of the Rooftop Premises for the installation and operation of Tenant's Rooftop Equipment. Tenant shall use Landlord's roof contractor (if such roof is under warranty by such contractor) or another contractor reasonably acceptable to Landlord for any work impacting the roof or roof membrane. If Tenant's Rooftop Equipment damages the roof (other than ordinary wear and tear damage or damage arising from extraordinary events of a nature not controllable by Tenant such as high winds, fire, electrical storms and the like) or invalidates or adversely affects any warranty, Tenant shall be fully responsible for the cost of repairs directly related and limited to the damage caused by Tenant's Rooftop Equipment (and any subsequent repairs to the roof to the extent that any warranty is invalidated or adversely affected). Except as set forth in the next sentence, Landlord shall elect, at the time of Landlord's approval thereof, either to require Tenant to convey to Landlord, in consideration of Ten Dollars ($10.00), all of Tenant's right, title and interest in and to all or any portion of Tenant's Rooftop Equipment or to remove such Tenant's Rooftop Equipment or a portion thereof at the expiration or sooner termination of the Term. Notwithstanding the foregoing, unless this Lease has been terminated due to a Default by Tenant, Tenant may remove Tenant's satellite dishes and generators and equipment appurtenant thereto at the expiration of the Term at Tenant's cost provided that Tenant complies with any reasonable requirements or conditions imposed by Landlord and that Tenant remains responsible for the cost of repairs directly related and limited to the damage caused by the removal of such equipment.

8.4 Access. Subject to reasonable security procedures that Landlord may institute from time to time to prevent unauthorized access to the Building, Tenant shall have access to the Premises, the Rooftop Premises, the Building garage and surface lot, the freight elevator and freight loading dock, and any other appurtenant areas, twenty-four (24) hours per day, seven (7) days per week. A security card will be issued to all permitted Building occupants. An access card will be required for access to the Building between the hours of 6:00 p.m. and 7:00 a.m. on weekdays and 24 hours a day on weekends. Landlord shall install a card key access system on the elevators providing Tenant with the ability to lock off any full floors that it occupies.

ARTICLE 9
ALTERATIONS

9.1 Alterations and Tenant's Property. Any alterations, additions, or improvements made to the Premises by or on behalf of Tenant, including additional locks or bolts of any kind or nature upon any doors or windows in the Premises, but excluding installation, removal or realignment of furniture systems (other than removal of furniture systems owned or paid for by Landlord) not involving any modifications to the structure or connections (other than by ordinary plugs or jacks) to Building Systems (as defined in **Section 10.1**) ("**Alterations**"), shall be subject to Landlord's prior written consent, which may be given or withheld in Landlord's sole discretion if any such Alteration affects the structure or Building Systems and shall not be otherwise unreasonably withheld, conditioned or delayed. If Landlord approves any Alterations, Landlord

may impose such reasonable conditions on Tenant in connection with the commencement, performance and completion of such Alterations as Landlord may deem appropriate in Landlord's sole and absolute discretion. However, Landlord's consent shall not be required for any Alterations that (a) are not visible from the exterior of the Building; (b) will not adversely affect the Building Systems or structural elements; and (c) either are of a cosmetic nature such as painting, wallpapering, hanging pictures and installing carpeting, or cost less than $50,000 in any one instance. Any request for approval shall be in writing, delivered not less than 15 Business Days in advance of any proposed construction, and accompanied by plans, specifications, bid proposals, work contracts and such other information concerning the nature and cost of the alterations as may be reasonably requested by Landlord, including the identities and mailing addresses of all persons performing work or supplying materials. Landlord's right to review plans and specifications and to monitor construction shall be solely for its own benefit, and Landlord shall have no duty to ensure that such plans and specifications or construction comply with applicable Legal Requirements. Tenant shall cause, at its sole cost and expense, all Alterations to comply with insurance requirements and with Legal Requirements and shall implement at its sole cost and expense any alteration or modification required by Legal Requirements as a result of any Alterations. Landlord shall not charge Tenant any coordination, overhead or contractor supervision fees in connection with the Alterations; provided, however that Landlord shall be reimbursed for any reasonable third-party, out of pocket expenses incurred by Landlord in connection with the review and approval of the Alterations. Before Tenant begins any Alteration, Landlord may post on and about the Premises notices of non-responsibility pursuant to applicable law. Tenant shall reimburse Landlord for, and indemnify and hold Landlord harmless from, any expense incurred by Landlord by reason of faulty work done by Tenant or its contractors, delays caused by such work, or inadequate cleanup. The construction of Tenant's Work shall be governed by the provisions contained in Section 5.2, and not the provisions of this Article 9.

Upon Landlord's request, Tenant shall furnish security or make other arrangements satisfactory to Landlord to assure payment for the completion of all Alterations work free and clear of liens, and shall provide (and cause each contractor or subcontractor to provide) certificates of insurance for workers' compensation and other coverage in amounts and from an insurance company satisfactory to Landlord protecting Landlord against liability for personal injury or property damage during construction. Upon completion of any Alterations, Tenant shall deliver to Landlord: (i) sworn statements setting forth the names of all contractors and subcontractors who did the work and final lien waivers from all such contractors and subcontractors; and (ii) "as built" plans for any such Alteration.

Except for Removable Installations (as hereinafter defined), all Installations (as hereinafter defined) shall be and shall remain the property of Landlord during the Term and following the expiration or earlier termination of the Term, shall not be removed by Tenant at any time during the Term, and shall remain upon and be surrendered with the Premises as a part thereof. Notwithstanding the foregoing, Landlord may, at the time its approval of any such Installation is requested, notify Tenant that Landlord requires that Tenant remove such Installation upon the expiration or earlier termination of the Term, in which event Tenant shall remove such Installation in accordance with the immediately succeeding sentence. Upon the expiration or earlier termination of the Term, Tenant shall remove (i) Connecting Cable as required in Section 8.2, (ii) any Installations for which Landlord has given Tenant notice of removal in accordance with the immediately preceding sentence, and (iii) all of Tenant's Property (as hereinafter defined), and

Tenant shall restore and repair any damage caused by or occasioned as a result of such removal, including, without limitation, capping off all such connections behind the walls of the Premises and repairing any holes. During any restoration period beyond the expiration or earlier termination of the Term, Tenant shall pay Rent to Landlord as provided herein as if said space were otherwise occupied by Tenant. Landlord hereby waives any lien or other interest in any of Tenant's Property and Removable Installations and shall confirm such waiver in a form reasonably acceptable to Landlord and Tenant provided that Landlord shall be paid for Landlord's reasonable out of pocket expenses in connection with the waiver process.

For purposes of this Lease, (x) "**Removable Installations**" means any Installations that Tenant desires to have removed from the Premises at the expiration or earlier termination of the Term which Landlord agrees in writing may be removed by Tenant, (y) "**Tenant's Property**" means Removable Installations and, other than Installations, any personal property or equipment of Tenant that may be removed without material damage to the Premises, and (z) "**Installations**" means all property of any kind paid for by Landlord, all Alterations, all fixtures, and all partitions, hardware, built-in machinery, built-in casework and cabinets and other similar additions, equipment, property and improvements built into the Premises so as to become an integral part of the Premises, including, without limitation, fume hoods which penetrate the roof or plenum area, built-in cold rooms, built-in warm rooms, walk-in cold rooms, walk-in warm rooms, deionized water systems, glass washing equipment, autoclaves, chillers, built-in plumbing, electrical and mechanical equipment and systems, and any power generator and transfer switch.

ARTICLE 10
REPAIRS AND MAINTENANCE

10.1 Landlord's Repairs. Landlord, as an Operating Expense subject to the provisions of Section 4.5 hereof, shall maintain all of the structural, exterior, parking and other Common Areas of the Project, including roof, HVAC, plumbing, fire sprinklers, elevators and all other building systems serving the Premises and other portions of the Project ("**Building Systems**"), in good repair, comparable to other first class lab research buildings in the Kendall Square area and in compliance with all applicable Legal Requirements, reasonable wear and tear and uninsured losses and damages and damage caused by Tenant, or by any of Tenant's agents, servants, employees, invitees and contractors (collectively, "**Tenant Parties**") excluded. Losses and damages caused by Tenant or any Tenant Party shall be repaired by Landlord, to the extent not covered by insurance, at Tenant's sole cost and expense. Landlord reserves the right to stop Building Systems services when necessary (i) by reason of accident or emergency, or (ii) for planned repairs, alterations or improvements, which are, in the judgment of Landlord, desirable or necessary to be made, until said repairs, alterations or improvements shall have been completed. Landlord shall have no responsibility or liability for failure to supply Building Systems services during any such period of interruption; provided, however, that Landlord shall, except in case of emergency, give Tenant 24 hours advance notice of any planned stoppage of Building Systems services for routine maintenance, repairs, alterations or improvements. Tenant shall promptly give Landlord written notice of any repair required by Landlord pursuant to this Section, after which Landlord shall make a commercially reasonable effort to effect such repair. Landlord shall not be liable for any failure to make any repairs or to perform any maintenance unless such failure shall persist for an unreasonable time after Tenant's written notice of the need for such repairs or maintenance but in no event not later than thirty (30) days after receipt of such notice, or such longer time as is

reasonably necessary if more than 30 days are reasonably required to complete such repairs so long as Landlord commences such repairs within such 30 day period and thereafter diligently attempts to complete the same. Tenant waives its rights under any state or local law to terminate this Lease or to make such repairs at Landlord's expense and agrees that the parties' respective rights with respect to such matters shall be solely as set forth herein. Repairs required as the result of fire, earthquake, flood, vandalism, war, or similar cause of damage or destruction shall be controlled by **Section 14.1**.

10.2 Tenant's Repairs. Subject to **Section 10.1** hereof, Tenant, at its expense, shall repair, replace and maintain in good condition all portions of the Premises, including, without limitation, entries, doors, ceilings, interior windows, interior walls, and the interior side of demising walls, reasonable wear and tear and damage by fire or other casualty excepted. Such repair and replacement may include capital expenditures and repairs whose benefit may extend beyond the Term. Should Tenant fail to make any such repair or replacement or fail to maintain the Premises, Landlord shall give Tenant notice of such failure. If Tenant fails to commence cure of such failure within 30 days of Landlord's notice, and thereafter diligently prosecute such cure to completion, Landlord may perform such work and shall be reimbursed by Tenant within 30 days after demand therefor; provided, however, that if such failure by Tenant creates or could create an emergency, Landlord may immediately commence cure of such failure and shall thereafter be entitled to recover the costs of such cure from Tenant. Subject to Articles 13 and 14, Tenant shall bear the full uninsured cost of any repair or replacement to any part of the Project that results from damage caused by Tenant or any Tenant Party and any repair that benefits only the Premises.

ARTICLE 11
MECHANIC'S LIENS

11.1 Mechanic's Liens. Tenant shall discharge, by bond or otherwise, any mechanic's lien filed against the Premises or against the Project for work claimed to have been done for, or materials claimed to have been furnished to, Tenant within 10 Business Days after written notice of the filing thereof, at Tenant's sole cost and shall otherwise keep the Premises and the Project free from any liens arising out of work performed, materials furnished or obligations incurred by Tenant. Should Tenant fail to discharge any lien described herein, Landlord shall have the right, but not the obligation, to pay such claim or post a bond or otherwise provide security to eliminate the lien as a claim against title to the Project and the cost thereof shall be immediately due from Tenant as Additional Rent. If Tenant shall lease or finance the acquisition of office equipment, furnishings, or other personal property of a removable nature utilized by Tenant in the operation of Tenant's business, Tenant warrants that any Uniform Commercial Code Financing Statement filed as a matter of public record by any lessor or creditor of Tenant will upon its face or by exhibit thereto indicate that such Financing Statement is applicable only to removable personal property of Tenant located within the Premises. In no event shall the address of the Project be furnished on the statement without qualifying language as to applicability of the lien only to removable personal property, located in an identified suite held by Tenant.

ARTICLE 12
INDEMNIFICATION

12.1 Indemnification. Tenant hereby indemnifies and agrees to defend, save and hold Landlord harmless from and against any and all demands, claims, liabilities, losses, costs, expenses, actions, causes of action, damages or judgments, and all reasonable expenses incurred in investigating or resisting the same (including, without limitation, reasonable attorneys' fees, charges and disbursements and costs of suit) (collectively, " **Claims**") for injury or death to persons or damage to property (a) occurring within the Premises, or (b) occurring outside of the Premises and caused by the negligence or willful misconduct of Tenant, or (c) arising from a breach or default by Tenant in the performance of any of its obligations hereunder, in all cases unless caused solely by the willful misconduct or negligence of Landlord or Landlord's agents, servants, employees, and contractors. Landlord shall not be liable to Tenant for, and Tenant assumes all risk of damage to, personal property (including, without limitation, loss of records kept within the Premises), unless caused solely by the willful misconduct or negligence of Landlord or Landlord's agents, servants, employees, and contractors, but subject to waiver of claims and subrogation provisions of Article 13. Tenant further hereby irrevocably waives any and all Claims for injury to Tenant's business or loss of income relating to any such damage or destruction of personal property (including, without limitation, any loss of records). Landlord shall not be liable for any damages arising from any act, omission or neglect of any tenant in the Project or of any other third party.

The provisions of this Section 12.1 shall survive the expiration or earlier termination of this Lease.

ARTICLE 13
INSURANCE

13.1 Insurance. (a) Tenant shall not conduct or permit to be conducted any activity, or place any equipment in or about the Premises or the Building which will in any way increase the rate of fire insurance or other insurance on the Building pertaining to the Permitted Use in compliance with the terms of the Lease provided that the Hazardous Materials List (defined in Section 21.2) does not change. If any increase in the rate of fire insurance or other insurance is stated by any insurance company to be due to any activity or equipment of Tenant in or about the Premises or the Building, such statement shall be conclusive evidence that the increase in such rate is due to such activity or equipment and, as a result thereof, Tenant shall be liable for the amount of such increase. Tenant shall reimburse Landlord for such amount upon written demand from Landlord and such sum shall be considered additional rent payable hereunder.

(b) Landlord shall insure the Building, other than Tenant's Work and Alterations (including improvements and betterments which shall be Tenant's obligation to insure), against loss due to fire and other casualties included in standard extended coverage insurance policies in an amount equal to ninety percent (90%) of the replacement cost thereof (with a waiver of co-insurance), exclusive of architectural and engineering fees, excavations, footings and foundations. Throughout the Lease Term, Landlord shall maintain commercial general liability insurance (written on an occurrence basis) covering the Project. Such insurance shall need not cover (a) Tenant's furniture, fixtures, equipment or other personal property of Tenant on the Premises, or (b) any portion of the Tenant's Work.

(c) Commencing on the Lease Commencement Date and throughout the Lease Term, Tenant shall obtain and maintain (1) commercial general liability insurance (written on an occurrence basis) including coverage provided in the current Insurance Services Office commercial general liability policy form insuring the indemnification obligations assumed by Tenant under this lease to the extent they are insurable, premises and operations coverage, containing an endorsement for personal injury, (2) all-risk property insurance, or its equivalent (with flood and earthquake coverage at Tenant's option), (3) business interruption insurance (in an amount not less than the Base Rent and Additional Rent then in effect during any year), (4) comprehensive automobile liability insurance (covering any automobiles owned or operated by Tenant, if any), (5) worker's compensation insurance, (6) during all periods alcoholic beverages are dispensed or sold by Tenant at the Building or the Premises, liquor liability insurance or host liquor liability insurance as the case may be, (7) employer's liability insurance, and (8) such additional insurance relating to Tenant's use and storage of Hazardous Materials as may be necessary to comply with any requirement of any Governmental Authority. Such commercial general liability insurance shall be in an amount (which may include umbrella liability insurance) of no less than Two Million Dollars ($2,000,000) combined single limit per occurrence with a Three Million Dollar ($3,000,000) annual aggregate. Such property insurance shall be in an amount not less than that required to replace all of Tenant's Work and Alterations (including improvements and betterments) and all other contents of the Tenant on the Premises (including, without limitation, Tenant's trade fixtures, decorations, furnishings, equipment and personal property). Such automobile liability insurance shall be in an amount not less than One Million Dollars ($1,000,000) for each accident. Such worker's compensation insurance shall carry minimum limits as defined by the law of the jurisdiction in which the Building is located (as the same may be amended from time to time). Such employer's liability insurance shall be in an amount not less than Five Hundred Thousand Dollars ($500,000) for each accident, Five Hundred Thousand Dollars ($500,000) disease-policy limit, and Five Hundred Thousand Dollars ($500,000) disease-each employee.

(d) All such insurance required of Tenant under this Section shall: (1) be issued by a company that is licensed to do business in the jurisdiction in which the Building is located and that has a rating equal to or exceeding A:VII from Best's Insurance Guide; (2) in the case of the commercial general liability insurance, name as additional insureds, the Landlord and the Landlord's managing agent of the Building and if required by Landlord's lender, the holder of any mortgage will be added as additional insured upon request by Landlord; (3) in the case of the all-risk property insurance and business interruption insurance, provide that the insurer thereunder waives all right of recovery by way of subrogation against Landlord, its partners, employees and mortgage holder where required in writing prior to a loss, in connection with any loss or damage covered by Tenant's property policy; (4) be reasonably acceptable in form and content to Landlord if not on customary industry form and content; (5) be primary and noncontributory; (6) to the extent obtainable, tenant's insurer will endeavor to provide to Landlord, 30 days prior written notice of cancellation (with an exception of 10 days for non-payment of premium); however Tenant agrees to provide notice to Landlord as soon as they are aware of such cancellation from their carriers; and (7) not contain any deductible provision that is not commercially reasonable unless such provision is first approved in writing by Landlord (provided that Tenant's deductible of $25,000 as of the Effective Date is deemed approved). Landlord may, from time to time, require Tenant to obtain additional insurance if such request is reasonable and customary with insurance requirements of other similar tenants in the same geographic region, or if Landlord's Lender requires a change to comply with loan requirements. Tenant shall provide certificates of insurance evidencing all required coverage prior to commencement of Tenant's Work and annually during the term of the lease prior to each policy expiration. Tenant shall also agree to provide full copies of actual policies upon written request from Landlord. Landlord may defer commencement of the Tenant's Work pending delivery of evidence of insurance.

(e) Tenant hereby waives and releases Landlord and the holder of any mortgage from any and all liabilities, claims and losses for damage to property for which Landlord is or may otherwise be held liable to the extent Tenant either is required to maintain property insurance pursuant to this Article with respect to the property so damaged, or receives insurance proceeds on account thereof. Landlord hereby waives and releases Tenant from any and all liabilities, claims and losses for damage to property for which Tenant is or may be otherwise held liable to the extent Landlord either is required to maintain property insurance pursuant to this Article with respect to the property so damaged, or receives insurance proceeds on account thereof. In the case of the all-risk property insurance, both parties shall secure waiver of subrogation endorsements from their respective insurance carriers as to the other party.

ARTICLE 14
RESTORATION

14.1 Restoration. If, at any time during the Term, the Project or the Premises are damaged or destroyed by a fire or other insured casualty, Landlord shall notify Tenant within 30 days after discovery of such damage as to the amount of time Landlord reasonably estimates it will take to restore the Project or the Premises, as applicable (the "**Restoration Period**"). If the Restoration Period is reasonably estimated to exceed 9 months (the " **Maximum Restoration Period**"), Landlord may, in such notice, elect to terminate this Lease as of the date that is 45 days after the date of discovery of such damage or destruction. If Landlord, in such notice, does not elect to terminate this Lease, and the restoration will exceed the Maximum Restoration period, Tenant may terminate this Lease by providing Landlord with notice of such election to terminate this Lease within five (5) Business Days of Tenant's receipt of such notice. Unless Landlord or Tenant, as the case may be, so elects to terminate this Lease, Landlord shall, subject to receipt of sufficient insurance proceeds (with any deductible to be treated as a current Operating Expense), promptly restore the Premises (including Landlord's Work and Tenant's Work, but excluding the improvements installed by Tenant or by Landlord and paid for by Tenant), subject to delays arising from the collection of insurance proceeds, from Force Majeure events or as needed to obtain any license, clearance or other authorization of any kind required to enter into and restore the Premises issued by any Governmental Authority having jurisdiction over the use, storage, handling, treatment, generation, release, disposal, removal or remediation of Hazardous Materials in, on or about the Premises (collectively referred to herein as " **Hazardous Materials Clearances**"); provided, however, that if repair or restoration of the Premises is not substantially complete as of the end of the Maximum Restoration Period or, if longer, the Restoration Period, Landlord may, in its sole and absolute discretion, elect not to proceed with such repair and restoration, in which event Landlord shall be relieved of its obligation to make such repairs or restoration and this Lease shall terminate as of the date that is 75 days after the later of: (i) discovery of such damage or destruction, or (ii) the date all required Hazardous Materials Clearances are obtained, but Landlord shall retain any Rent paid and the right to any Rent payable by Tenant prior to such election by Landlord.

Tenant, at its expense, shall promptly perform, subject to delays arising from the collection of insurance proceeds, from Force Majeure (as defined in **Section 30.20**) events or to obtain Hazardous Material Clearances, all repairs or restoration not required to be done by Landlord and shall promptly re-enter the Premises and commence doing business in accordance with this Lease.

Notwithstanding the foregoing, either party may terminate this Lease if the Premises are damaged during the last year of the Term and Landlord reasonably estimates that it will take more than two months to repair such damage, or if insurance proceeds are not available for such restoration. Rent shall be abated from the date all required Hazardous Material Clearances are obtained until the Premises are repaired and restored, in the proportion which the area of the Premises, if any, which is not usable by Tenant bears to the total area of the Premises, unless Landlord provides Tenant with other space during the period of repair that is suitable for the temporary conduct of Tenant's business. Such abatement shall be the sole remedy of Tenant, and except as provided in this Section, Tenant waives any right to terminate the Lease by reason of damage or casualty loss.

The provisions of this Lease, including this Section, constitute an express agreement between Landlord and Tenant with respect to any and all damage to, or destruction of, all or any part of the Premises, or any other portion of the Project, and any statute or regulation which is now or may hereafter be in effect shall have no application to this Lease or any damage or destruction to all or any part of the Premises or any other portion of the Project, the parties hereto expressly agreeing that this Section sets forth their entire understanding and agreement with respect to such matters.

ARTICLE 15
CONDEMNATION

15.1 Condemnation. If the whole or any material part of the Premises or the Project is taken for any public or quasi-public use under governmental law, ordinance, or regulation, or by right of eminent domain, or by private purchase in lieu thereof (a " **Taking**" or "**Taken**"), and the Taking would in Landlord's reasonable judgment, either prevent or materially interfere with Tenant's use of the Premises or materially interfere with or impair Landlord's ownership or operation of the Project, then upon written notice by Landlord this Lease shall terminate and Rent shall be apportioned as of said date. In addition, if a Taking of the whole or any material part of the Premises or the Project would in the reasonable judgment of Tenant either prevent or materially interfere with Tenant's use of the Premises, Tenant shall have the right to terminate this Lease by written notice to Landlord within thirty (30) days of the date that Landlord's title has been divested of such property. If part of the Premises shall be Taken, and this Lease is not terminated as provided above, Landlord shall promptly restore the Premises and the Project as nearly as is commercially reasonable under the circumstances to their condition prior to such partial Taking and the rentable square footage of the Building, the rentable square footage of the Premises, Tenant's Share of Operating Expenses and the Rent payable hereunder during the unexpired Term shall be reduced to such extent as may be fair and reasonable under the circumstances. Upon any such Taking, Landlord shall be entitled to receive the entire price or award from any such Taking without any payment to Tenant, and Tenant hereby assigns to Landlord Tenant's interest, if any, in such award. Tenant shall have the right, to the extent that same shall not diminish Landlord's award, to make a separate claim against the condemning authority (but not Landlord) for such

compensation as may be separately awarded or recoverable by Tenant for moving expenses and damage to Tenant's trade fixtures, if a separate award for such items is made to Tenant. Tenant hereby waives any and all rights it might otherwise have pursuant to any provision of state law to terminate this Lease upon a partial Taking of the Premises or the Project.

ARTICLE 16
EVENTS OF DEFAULT

16.1 Events of Default. Each of the following events shall be a default ("**Default**") by Tenant under this Lease:

(a) Payment Defaults. Tenant shall fail to pay any installment of Rent or any other payment hereunder when due and such default shall continue for more than five (5) Business Days after written notice from Landlord.

(b) Insurance. Any insurance required to be maintained by Tenant pursuant to this Lease shall be canceled or terminated or shall expire or shall be reduced or materially changed, or Landlord shall receive a notice of nonrenewal of any such insurance and Tenant shall fail to replace such insurance at least 20 days before the expiration of the current coverage.

(c) Abandonment. Tenant shall no longer conduct any of its business operations in the Premises.

(d) Improper Transfer. Tenant shall assign, sublease or otherwise transfer all or any portion of Tenant's interest in this Lease or the Premises except as expressly permitted herein, or Tenant's interest in this Lease shall be attached, executed upon, or otherwise judicially seized and such action is not released within 90 days of the action.

(e) Liens. Tenant shall fail to discharge or otherwise obtain the release of any lien placed upon the Premises in violation of this Lease within 15 days after written notice from Landlord.

(f) Insolvency Events. Tenant or any guarantor or surety of Tenant's obligations hereunder shall: (A) make a general assignment for the benefit of creditors; (B) commence any case, proceeding or other action seeking to have an order for relief entered on its behalf as a debtor or to adjudicate it a bankrupt or insolvent, or seeking reorganization, arrangement, adjustment, liquidation, dissolution or composition of it or its debts or seeking appointment of a receiver, trustee, custodian or other similar official for it or for all or of any substantial part of its property (collectively a " **Proceeding for Relief**"); (C) become the subject of any Proceeding for Relief which is not dismissed within 90 days of its filing or entry; or (D) die or suffer a legal disability (if Tenant, guarantor, or surety is an individual) or be dissolved or otherwise fail to maintain its legal existence (if Tenant, guarantor or surety is a corporation, partnership or other entity).

(g) Estoppel Certificate or Subordination Agreement. Tenant fails to execute any document required from Tenant under Article 18 or 19 within 5 Business Days after a second notice requesting such document.

(h) Other Defaults. Tenant shall fail to comply with any provision of this Lease other than those specifically referred to in this Section, and, except as otherwise expressly provided herein, such failure shall continue for a period of 30 days after written notice thereof from Landlord to Tenant.

Any notice given pursuant to this Section hereof shall: (i) specify the alleged default, (ii) demand that Tenant cure such default, (iii) be in lieu of, and not in addition to, or shall be deemed to be, any notice required under any provision of applicable law, and (iv) not be deemed a forfeiture or a termination of this Lease unless Landlord elects otherwise in such notice; provided that if the nature of Tenant's default pursuant to this Section is such that it cannot be cured by the payment of money and reasonably requires more than 30 days to cure, then Tenant shall not be deemed to be in default if Tenant commences such cure within said 30 day period and thereafter diligently prosecutes the same to completion; provided, however, that such cure shall be completed no later than 90 days from the date of Landlord's notice.

16.2 Landlord's Remedies.

(a) Payment By Landlord; Interest. Upon a Default by Tenant hereunder, Landlord may, without waiving or releasing any obligation of Tenant hereunder, make such payment or perform such act. All sums so paid or incurred by Landlord, together with interest thereon, from the date such sums were paid or incurred, at the Default Rate, shall be payable to Landlord on demand as Additional Rent.

(b) Late Payment Rent. Late payment by Tenant to Landlord of Rent and other sums due will cause Landlord to incur costs not contemplated by this Lease, the exact amount of which will be extremely difficult and impracticable to ascertain. Such costs include, but are not limited to, processing and accounting charges and late charges which may be imposed on Landlord under any Mortgage covering the Premises. Therefore, if any installment of Rent due from Tenant is not received by Landlord within 5 days after the date such payment is due, Tenant shall pay to Landlord an additional sum equal to 5% of the overdue Rent as a late charge. The parties agree that this late charge represents a fair and reasonable estimate of the costs Landlord will incur by reason of late payment by Tenant. In addition to the late charge, Rent not paid when due shall bear interest at the Default Rate from the 5th day after the date due until paid.

(c) Remedies. Upon the occurrence of a Default, Landlord, at its option, without further notice or demand to Tenant, shall have in addition to all other rights and remedies provided in this Lease, at law or in equity, the option to pursue any one or more of the following remedies, each and all of which shall be cumulative and nonexclusive, without any notice or demand whatsoever.

(i) Terminate this Lease, or at Landlord's option, Tenant's right to possession only, in which event Tenant shall immediately surrender the Premises to Landlord, and if Tenant fails to do so, Landlord may, without prejudice to any other remedy which it may have for possession or arrearages in rent, enter upon and take possession of the Premises in compliance with applicable Legal Requirements and expel or remove Tenant and any other person who may be occupying the Premises or any part thereof, without being liable for prosecution or any claim for damages therefor unless such process is accomplished by Landlord in violation of applicable Legal Requirements;

(ii) Upon any termination of this Lease, whether pursuant to the foregoing subsection (i) or otherwise, Landlord may recover from Tenant the following:

(A) The worth at the time of award of any unpaid Rent which has been earned at the time of such termination; plus

(B) The worth at the time of award of the amount by which the unpaid Rent which would have been earned after termination until the time of award exceeds the amount of such rental loss that Tenant proves could have been reasonably avoided; plus

(C) The worth at the time of award of the amount by which the unpaid Rent for the balance of the Term after the time of award exceeds the amount of such rental loss that Tenant proves could have been reasonably avoided; plus

(D) Any other amount necessary to compensate Landlord for all the detriment proximately caused by Tenant's failure to perform its obligations under this Lease or which in the ordinary course of things would be likely to result therefrom, specifically including, but not limited to, brokerage commissions and advertising expenses incurred, expenses of remodeling the Premises or any portion thereof for a new tenant, whether for the same or a different use, and any special concessions made to obtain a new tenant; and

(E) At Landlord's election, such other amounts in addition to or in lieu of the foregoing as may be permitted from time to time by applicable law.

As used in the foregoing subsection (c)(ii) (A) and (B), the "**worth at the time of award**" shall be computed by allowing interest at the Default Rate. As used in subsection (c)(ii)(C) above, the "**worth at the time of award**" shall be computed by discounting such amount at the discount rate of the Federal Reserve Bank of Boston at the time of award plus 1%.

(iii) Landlord may continue this Lease in effect after Tenant's Default and recover Rent as it becomes due (Landlord and Tenant hereby agreeing that Tenant has the right to sublet or assign hereunder, subject only to reasonable limitations). Accordingly, if Landlord does not elect to terminate this Lease following a Default by Tenant, Landlord may, from time to time, without terminating this Lease, enforce all of its rights and remedies hereunder, including the right to recover all Rent as it becomes due.

(iv) Intentionally Deleted.

(v) Independent of the exercise of any other remedy of Landlord hereunder or under applicable law, upon the occurrence of a monetary Default or Default pertaining to Tenant's failure to comply with the requirements of **Article 21**, Landlord may conduct an environmental test of the Premises as generally described in **Section 21.4** hereof, at Tenant's expense.

Notwithstanding anything to the contrary contained herein, in no event shall Tenant ever be liable to Landlord for any special, indirect, consequential or punitive damages under this Lease except as may arise in connection with Tenant's holding over of the Premises as set forth in Article 25.

(d) Effect of Exercise. Exercise by Landlord of any remedies hereunder or otherwise available shall not be deemed to be an acceptance of surrender of the Premises and/or a termination of this Lease by Landlord, it being understood that such surrender and/or termination can be effected only by the express written agreement of Landlord and Tenant. Any law, usage, or custom to the contrary notwithstanding, Landlord shall have the right at all times to enforce the provisions of this Lease in strict accordance with the terms hereof; and the failure of Landlord at any time to enforce its rights under this Lease strictly in accordance with same shall not be construed as having created a custom in any way or manner contrary to the specific terms, provisions, and covenants of this Lease or as having modified the same and shall not be deemed a waiver of Landlord's right to enforce one or more of its rights in connection with any subsequent default. A receipt by Landlord of Rent or other payment with knowledge of the breach of any covenant hereof shall not be deemed a waiver of such breach, and no waiver by Landlord of any provision of this Lease shall be deemed to have been made unless expressed in writing and signed by Landlord. To the greatest extent permitted by law, Tenant waives all right of redemption in case Tenant shall be dispossessed by a judgment or by warrant of any court or judge. Any reletting of the Premises or any portion thereof shall be on such terms and conditions as Landlord in its sole discretion may determine. Landlord shall not be liable for, nor shall Tenant's obligations hereunder be diminished because of, Landlord's failure to relet the Premises or collect rent due in respect of such reletting or otherwise to mitigate any damages arising by reason of Tenant's Default.

ARTICLE 17
ASSIGNMENT AND SUBLETTING

17.1 General Prohibition. Without Landlord's prior written consent which shall not be unreasonably withheld, conditioned or delayed subject to and on the conditions described in this Section, Tenant shall not, directly or indirectly, voluntarily or by operation of law, assign this Lease or sublease the Premises or any part thereof or mortgage, pledge, or hypothecate its leasehold interest or grant any concession or license within the Premises, and any attempt to do any of the foregoing shall be void and of no effect.

17.2 Permitted Transfers. If Tenant desires to assign, sublease, hypothecate or otherwise transfer this Lease or sublet the Premises other than pursuant to a Permitted Assignment (as defined below), then at least 15 Business Days, but not more than 45 Business Days, before the date Tenant desires the assignment or sublease to be effective (the "**Assignment Date**"), Tenant shall give Landlord a notice (the "**Assignment Notice**") containing such information about the

proposed assignee or sublessee, including the proposed use of the Premises and any Hazardous Materials proposed to be used, stored handled, treated, generated in or released or disposed of from the Premises, the Assignment Date, any relationship between Tenant and the proposed assignee or sublessee, and all material terms and conditions of the proposed assignment or sublease, including a copy of any proposed assignment or sublease in its final form, and such other information as Landlord may deem reasonably necessary or appropriate to its consideration whether to grant its consent. Landlord may, by giving written notice to Tenant within 10 Business Days after receipt of the Assignment Notice: (i) grant such consent, or (ii) refuse such consent, in its reasonable discretion; or (iii) terminate this Lease with respect to the space described in the Assignment Notice as of the Assignment Date (an " **Assignment Termination**"). Among other reasons, it shall be reasonable for Landlord to withhold its consent in any of these instances: (1) the proposed assignee or subtenant is a governmental agency; (2) in Landlord's reasonable judgment, the use of the Premises by the proposed assignee or subtenant would entail any Alterations that would substantially lessen the value of the leasehold improvements in the Premises, or would require substantially increased services by Landlord; (3) in Landlord's reasonable judgment, the proposed assignee or subtenant lacks the creditworthiness to support the financial obligations it will incur under the proposed assignment (4) in Landlord's reasonable judgment, the business of the proposed assignee or subtenant is inconsistent with the type and quality of the nature of the Building; (5) the use of the Premises by the proposed assignee or subtenant will violate any applicable Legal Requirement; (6) Landlord has experienced previous defaults by or is in litigation with the proposed assignee or subtenant; or (7) the proposed assignee or subtenant is an existing tenant in the Building and Landlord has, or within a reasonable time frame will have, vacant space of comparable size, or a prospective tenant with whom Landlord has been in negotiations within the previous six (6) months; or (8) if the assignment or subletting concerns more than 50% of the Premises, the net worth (as determined in accordance with generally accepted accounting principles) of the proposed assignee or subtenant is less than $10,000,000. If Landlord delivers notice of its election to exercise an Assignment Termination, Tenant shall have the right to withdraw such Assignment Notice by written notice to Landlord of such election within 5 Business Days after Landlord's notice electing to exercise the Assignment Termination. If Tenant withdraws such Assignment Notice, this Lease shall continue in full force and effect. If Tenant does not withdraw such Assignment Notice, this Lease, and the term and estate herein granted, shall terminate as of the Assignment Date with respect to the space described in such Assignment Notice. No failure of Landlord to exercise any such option to terminate this Lease, or to deliver a timely notice in response to the Assignment Notice, shall be deemed to be Landlord's consent to the proposed assignment, sublease or other transfer. Tenant shall reimburse Landlord for its reasonable, out of pocket costs in connection with its consideration of any Assignment Notice and/or its preparation or review of any consent documents (provided that such expenses shall not exceed $5,000 in any one instance with respect to the approval of any assignments or sublets unless such assignment or sublease does not occur in the ordinary course of business (e.g. is in connection with a bankruptcy or reorganization of tenant), involves additional documentation beyond Landlord's customary form of consent or significant negotiation of the same, or Landlord provides unusual or extraordinary services in connection therewith).

Notwithstanding the foregoing, Landlord's consent to an assignment of this Lease or a subletting of any portion of the Premises to any entity controlling, controlled by or under common control with Tenant (a "**Control Permitted Assignment**") shall not be required, provided that Landlord shall have the right to approve the form of any such sublease or assignment. In addition,

Tenant shall have the right to assign this Lease, upon prior written notice to Landlord but without obtaining Landlord's prior written consent, to a corporation or other entity which is a successor-in-interest to Tenant, by way of merger, consolidation or corporate reorganization, or by the purchase of all or substantially all of the assets or the ownership interests of Tenant provided that (i) such merger or consolidation, or such acquisition or assumption, as the case may be, is for a good business purpose and not principally for the purpose of transferring the Lease, and (ii) the net worth (as determined in accordance with generally accepted accounting principles ("**GAAP**")) of the assignee is not less than the greater of the net worth (as determined in accordance with GAAP) of Tenant as of the date of this Lease or the date of Tenant's most current quarterly or annual financial statements, and (iii) such assignee shall agree in writing to assume all of the terms, covenants and conditions of this Lease arising after the effective date of the assignment (a " **Corporate Permitted Assignment** "). Control Permitted Assignments and Corporate Permitted Assignments are hereinafter referred to as " **Permitted Assignments** ."

Notwithstanding anything to the contrary in this Article, Tenant shall have the right to obtain financing from investors (including venture capital funding and corporate partners) which invest in private companies or undergo a public offering which results in a change in control of Tenant without such change of control constituting an assignment under this Section requiring Landlord consent, provided that (i) Tenant notifies Landlord in writing of the financing prior to the closing of the financing (or, if prohibited from so notifying Landlord by Legal Requirements or other contractual confidentiality obligations, then promptly thereafter), and (ii) provided that in no event shall such financing result in a change in use of the Premises from the use contemplated by Tenant at the commencement of the Term.

17.3 Additional Conditions. As a condition to any such assignment or subletting, whether or not Landlord's consent is required, Landlord may require:

(i) that any assignee or subtenant agree, in writing at the time of such assignment or subletting, that if Landlord gives such party notice that Tenant is in Default under this Lease, such party shall thereafter make all payments otherwise due Tenant directly to Landlord, which payments will be received by Landlord without any liability except to credit such payment against those due under the Lease, and any such third party shall agree to attorn to Landlord or its successors and assigns should this Lease be terminated for any reason; provided, however, in no event shall Landlord or its successors or assigns be obligated to accept such attornment; and

(ii) A list of Hazardous Materials, certified by the proposed assignee or sublessee to be true and correct, which the proposed assignee or sublessee intends to use, store, handle, treat, generate in or release or dispose of from the Premises, together with copies of all documents relating to such use, storage, handling, treatment, generation, release or disposal of Hazardous Materials by the proposed assignee or subtenant in the Premises or on the Project, prior to the proposed assignment or subletting, including, without limitation: permits; approvals; reports and correspondence; storage and management plans; plans relating to the installation of any storage tanks to be installed in or under the Project (provided, said installation of tanks shall only be permitted after Landlord has given its written consent to do so, which consent may be withheld in Landlord's sole and absolute discretion); and all closure plans or any other documents required by any and all federal, state and local Governmental Authorities for any storage tanks

installed in, on or under the Project for the closure of any such tanks. Neither Tenant nor any such proposed assignee or subtenant is required, however, to provide Landlord with any portion(s) of the such documents containing information of a proprietary nature which, in and of themselves, do not contain a reference to any Hazardous Materials or hazardous activities.

17.4 No Release of Tenant, Sharing of Excess Rents. Notwithstanding any assignment or subletting, Tenant shall at all times remain fully and primarily responsible and liable for the payment of Rent and for compliance with all of Tenant's other obligations under this Lease. If the Rent due and payable by a sublessee or assignee (or a combination of the rental payable under such sublease or assignment plus any bonus or other consideration therefor or incident thereto in any form) exceeds the sum of the rental payable under this Lease, (excluding however, any Rent payable under this Section) and actual and reasonable brokerage fees, legal costs and any design or construction fees directly related to and required pursuant to the terms of any such sublease and any unamortized tenant improvement expenses paid by Tenant in excess of Landlord's Contribution) ("**Excess Rent**"), then Tenant shall be bound and obligated to pay Landlord as Additional Rent hereunder 50% of such Excess Rent within 10 days following receipt thereof by Tenant. If Tenant shall sublet the Premises or any part thereof, Tenant hereby immediately and irrevocably assigns to Landlord, as security for Tenant's obligations under this Lease, all rent from any such subletting, and Landlord as assignee and as attorney-in-fact for Tenant, or a receiver for Tenant appointed on Landlord's application, may collect such rent and apply it toward Tenant's obligations under this Lease; except that, until the occurrence of a Default, Tenant shall have the right to collect and retain such rent.

17.5 No Waiver. The consent by Landlord to an assignment or subletting shall not relieve Tenant or any assignees of this Lease or any sublessees of the Premises from obtaining the consent of Landlord to any further assignment or subletting nor shall it release Tenant or any assignee or sublessee of Tenant from full and primary liability under the Lease. The acceptance of Rent hereunder, or the acceptance of performance of any other term, covenant, or condition thereof, from any other person or entity shall not be deemed to be a waiver of any of the provisions of this Lease or a consent to any subletting, assignment or other transfer of the Premises.

17.6 Prior Conduct of Proposed Transferee. Notwithstanding any other provision of this Section, if the proposed assignee or sublessee has operations in the Commonwealth of Massachusetts that are or have been subject to an enforcement order issued by any Governmental Authority and such operations are substantially comparable to the operations proposed by the assignee or sublessee for the Premises in connection with the use, storage, handling, treatment, generation, release or disposal of Hazardous Materials (including, without limitation, any order related to the failure to make a required reporting to any Governmental Authority) pertaining to a use similar to the Permitted Use, Landlord shall have the absolute right to refuse to consent to any assignment or subletting to any such party.

ARTICLE 18
ESTOPPEL CERTIFICATE

18.1 Estoppel Certificate. Tenant shall, within 10 Business Days of written notice from Landlord, execute, acknowledge and deliver a statement to Landlord, or any prospective purchaser or lender, in writing (i) certifying that this Lease is unmodified and in full force and effect (or, if

modified, stating the nature of such modification and certifying that this Lease as so modified is in full force and effect) and the dates to which the rental and other charges are paid in advance, if any, (ii) acknowledging whether or not any uncured defaults exist on the part of Landlord hereunder, or specifying such defaults if any are claimed, and (iii) setting forth such further information with respect to the status of this Lease or the Premises as may be requested thereon. Any such statement may be relied upon by any prospective purchaser or encumbrancer of all or any portion of the real property of which the Premises are a part. Tenant's failure to deliver such statement within such time shall, at the option of Landlord, constitute a Default under this Lease, and, in any event, shall be conclusive upon Tenant that the Lease is in full force and effect and without modification except as may be represented by Landlord in any certificate prepared by Landlord and delivered to Tenant for execution. Landlord shall, within 10 Business Days of written notice from Tenant, execute, acknowledge and deliver a comparable statement to Tenant.

ARTICLE 19
SUBORDINATION

19.1 Subordination. This Lease and Tenant's interest and rights hereunder are hereby made and shall be subject and subordinate at all times to the lien of any Mortgage now existing or hereafter created on or against the Project or the Premises, and all amendments, restatements, renewals, modifications, consolidations, refinancing, assignments and extensions thereof, provided that the Holder of such Mortgage delivers to Tenant a subordination, non-disturbance and attornment agreement on such holder's standard and customary form provided that such holder is an institutional lender or investor. Tenant agrees, at the election of the Holder of any such Mortgage, to attorn to any such Holder. Notwithstanding the foregoing, any such Holder may at any time subordinate its Mortgage to this Lease, without Tenant's consent, by notice in writing to Tenant, and thereupon this Lease shall be deemed prior to such Mortgage without regard to their respective dates of execution, delivery or recording and in that event such Holder shall have the same rights with respect to this Lease as though this Lease had been executed prior to the execution, delivery and recording of such Mortgage and had been assigned to such Holder. The term "**Mortgage**" whenever used in this Lease shall be deemed to include deeds of trust, security assignments and any other encumbrances, and any reference to the "**Holder**" of a Mortgage shall be deemed to include the beneficiary under a deed of trust.

ARTICLE 20
SURRENDER

20.1 Surrender. Upon the expiration of the Term or earlier termination of Tenant's right of possession, Tenant shall surrender the Premises to Landlord in the condition the Premises are required to be maintained during the Term, along with any Alterations or Installations permitted by Landlord to remain in the Premises pursuant to the provisions of this Lease, free of Hazardous Materials brought upon, kept, used, stored, handled, treated, generated in, or released or disposed of from, the Premises by Tenant or any Tenant Party or subtenant (collectively, "**Tenant HazMat Operations**") and released of all Hazardous Materials Clearances, broom clean, ordinary wear and tear and casualty loss and condemnation covered by **Sections 14 and 15** excepted. At least 3 months prior to the surrender of the Premises, Tenant shall deliver to Landlord a narrative description of the actions proposed (or required by any Governmental Authority) to be taken by Tenant in order to surrender the Premises (including any Installations permitted by Landlord to

remain in the Premises) at the expiration or earlier termination of the Term, free from any residual impact from the Tenant HazMat Operations and otherwise released for unrestricted use and occupancy (the "**Surrender Plan**"). Such Surrender Plan shall be accompanied by a current listing of (i) all Hazardous Materials licenses and permits held by or on behalf of any Tenant Party with respect to the Premises, and (ii) all Hazardous Materials used, stored, handled, treated, generated, released or disposed of from the Premises, and shall be subject to the review and approval of Landlord's environmental consultant. In connection with the review and approval of the Surrender Plan, upon the request of Landlord, Tenant shall deliver to Landlord or its consultant such additional non-proprietary information concerning Tenant HazMat Operations as Landlord shall request. On or before such surrender, Tenant shall deliver to Landlord evidence that the approved Surrender Plan shall have been satisfactorily completed and Landlord shall have the right, subject to reimbursement at Tenant's expense as set forth below, to cause Landlord's environmental consultant to inspect the Premises and perform such additional procedures as may be deemed reasonably necessary to confirm that the Premises are, as of the effective date of such surrender or early termination of the Lease, free from any residual impact from Tenant HazMat Operations. Tenant shall reimburse Landlord, as Additional Rent, for the actual out-of pocket expense incurred by Landlord for Landlord's environmental consultant to review and approve the Surrender Plan and to visit the Premises and verify satisfactory completion of the same, which cost shall not exceed $5,000. Landlord shall have the unrestricted right to deliver such Surrender Plan and any report by Landlord's environmental consultant with respect to the surrender of the Premises to third parties.

If Tenant shall fail to prepare or submit a Surrender Plan approved by Landlord, or if Tenant shall fail to complete the approved Surrender Plan, or if such Surrender Plan, whether or not approved by Landlord, shall fail to adequately address any residual effect of Tenant HazMat Operations in, on or about the Premises, Landlord shall have the right to take such actions as Landlord may deem reasonable or appropriate to assure that the Premises and the Project are surrendered free from any residual impact from Tenant HazMat Operations, the cost of which actions shall be reimbursed by Tenant as Additional Rent, without regard to the limitation set forth in the first paragraph of this Section.

Tenant shall immediately return to Landlord all keys and/or access cards to parking, the Project, restrooms or all or any portion of the Premises furnished to or otherwise procured by Tenant. If any such access card or key is lost, Tenant shall pay to Landlord, at Landlord's election, either the cost of replacing such lost access card or key or the cost of reprogramming the access security system in which such access card was used or changing the lock or locks opened by such lost key. Any Tenant's Property, Alterations and property not so removed by Tenant as permitted or required herein shall be deemed abandoned and may be stored, removed, and disposed of by Landlord at Tenant's expense, and Tenant waives all claims against Landlord for any damages resulting from Landlord's retention and/or disposition of such property. All obligations of Tenant hereunder not fully performed as of the termination of the Term, including the obligations of Tenant under Article 21 hereof, shall survive the expiration or earlier termination of the Term, including, without limitation, indemnity obligations, payment obligations with respect to Rent and obligations concerning the condition and repair of the Premises.

ARTICLE 21
ENVIRONMENTAL REQUIREMENTS

21.1 Prohibition/Compliance/Indemnity. Tenant shall not cause or permit any Hazardous Materials (as hereinafter defined) to be brought upon, kept, used, stored, handled, treated, generated in or about, or released or disposed of from, the Premises or the Project in violation of applicable Environmental Requirements (as hereinafter defined) by Tenant or any Tenant Party or subtenant. If Tenant breaches the obligation stated in the preceding sentence, or if the presence of Hazardous Materials in the Premises is caused or permitted by Tenant or any Tenant Party during the Term or any holding over results in contamination of the Premises, the Project or any adjacent property, or if contamination of the Premises, the Project or any adjacent property by Hazardous Materials brought into, kept, used, stored, handled, treated, generated in or about, or released or disposed of from, the Premises by Tenant or any Tenant Party or subtenant otherwise occurs during the Term or any holding over, Tenant hereby indemnifies and shall defend and hold Landlord, its officers, directors, employees, agents and contractors harmless from any and all actions (including, without limitation, remedial or enforcement actions of any kind, administrative or judicial proceedings, and orders or judgments arising out of or resulting therefrom), costs, claims, damages (including, without limitation, punitive damages and damages based upon diminution in value of the Premises or the Project, or the loss of, or restriction on, use of the Premises or any portion of the Project), expenses (including, without limitation, attorneys', consultants' and experts' fees, court costs and amounts paid in settlement of any claims or actions), fines, forfeitures or other civil, administrative or criminal penalties, injunctive or other relief (whether or not based upon personal injury, property damage, or contamination of, or adverse effects upon, the environment, water tables or natural resources), liabilities or losses (collectively, "**Environmental Claims**") which arise during or after the Term as a result of such contamination. This indemnification of Landlord by Tenant includes, without limitation, costs incurred in connection with any investigation of site conditions or any cleanup, treatment, remedial, removal, or restoration work required by any federal, state or local Governmental Authority because of Hazardous Materials present in the air, soil or ground water above, on, or under the Premises. Without limiting the foregoing, if the presence of any Hazardous Materials on the Premises, the Project or any adjacent property caused or permitted by Tenant or any Tenant Party results in any contamination of the Premises, the Project or any adjacent property, Tenant shall promptly take all actions at its sole expense and in accordance with applicable Environmental Requirements as are necessary to return the Premises, the Project or any adjacent property to the condition existing prior to the time of such contamination, provided that Landlord's approval of such action shall first be obtained, which approval shall not unreasonably be withheld so long as such actions would not potentially have any material adverse long-term or short-term effect on the Premises or the Project.

Notwithstanding anything to the contrary contained in this Section 20, Tenant shall not be responsible for, and the indemnification and hold harmless obligation set forth in this paragraph shall not apply to (i) contamination in the Premises which existed in the Premises prior to the Commencement Date, or (ii) the presence of any Hazardous Materials in the Premises which migrated from outside of the Premises into the Premises, or (iii) contamination caused by Landlord or any Landlord Party.

21.2 Business. Landlord acknowledges that it is not the intent of this Section to prohibit Tenant from using the Premises for the Permitted Use. Tenant may operate its business according to prudent industry practices so long as the use or presence of Hazardous Materials is strictly and properly monitored according to all then applicable Environmental Requirements. As a material inducement to Landlord to allow Tenant to use Hazardous Materials in connection with its business, Tenant agrees to deliver to Landlord prior to the Lease Commencement Date a list identifying each type of Hazardous Materials to be brought upon, kept, used, stored, handled, treated, generated on, or released or disposed of from, the Premises and setting forth any and all governmental approvals or permits required in connection with the presence, use, storage, handling, treatment, generation, release or disposal of such Hazardous Materials on or from the Premises ("**Hazardous Materials List**"). Tenant shall deliver to Landlord an updated Hazardous Materials List at least once a year and shall also deliver an updated list before any new Hazardous Material is brought onto, kept, used, stored, handled, treated, generated on, or released or disposed of from, the Premises. Tenant shall deliver to Landlord true and correct copies of the following documents (the " **Haz Mat Documents**") relating to the use, storage, handling, treatment, generation, release or disposal of Hazardous Materials prior to the Lease Commencement Date, or if unavailable at that time, concurrent with the receipt from or submission to a Governmental Authority: permits; approvals; reports and correspondence; storage and management plans, notice of violations of any Legal Requirements; plans relating to the installation of any storage tanks to be installed in the Project (provided, said installation of tanks shall only be permitted in compliance with the applicable Legal Requirements and subject to any reasonable conditions or requirements imposed by Landlord); all closure plans or any other documents required by any and all federal, state and local Governmental Authorities for any storage tanks installed in, on or under the Project for the closure of any such tanks; and a Surrender Plan (to the extent surrender in accordance with Article 20 cannot be accomplished in 3 months). Tenant is not required, however, to provide Landlord with any portion(s) of the Haz Mat Documents containing information of a proprietary nature which, in and of themselves, do not contain a reference to any Hazardous Materials or hazardous activities. It is not the intent of this Section to provide Landlord with information which could be detrimental to Tenant's business should such information become possessed by Tenant's competitors.

21.3 Tenant Representation and Warranty. Tenant hereby represents and warrants to Landlord that (i) neither Tenant nor any of its legal predecessors has been required by any prior landlord, lender or Governmental Authority at any time to take remedial action in connection with Hazardous Materials contaminating a property which contamination was permitted by Tenant of such predecessor or resulted from Tenant's or such predecessor's action or use of the property in question, and (ii) Tenant is not subject to any enforcement order issued by any Governmental Authority in connection with the use, storage, handling, treatment, generation, release or disposal of Hazardous Materials (including, without limitation, any order related to the failure to make a required reporting to any Governmental Authority). If Landlord determines that this representation and warranty was not true as of the date of this lease, Landlord shall have the right to terminate this Lease in Landlord's sole and absolute discretion.

21.4 Testing. If any Governmental Authority requires testing to determine whether any contamination of the Premises or the Project has occurred as a result of Tenant's use, then Landlord shall have the right to conduct such testing at Tenant's expense. If Tenant conducts its own tests of the Premises using third party contractors and test procedures acceptable to Landlord (and such Governmental Authority), which tests are certified to Landlord (and such Governmental Authority), Landlord shall accept such tests in lieu of the tests to be paid for by Tenant. In

addition, at any time, and from time to time, prior to the expiration or earlier termination of the Term, Landlord shall have the right to conduct appropriate tests of the Premises and the Project to determine if contamination has occurred as a result of Tenant's use of the Premises. In connection with such testing, upon the request of Landlord, Tenant shall deliver to Landlord or its consultant such non-proprietary information concerning the use of Hazardous Materials in or about the Premises by Tenant or any Tenant Party. If contamination has occurred for which Tenant is liable under this Section, Tenant shall pay all costs to conduct such tests. If no such contamination is found, Landlord shall pay the costs of such tests (which shall not constitute an Operating Expense). Landlord shall provide Tenant with a copy of all third party, non-confidential reports and tests of the Premises made by or on behalf of Landlord during the Term without representation or warranty and subject to a confidentiality agreement. Tenant shall, at its sole cost and expense, promptly and satisfactorily remediate any environmental conditions identified by such testing for which Tenant is responsible hereunder in accordance with all Environmental Requirements. Landlord's receipt of or satisfaction with any environmental assessment in no way waives any rights which Landlord may have against Tenant.

21.5 Control Areas. Tenant shall be allowed to utilize up to its pro rata share of the Hazardous Materials inventory within any control area or zone (located within the Premises), as designated by the applicable building code, for chemical use or storage. As used in the preceding sentence, Tenant's pro rata share of any control areas or zones located within the Premises shall be determined based on the rentable square footage that Tenant leases within the applicable control area or zone. For purposes of example only, if a control area or zone contains 10,000 rentable square feet and 2,000 rentable square feet of a tenant's premises are located within such control area or zone (while such premises as a whole contains 5,000 rentable square feet), the applicable tenant's pro rata share of such control area would be 20%.

21.6 Intentionally Deleted.

21.7 Tenant's Obligations. Tenant's obligations under this Section shall survive the expiration or earlier termination of the Lease. any period of time after the expiration or earlier termination of this Lease required by Tenant or Landlord to complete the removal from the Premises of any Hazardous Materials (including, without limitation, the release and termination of any licenses or permits restricting the use of the Premises and the completion of the approved Surrender Plan), Tenant shall continue to pay the full Rent in accordance with this Lease for any portion of the Premises not relet by Landlord in Landlord's sole discretion, which Rent shall be prorated daily.

21.8 Definitions. As used herein, the term "**Environmental Requirements**" means all applicable present and future statutes, regulations, ordinances, rules, codes, judgments, orders or other similar enactments of any Governmental Authority regulating or relating to health, safety, or environmental conditions on, under, or about the Premises or the Project, or the environment, including without limitation, the following: the Comprehensive Environmental Response, Compensation and Liability Act; the Resource Conservation and Recovery Act; and all state and local counterparts thereto, and any regulations or policies promulgated or issued thereunder. As used herein, the term **"Hazardous Materials**" means and includes any substance, material, waste, pollutant, or contaminant listed or defined as hazardous or toxic (other than reasonable amounts of routine cleaning products), or regulated by reason of its impact or potential impact on humans,

animals and/or the environment under any Environmental Requirements, asbestos and petroleum, including crude oil or any fraction thereof, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas). As defined in Environmental Requirements, Tenant is and shall be deemed to be the "**operator**" of Tenant's "**facility**" and the "**owner**" of all Hazardous Materials brought on the Premises by Tenant or any Tenant Party, and the wastes, by-products, or residues generated, resulting, or produced therefrom.

ARTICLE 22
TENANT'S REMEDIES/LIMITATION OF LIABILITY

22.1 Tenant's Remedies/Limitation of Liability. Landlord shall not be in default hereunder unless Landlord fails to perform any of its obligations hereunder within 30 days after written notice from Tenant specifying such failure (unless such performance will, due to the nature of the obligation, require a period of time in excess of 30 days, then after such period of time as is reasonably necessary, provided that Landlord shall diligently and continuously pursue such cure). Upon any default by Landlord, Tenant shall give notice by registered or certified mail to any Holder of a Mortgage covering the Premises and to any landlord of any lease of property in or on which the Premises are located and Tenant shall offer such Holder and/or landlord a reasonable opportunity to cure the default, including time to obtain possession of the Project by power of sale or a judicial action if such should prove necessary to effect a cure; provided Landlord shall have furnished in advance to Tenant in writing the names and addresses of all such persons who are to receive such notices. All obligations of Landlord hereunder shall be construed as covenants, not conditions; and, except as may be otherwise expressly provided in this Lease, Tenant may not terminate this Lease for breach of Landlord's obligations hereunder.

All obligations of Landlord under this Lease arising or accruing during the period of such Landlord's ownership of the Premises, and not thereafter, will be binding upon Landlord. The term "Landlord" in this Lease shall mean only the owner for the time being of the Premises. Upon the transfer by such owner of its interest in the Premises, such owner shall thereupon be released and discharged from all obligations of Landlord thereafter accruing, but such obligations shall be binding during the Term upon each new owner for the duration of such owner's ownership.

22.2 Limitation on Landlord's Liability. NOTWITHSTANDING ANYTHING SET FORTH HEREIN OR IN ANY OTHER AGREEMENT BETWEEN LANDLORD AND TENANT TO THE CONTRARY: (A) EXCEPT TO THE EXTENT ARISING AS A RESULT OF THE NEGLIGENCE OR WILLFUL MISCONDUCT OF LANDLORD OR ANY LANDLORD PARTY, LANDLORD SHALL NOT BE LIABLE TO TENANT OR ANY OTHER PERSON FOR (AND TENANT AND EACH SUCH OTHER PERSON ASSUME ALL RISK OF) LOSS, DAMAGE OR INJURY, TO: TENANT'S PERSONAL PROPERTY OF EVERY KIND AND DESCRIPTION, INCLUDING, WITHOUT LIMITATION TRADE FIXTURES, EQUIPMENT, INVENTORY, SCIENTIFIC RESEARCH, SCIENTIFIC EXPERIMENTS, LABORATORY ANIMALS, PRODUCT, SPECIMENS, SAMPLES, AND/OR SCIENTIFIC, BUSINESS, ACCOUNTING AND OTHER RECORDS OF EVERY KIND AND DESCRIPTION KEPT AT THE PREMISES AND ANY AND ALL INCOME DERIVED OR DERIVABLE THEREFROM; (B) THERE SHALL BE NO PERSONAL RECOURSE TO LANDLORD FOR ANY ACT OR OCCURRENCE IN, ON OR ABOUT THE PREMISES OR ARISING IN ANY WAY UNDER THIS LEASE OR ANY OTHER

AGREEMENT BETWEEN LANDLORD AND TENANT WITH RESPECT TO THE SUBJECT MATTER HEREOF AND ANY LIABILITY OF LANDLORD HEREUNDER SHALL BE STRICTLY LIMITED SOLELY TO LANDLORD'S INTEREST IN THE PROJECT OR ANY PROCEEDS FROM SALE OR CONDEMNATION THEREOF AND ANY INSURANCE PROCEEDS PAYABLE IN RESPECT OF LANDLORD'S INTEREST IN THE PROJECT OR IN CONNECTION WITH ANY SUCH LOSS; AND (C) IN NO EVENT SHALL ANY PERSONAL LIABILITY BE ASSERTED AGAINST LANDLORD IN CONNECTION WITH THIS LEASE NOR SHALL ANY RECOURSE BE HAD TO ANY OTHER PROPERTY OR ASSETS OF LANDLORD OR ANY OF LANDLORD'S OFFICERS, DIRECTORS, EMPLOYEES, AGENTS OR CONTRACTORS. UNDER NO CIRCUMSTANCES SHALL LANDLORD OR ANY OF LANDLORD'S OFFICERS, DIRECTORS, EMPLOYEES, AGENTS OR CONTRACTORS BE LIABLE FOR INJURY TO TENANT'S BUSINESS OR FOR ANY LOSS OF INCOME OR PROFIT THEREFROM. NOTWITHSTANDING ANYTHING TO THE CONTRARY CONTAINED HEREIN, IN NO EVENT SHALL LANDLORD EVER BE LIABLE TO TENANT FOR ANY SPECIAL, INDIRECT, CONSEQUENTIAL OR PUNITIVE DAMAGES UNDER THIS LEASE

ARTICLE 23
INSPECTION AND ACCESS

23.1 Inspection and Access. Landlord and its agents, representatives, and contractors may enter the Premises during business hours on not less than 48 hours advance written notice (except in the case of emergencies in which case no such notice shall be required and such entry may be at any time) for the purpose of making such repairs as may be required or permitted pursuant to the Lease, inspecting the Premises, showing the Premises to prospective purchasers or lenders and, during the last year of the Term, to prospective tenants, and at any time during the Term for any other business purpose. Notwithstanding the foregoing, Landlord acknowledges that the Premises may contain confidential proprietary information and research and laboratory experiments. Accordingly, Tenant may elect to have a Tenant representative accompany any such tours with prospective purchasers, tenants or lenders. If Tenant does not so elect to have a representative accompany the tour within 24 hours after receiving Landlord's notice, Tenant shall be deemed to have waiver such right.

Landlord may grant easements, make public dedications, designate Common Areas and create restrictions pertaining to the Project, provided that no such easement, dedication, designation or restriction materially, adversely affects Tenant's use or occupancy of the Premises for the Permitted Use. At Landlord's request, Tenant shall execute such instruments as may be necessary for such easements, dedications or restrictions. Tenant shall at all times, except in the case of emergencies, have the right to escort Landlord or its agents, representatives, contractors or guests while the same are in the Premises, provided such escort does not materially and adversely affect Landlord's access rights hereunder

ARTICLE 24
SIGNAGE

24.1 Signs; Exterior Appearance. Tenant shall not, without the prior written consent of Landlord, which may be granted or withheld in Landlord's sole but reasonable discretion: (i) attach any awnings, exterior lights, decorations, balloons, flags, pennants, banners, painting or other projection to any outside wall of the Project, (ii) use any curtains, blinds, shades or screens other than Landlord's standard window coverings, (iii) coat or otherwise sunscreen the interior or exterior of any windows, (iv) place any bottles, parcels, or other articles on the window sills, (v) place any equipment, furniture or other items of personal property on any exterior balcony, or (vi) paint, affix or exhibit on any part of the Premises or the Project any signs, notices, window or door lettering, placards, decorations, or advertising media of any type which can be viewed from the exterior of the Building. Landlord shall provide at Landlord's expense building standard signage in the lobby and at Tenant's entrance. Notwithstanding the foregoing, if Tenant occupies the entire floor, Tenant may install at Tenant's expense Tenant's signage in the elevator lobby in a size and location to be determined and subject to Landlord's approval which will not be unreasonably withheld, conditioned or delayed. Notwithstanding the foregoing, provided that Tenant occupies at least the entire third floor, and subject to the rights of Foundation Medicine, Tenant shall have a non-exclusive right to install at Tenant's expense exterior signage on the Building façade in a location and with a design, size and operation subject to Landlord's approval which shall not be unreasonably conditioned, withheld or delayed, and subject to the applicable Legal Requirements of the City of Cambridge. Tenant shall be responsible for all costs relating to the permitting, installation and maintenance of the signage. Tenant shall remove any such signage, and repair any damage caused by such removal, prior to the expiration or earlier termination of this Lease.

ARTICLE 25
HOLDING OVER

25.1 Holding Over. If, with Landlord's express written consent, Tenant retains possession of the Premises after the termination of the Term, (i) unless otherwise agreed in such written consent, such possession shall be subject to immediate termination by Landlord at any time, (ii) all of the other terms and provisions of this Lease shall remain in full force and effect (excluding any expansion or renewal option or other similar right or option) during such holdover period, (iii) Tenant shall continue to pay Base Rent in the amount payable upon the date of the expiration or earlier termination of this Lease, and (iv) all other payments shall continue under the terms of this Lease. If Tenant remains in possession of the Premises after the expiration or earlier termination of the Term without the express written consent of Landlord, Tenant shall become a tenant at sufferance upon the terms of this Lease except that the monthly rental shall be equal to 150% of Base Rent in effect during the last 30 days of the Term, plus all other Additional Rent hereunder, and Tenant shall be responsible for all damages suffered by Landlord resulting from or occasioned by Tenant's holding over, including consequential damages. No holding over by Tenant, whether with or without consent of Landlord, shall operate to extend this Lease except as otherwise expressly provided, and this Section shall not be construed as consent for Tenant to retain possession of the Premises. Acceptance by Landlord of Rent after the expiration of the Term or earlier termination of this Lease shall not result in a renewal or reinstatement of this Lease.

ARTICLE 26
WAIVER OF JURY TRIAL

26.1 Waiver of Jury Trial. TO THE EXTENT PERMITTED BY LAW, TENANT AND LANDLORD WAIVE ANY RIGHT TO TRIAL BY JURY OR TO HAVE A JURY PARTICIPATE IN RESOLVING ANY DISPUTE, WHETHER SOUNDING IN CONTRACT, TORT, OR OTHERWISE, BETWEEN LANDLORD AND TENANT ARISING OUT OF THIS LEASE OR ANY OTHER INSTRUMENT, DOCUMENT, OR AGREEMENT EXECUTED OR DELIVERED IN CONNECTION HEREWITH OR THE TRANSACTIONS RELATED HERETO.

ARTICLE 27
SECURITY DEPOSIT

27.1 Security Deposit. Tenant shall deposit with Landlord, upon delivery of an executed copy of this Lease to Landlord, a security deposit (the "**Security Deposit**") for the performance of all of Tenant's obligations hereunder in the amount set forth in **Section 1.1** of this Lease, which Security Deposit shall be in the form of an unconditional and irrevocable letter of credit (the " **Letter of Credit**"): (i) in form and substance satisfactory to Landlord, (ii) naming Landlord as beneficiary, (iii) expressly allowing Landlord to draw upon it at any time from time to time by delivering to the issuer notice that Landlord is entitled to draw thereunder, (iv) issued by an FDIC-insured financial institution satisfactory to Landlord, (v) redeemable by presentation of a sight draft in the state of Landlord's choice, and (vi) transferable without fee or cost to Landlord. If Tenant does not provide Landlord with a substitute Letter of Credit complying with all of the requirements hereof at least 10 days before the stated expiration date of any then current Letter of Credit, Landlord shall have the right to draw the full amount of the current Letter of Credit and hold the funds drawn in cash without obligation for interest thereon as the Security Deposit. The Letter of Credit shall be held by Landlord as security for the performance of Tenant's obligations under this Lease. The Letter of Credit is not an advance rental deposit or a measure of Landlord's damages in case of Tenant's default. Upon each occurrence of a Default (as defined in **Section 16.1**), Landlord may draw all or any part of the Letter of Credit to pay delinquent payments due under this Lease, future rent damages, and the cost of any damage, injury, expense or liability caused by such Default, without prejudice to any other remedy provided herein or provided by law. Landlord's right to use the Letter of Credit under this Section includes the right to use the Letter of Credit to pay future rent damages following the termination of this Lease pursuant to **Section 16.2** below. Upon any use of all or any portion of the Letter of Credit, Tenant shall on demand deliver a new Letter of Credit or amend the existing Letter of Credit to restore the Letter of Credit to the amount set forth on Page 1 of this Lease. Tenant hereby waives the provisions of any law, now or hereafter in force which provide that Landlord may claim from a security deposit only those sums reasonably necessary to remedy defaults in the payment of Rent, to repair damage caused by Tenant or to clean the Premises, it being agreed that Landlord may, in addition, claim those sums reasonably necessary to compensate Landlord for any other loss or damage, foreseeable or unforeseeable, caused by the Default of Tenant. Upon bankruptcy or other debtor-creditor proceedings against Tenant, the Letter of Credit shall be deemed to be applied first to the payment of Rent and other charges due Landlord for periods prior to the filing of such proceedings. The Letter of Credit, or any balance thereof (i.e., after deducting therefrom all amounts to which Landlord is entitled under the provisions of this Lease), shall be returned to Tenant (or, at Landlord's option, to the last assignee of Tenant's interest hereunder) within 90 days after the expiration or earlier termination of this Lease.

Provided that no Default (as defined in Section 16.1) has occurred or event that with the passage of time, or the giving of notice, or both, would constitute a Default has occurred that remains uncured, the amount of the Security Deposit shall be reduced to the following amounts: (i) $1,044,247.90 effective as of the Rent Commencement Date; (ii) $835,398.32 effective as of the first anniversary of the Rent Commencement Date; and (iii) $626,548.74 effective as of the second anniversary of the Rent Commencement Date. Within thirty (30) days following receipt of Tenant's written request for the applicable reduction, any portion of the Security Deposit in excess of the respective reduced amounts shall, if held by Landlord in cash, be refunded to Tenant, without interest, or Landlord shall agree to an appropriate replacement or amendment of the Letter of Credit in order to effect the applicable reduction.

If Landlord transfers its interest in the Project or this Lease, Landlord shall either (a) transfer any Security Deposit then held by Landlord to a person or entity assuming Landlord's obligations under this Section, or (b) return to Tenant any Security Deposit then held by Landlord and remaining after the deductions permitted herein. Upon such transfer to such transferee or the return of the Security Deposit to Tenant, Landlord shall have no further obligation with respect to the Security Deposit, and Tenant's right to the return of the Security Deposit shall apply solely against Landlord's transferee. The Security Deposit is not an advance rental deposit or a measure of Landlord's damages in case of Tenant's default. Landlord's obligation respecting the Security Deposit is that of a debtor, not a trustee, and no interest shall accrue thereon.

ARTICLE 28
RIGHT TO EXTEND TERM

28.1 Extension Rights. Tenant shall have one right (an "**Extension Right**") to extend the term of this Lease for five (5) years (an " **Extension Term**") on the same terms and conditions as this Lease (other than with respect to Base Rent and the Landlord's Work) by giving Landlord written notice of its election to exercise the Extension Right no sooner than fifteen (15) months earlier than and at least 12 months prior to the expiration of the Base Term of the Lease.

Upon the commencement of the Extension Term, Base Rent shall be equal to the Market Rate (as defined below). Base Rent shall thereafter be adjusted on each annual anniversary of the commencement of the Extension Term by multiplying the Base Rent payable immediately before such adjustment by the Rent Adjustment Percentage and adding the resulting amount to the Base Rent payable immediately before such adjustment. As used herein, " **Market Rate**" shall mean the then market rental rate for space that includes laboratory and office space in the Cambridge, Massachusetts area of comparable age, quality, level of finish and proximity to amenities and public transportation as the Premises, as determined by Landlord and agreed to by Tenant. In addition, Landlord may impose a market rent for the parking rights provided hereunder.

If, on or before the date which is 180 days prior to the expiration of the Base Term of this Lease, Tenant has not agreed with Landlord's determination of the Market Rate during the Extension Term after negotiating in good faith, Tenant shall be deemed to have elected arbitration as described in this Article. Tenant acknowledges and agrees that, if Tenant has elected to exercise the Extension Right by delivering notice to Landlord as required in this Article, Tenant shall have no right thereafter to rescind or elect not to extend the term of the Lease for the Extension Term.

28.2 Arbitration. Within ten (10) days after Tenant's notice to Landlord of its election (or deemed election) to arbitrate Market Rate, each party shall deliver to the other a proposal containing the Market Rate that the submitting party believes to be correct (" **Extension Proposal**"). If either party fails to timely submit an Extension Proposal, the other party's submitted proposal shall determine the Base Rent for the Extension Term. If both parties submit Extension Proposals, then Landlord and Tenant shall meet within seven (7) days after delivery of the last Extension Proposal and make a good faith attempt to mutually appoint a single Arbitrator (and defined below) to determine the Market Rate. If Landlord and Tenant are unable to agree upon a single Arbitrator, then each shall, by written notice delivered to the other within ten (10) days after the meeting, select an Arbitrator. If either party fails to timely give notice of its selection for an Arbitrator, the other party's submitted proposal shall determine the Base Rent for the Extension Term. The two Arbitrators so appointed shall, within five (5) Business Days after their appointment, appoint a third Arbitrator. If the two Arbitrators so selected cannot agree on the selection of the third Arbitrator within the time above specified, then either party, on behalf of both parties, may request such appointment of such third Arbitrator by application to any state court of general jurisdiction in the jurisdiction in which the Premises are located, upon ten (10) days prior written notice to the other party of such intent.

(a) The decision of the Arbitrator(s) shall be made within thirty (30) days after the appointment of a single Arbitrator or the third Arbitrator, as applicable. The decision of the single Arbitrator shall be final and binding upon the parties. The average of the two closest Arbitrators in a three Arbitrator panel shall be final and binding upon the parties. Each party shall pay the fees and expenses of the Arbitrator appointed by or on behalf of such party and the fees and expenses of the third Arbitrator shall be borne equally by both parties. If the Market Rate is not determined by the first day of the Extension Term, then Tenant shall pay Landlord Base Rent in an amount equal to the Base Rent in effect immediately prior to the Extension Term until such determination is made. After the determination of the Market Rate, the parties shall make any necessary adjustments to such payments made by Tenant. Landlord and Tenant shall then execute an amendment recognizing the Market Rate for the Extension Term.

(b) An "**Arbitrator**" shall be any person appointed by or on behalf of either party or appointed pursuant to the provisions hereof and: (i) shall be (A) a member of the American Institute of Real Estate Appraisers with not less than ten (10) years of experience in the appraisal of improved office and high tech and life sciences laboratory real estate in the greater Boston, Massachusetts metropolitan area, or (B) a licensed commercial real estate broker with not less than ten (10) years experience representing landlords and/or tenants in the leasing of high tech or life sciences space in Cambridge, Massachusetts, (ii) devoting substantially all of their time to professional appraisal or brokerage work, as applicable, at the time of appointment and (iii) be in all respects impartial and disinterested.

28.3 Rights Personal. The Extension Right is personal to Tenant and is not assignable without Landlord's consent, which may be granted or withheld in Landlord's sole discretion separate and apart from any consent by Landlord to an assignment of Tenant's interest in the Lease.

28.4 Exceptions. Notwithstanding anything set forth above to the contrary, at Landlord's option, the Extension Right shall not be in effect and Tenant may not exercise the Extension Right:

(i) during any period of time that Tenant is in Default under any provision of this Lease; or

(ii) if Tenant has been in Default under any provision of this Lease three or more times, whether or not the Defaults are cured, during the 12 month period immediately prior to the date that Tenant intends to exercise the Extension Right, whether or not the Defaults are cured.

28.5 No Extensions. The period of time within which the Extension Right may be exercised shall not be extended or enlarged by reason of Tenant's inability to exercise the Extension Right.

28.6 Termination. The Extension Right shall, at Landlord's option, terminate and be of no further force or effect even after Tenant's due and timely exercise of the Extension Right, if, after such exercise, but prior to the commencement date of the Extension Term, (i) Tenant fails to timely cure any Default by Tenant under this Lease; or (ii) Tenant has Defaulted three or more times during the period from the date of the exercise of the Extension Right to the date of the commencement of the Extension Term, whether or not such Defaults are cured.

ARTICLE 29
RIGHT OF FIRST OFFER

29.1 Tenant's Right of First Offer. After the initial lease-up of the entire Building, Tenant shall have a one-time Right of First Offer to lease any space ("**Offer Space**") in the Building subject to the right of Foundation Medicine after initial lease-up of the Building (and to the extent any space remains vacant after September 1, 2015) and subject to the right of Landlord to extend or renew any then current lease (or enter into a new lease with the same tenant even if no extension or renewal rights are contained in the current lease) and subject to the following terms and conditions:

(a) Landlord shall give notice ("**Offer Notice**") to Tenant of the availability (or anticipated availability) of such space, setting forth the terms and conditions on which Landlord would lease such space to Tenant which terms shall include rent at the Market Rate. The term of the lease for the Offer Space shall be co-terminus with the Term for the Premises provided that there is at least five (5) years of unexpired Term remaining in the Base Term or Extension Term. Otherwise the term pertaining to the Offer Space shall be five (5) years unless a longer term is requested by Tenant. Tenant shall have the right, exercisable by notice to Landlord given on or before the tenth (10 th) Business Day after receipt of the Offer Notice to lease such space on the terms and conditions set forth in the Offer Notice. If Tenant shall not elect to lease such space within the ten (10) Business Day period, Landlord shall be free to lease such space at any time and on any terms and conditions; *provided however*, that if Landlord intends to lease the Offer Space at an amount equal to or less than 95% of the rent offered to Tenant in the Offer Notice or

Landlord fails to lease the Offer Space within the twelve (12) month period following Tenant's failure to elect or election not to lease such Offer Space, Landlord shall again offer the Offer Space to Tenant pursuant to this Article 29 at such lower rent amount. The twelve (12) month deadline shall be extended as necessary if Landlord has commenced negotiations with a prospective tenant but not yet in good faith executed a lease during the twelve (12) month period.

(b) The terms and provisions of Sections 28.3-28.6 shall be incorporated into this Section and pertain to Tenant's option to exercise its Right of First Offer as if originally stated herein.

ARTICLE 30
MISCELLANEOUS

30.1 Notices. All notices or other communications between the parties shall be in writing and shall be deemed duly given upon delivery or refusal to accept delivery by the addressee thereof if delivered in person, or upon actual receipt if delivered by reputable overnight guaranty courier, addressed and sent to the parties at their addresses set forth above. Landlord and Tenant may from time to time by written notice to the other designate another address for receipt of future notices.

30.2 Joint and Several Liability. If and when included within the term "Tenant," as used in this instrument, there is more than one person or entity, each shall be jointly and severally liable for the obligations of Tenant.

30.3 Financial Information. Upon request from Landlord given not more than once in any twelve month period unless a Default shall have occurred and remain outstanding, Tenant shall furnish Landlord with true and complete copies of Tenant's most recent annual financial statements and Tenant's most recent unaudited quarterly financial statements, in form customarily prepared by Tenant. If Tenant becomes a "public company" and its financial information is publicly available, then the foregoing delivery requirements of this Section shall not apply. Such financial information shall be provided subject to the requirement that Landlord agree to: (a) hold in confidence all such financial information and not disclose the financial information to third parties other than Landlord's affiliates, attorneys, lenders and consultants without the prior written consent of Tenant; (b) use the financial information solely in connection with this Lease; (c) treat the financial information with the same degree of care it uses to protect its own but in no event with less than a reasonable degree of care; (d) reproduce the financial information solely to the extent necessary in connection with this Lease, with all such reproductions being considered confidential; and (e) disclose solely to its employees or consultants on a need-to-know basis; *provided, however*, that (i) any such employees and consultants are bound by written obligations of confidentiality at least as restrictive as those set forth in this Lease, and (ii) Landlord remains liable for the compliance of such employees and consultants with such obligations.

Landlord will not have obligations of non-disclosure and non-use with respect to any portion of the financial information that Landlord can demonstrate, by clear and convincing evidence: (a) is generally known to the public at the time of disclosure or becomes generally known through no wrongful act on the part of Landlord; (b) is in Landlord's possession at the time of disclosure other than as a result of Landlord's breach of any legal obligation; (c) becomes

known to Landlord through disclosure by sources other than Tenant having the legal right to disclose such financial information; or (d) is independently developed by Landlord without reference to or reliance upon the financial information as evidenced by written records.

If Landlord is required by a governmental authority or by order of a court of competent jurisdiction to disclose any of the financial information, Landlord will give Tenant prompt written notice thereof and Landlord shall take all reasonable and lawful actions to avoid or minimize the degree of such disclosure. Landlord will reasonably cooperate with Tenant in any efforts to seek a protective order.

30.4 Recordation. Tenant agrees not to record this Lease, but upon request of either party, both parties shall execute and deliver a notice of this Lease in form appropriate for recording or registration, and if this Lease is terminated before the Term expires, an instrument in such form acknowledging the date of termination.

30.5 Interpretation. The normal rule of construction to the effect that any ambiguities are to be resolved against the drafting party shall not be employed in the interpretation of this Lease or any exhibits or amendments hereto. Words of any gender used in this Lease shall be held and construed to include any other gender, and words in the singular number shall be held to include the plural, unless the context otherwise requires. The captions inserted in this Lease are for convenience only and in no way define, limit or otherwise describe the scope or intent of this Lease, or any provision hereof, or in any way affect the interpretation of this Lease.

30.6 Not Binding Until Executed. The submission by Landlord to Tenant of this Lease shall have no binding force or effect, shall not constitute an option for the leasing of the Premises, nor confer any right or impose any obligations upon either party until execution of this Lease by both parties.

30.7 Limitations on Interest. It is expressly the intent of Landlord and Tenant at all times to comply with applicable law governing the maximum rate or amount of any interest payable on or in connection with this Lease. If applicable law is ever judicially interpreted so as to render usurious any interest called for under this Lease, or contracted for, charged, taken, reserved, or received with respect to this Lease, then it is Landlord's and Tenant's express intent that all excess amounts theretofore collected by Landlord be credited on the applicable obligation (or, if the obligation has been or would thereby be paid in full, refunded to Tenant), and the provisions of this Lease immediately shall be deemed reformed and the amounts thereafter collectible hereunder reduced, without the necessity of the execution of any new document, so as to comply with the applicable law, but so as to permit the recovery of the fullest amount otherwise called for hereunder.

30.8 Choice of Law. Construction and interpretation of this Lease shall be governed by the internal laws of the state in which the Premises are located, excluding any principles of conflicts of laws.

30.9 Time. Time is of the essence as to the performance of Tenant's obligations under this Lease.

30.10 OFAC. Tenant, and all beneficial owners of Tenant, are currently (a) in compliance with and shall at all times during the Term of this Lease remain in compliance with the regulations of the Office of Foreign Assets Control ("**OFAC**") of the U.S. Department of Treasury and any statute, executive order, or regulation relating thereto (collectively, the "**OFAC Rules**"), (b) not listed on, and shall not during the term of this Lease be listed on, the Specially Designated Nationals and Blocked Persons List maintained by OFAC and/or on any other similar list maintained by OFAC or other governmental authority pursuant to any authorizing statute, executive order, or regulation, and (c) not a person or entity with whom a U.S. person is prohibited from conducting business under the OFAC Rules.

30.11 Incorporation by Reference. All exhibits and addenda attached hereto are hereby incorporated into this Lease and made a part hereof. If there is any conflict between such exhibits or addenda and the terms of this Lease, such exhibits or addenda shall control.

30.12 Entire Agreement. This Lease, including the exhibits attached hereto, constitutes the entire agreement between Landlord and Tenant pertaining to the subject matter hereof and supersedes all prior and contemporaneous agreements, understandings, letters of intent, negotiations and discussions, whether oral or written, of the parties, and there are no warranties, representations or other agreements, express or implied, made to either party by the other party in connection with the subject matter hereof except as specifically set forth herein.

30.13 No Accord and Satisfaction. No payment by Tenant or receipt by Landlord of a lesser amount than the monthly installment of Base Rent or any Additional Rent will be other than on account of the earliest stipulated Base Rent and Additional Rent, nor will any endorsement or statement on any check or letter accompanying a check for payment of any Base Rent or Additional Rent be an accord and satisfaction. Landlord may accept such check or payment without prejudice to Landlord's right to recover the balance of such Rent or to pursue any other remedy provided in this Lease.

30.14 Hazardous Activities. Notwithstanding any other provision of this Lease, Landlord, for itself and its employees, agents and contractors, reserves the right to refuse to perform any repairs or services in any portion of the Premises which, pursuant to Tenant's routine safety guidelines, practices or custom or prudent industry practices, require any form of protective clothing or equipment other than safety glasses. In any such case, Tenant shall contract with parties who are acceptable to Landlord, in Landlord's reasonable discretion, for all such repairs and services, and Landlord shall, to the extent required, equitably adjust Tenant's Share of Operating Expenses in respect of such repairs or services to reflect that Landlord is not providing such repairs or services to Tenant.

30.15 REIT/UBTI. The Landlord and the Tenant hereby agree that it is their intent that all minimum rent and all other additional rent and any other rent and charges payable to the Landlord under this lease (hereinafter individually and collectively referred to in this Section as " **Rent**") shall qualify as "rents from real property" within the meaning of Sections 512(b)(3) and 856(d) of the Internal Revenue Code of 1986, as amended, (the " **Code**") and the U.S. Department of the Treasury Regulations promulgated thereunder (the "**Regulations**"). In the event that (i) the Code or the Regulations, or interpretations thereof by the Internal Revenue Service contained in revenue rulings or other similar public pronouncements, shall be changed so that any Rent no longer so

qualifies as "rent from real property" for purposes of either said Section 512(b)(3) or Section 856(d) or (ii) the Landlord, in its sole discretion, determines that there is any risk that all or part of any Rent shall not qualify as "rents from real property" for the purposes of either said Sections 512(b)(3) or 856(d), such Rent shall be adjusted in such manner as the Landlord may require so that it will so qualify; provided, however, that any adjustments required pursuant to this Section shall be made so as to produce the equivalent (in economic terms) Rent as payable prior to such adjustment and shall not materially adversely affect the operations of Tenant in the Premises. The parties agree to execute such further commercially reasonable instrument as may reasonably be required by the Landlord in order to give effect to the foregoing provisions of this Section.

30.16 Quiet Enjoyment. So long as Tenant is not in Default under this Lease, Tenant shall, subject to the terms of this Lease, at all times during the Term, have peaceful and quiet enjoyment of the Premises against any person claiming by, through or under Landlord.

30.17 Prorations. All prorations required or permitted to be made hereunder shall be made on the basis of a 360 day year and 30 day months.

30.18 Rules and Regulations. Tenant shall, at all times during the Term and any extension thereof, comply with all reasonable rules and regulations at any time or from time to time established by Landlord covering use of the Premises and the Project. The current rules and regulations are attached hereto as **Exhibit J**. If there is any conflict between said rules and regulations and other provisions of this Lease, the terms and provisions of this Lease shall control. Furthermore, during the performance of Tenant's Work, if there is any conflict between said rules and regulations and the Tenant Design and Construction Guidelines attached hereto as **Exhibit H**, the terms and provisions of the Tenant Design and Construction Guidelines shall control. Landlord shall not have any liability or obligation for the breach of any rules or regulations by other tenants in the Project and shall not enforce such rules and regulations in a discriminatory manner.

30.19 Security. Landlord and Tenant acknowledge and agree that security devices and services, if any, while intended to deter crime may not in given instances prevent theft or other criminal acts and that Landlord is not providing any security services with respect to the Premises and that Tenant is not providing any security services with respect to areas outside of the Premises. Tenant agrees that, except to the extent caused by the negligence or willful misconduct of Landlord or any Landlord Party, Landlord shall not be liable to Tenant for, and Tenant waives any claim against Landlord with respect to, any loss by theft or any other damage suffered or incurred by Tenant in connection with any unauthorized entry into the Premises or any other breach of security with respect to the Premises. Tenant shall be entitled to install and maintain security devices and services as it deems appropriate within the Premises, and Landlord acknowledges that the scope of such security devices and services may include surveillance and monitoring of areas outside of the Premises provide that such devices do not affect the rights and use and enjoyment of other tenants in the Building. Tenant shall be solely responsible for the personal safety of Tenant's officers, employees, agents, contractors, guests and invitees while any such person is in, on or about the Premises and/or the Project. Tenant shall at Tenant's cost obtain insurance coverage to the extent Tenant desires protection against such criminal acts.

30.20 Force Majeure. Neither party shall be responsible or liable for delays in the performance of its obligations hereunder (other than monetary obligations) when caused by, related to, or arising out of acts of God, sinkholes or subsidence, strikes, lockouts, or other labor disputes, embargoes, quarantines, weather, national, regional, or local disasters, calamities, or catastrophes, inability to obtain labor or materials (or reasonable substitutes therefor) at reasonable costs or failure of, or inability to obtain, utilities necessary for performance, governmental restrictions, orders, limitations, regulations, or controls, national emergencies, delay in issuance or revocation of permits, enemy or hostile governmental action, terrorism, insurrection, riots, civil disturbance or commotion, fire or other casualty, and other causes or events beyond the reasonable control of such party (" **Force Majeure**").

30.21 Brokers. Landlord and Tenant each represents and warrants that it has not dealt with any broker, agent or other person in connection with this transaction and that no broker brought about this transaction, other than the Brokers listed in Section 1.1 hereof. Landlord and Tenant each hereby agree to indemnify and hold the other harmless from and against any claims by any broker, other than the Brokers named in Section 1.1, claiming a commission or other form of compensation by virtue of having dealt with Tenant or Landlord, as applicable, with regard to this leasing transaction. Landlord will be responsible to pay the commissions due to the named Brokers pursuant to a separate agreement.

30.22 Severability. If any clause or provision of this Lease is illegal, invalid or unenforceable under present or future laws, then and in that event, it is the intention of the parties hereto that the remainder of this Lease shall not be affected thereby. It is also the intention of the parties to this Lease that in lieu of each clause or provision of this Lease that is illegal, invalid or unenforceable, there be added, as a part of this Lease, a clause or provision as similar in effect to such illegal, invalid or unenforceable clause or provision as shall be legal, valid and enforceable.

[Signatures on next page]

IN WITNESS WHEREOF, Landlord and Tenant have executed this Lease as of the day and year first above written.

TENANT:

BLUEBIRD BIO, INC.,
a Delaware corporation

By: /s/ Nick Leschly
Name: Nick Leschly
Title: Chief Executive Officer

LANDLORD:

150 SECOND STREET, LLC,
a Delaware limited liability company

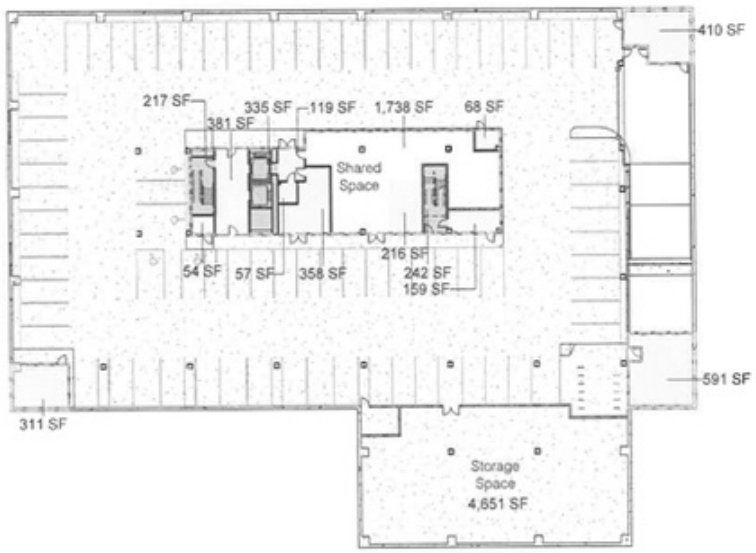
By: /s/ Shawn Hurley
Shawn Hurley, Manager

By: /s/ Mats Johansson
Mats Johansson, Manager

EXHIBIT A TO LEASE

PLAN OF PREMISES, STORAGE SPACES AND SHARED SPACES

(Attached)



- Gross Building Area (GBA) 5,707 SF
- Gross Measured Area (GMA) 5,256 SF
- Building Common Area (BCA)
- Major Vertical Penetrations
- Shared Space 1,738 SF
- Storage Space 4,651 SF
- Parking 34,047 SF

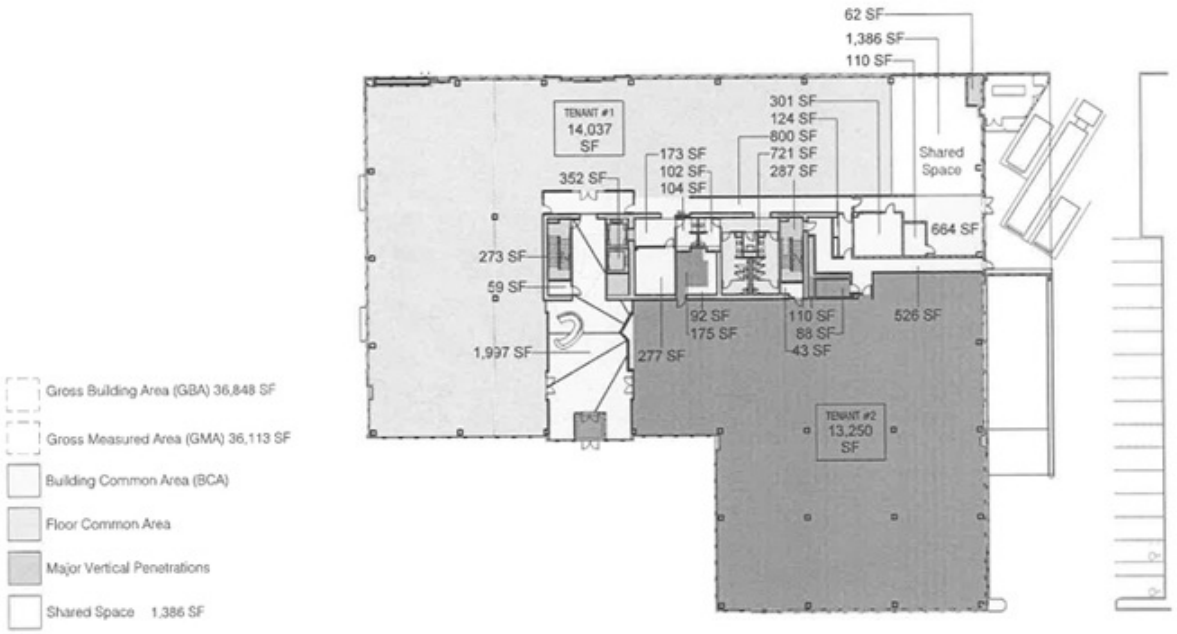
150 Second Street
Cambridge, Massachusetts

BASEMENT FLOOR PER 05/31/11 CONSTRUCTION DOCUMENTS
08/31/12

1/32" = 1'-0"

SKANSKA

ELKUS | MANFREDI ARCHITECTS



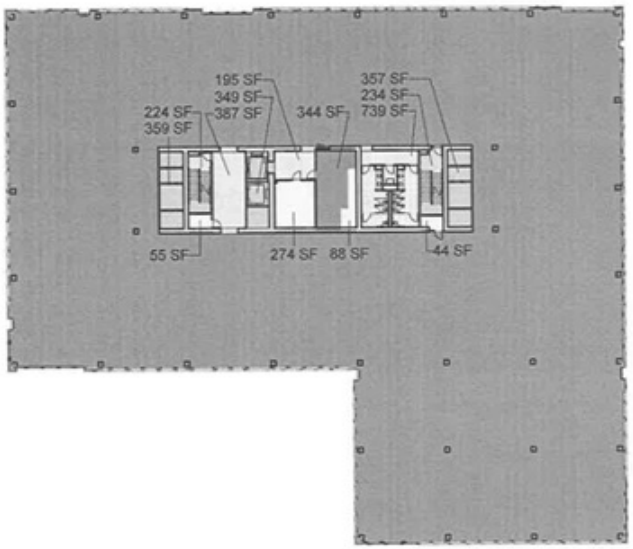
150 Second Street
Cambridge, Massachusetts

FIRST FLOOR PER 05/31/11 CONSTRUCTION DOCUMENTS - TWO TENANTS
08/31/12

1/32" = 1'-0"

SKANSKA

ELKUS | MANFREDI ARCHITECTS



Gross Building Area (GBA) 36,822 SF

Gross Measured Area (GMA) 36,081 SF

Building Common Area (BCA)

Floor Common Area

Major Vertical Penetrations

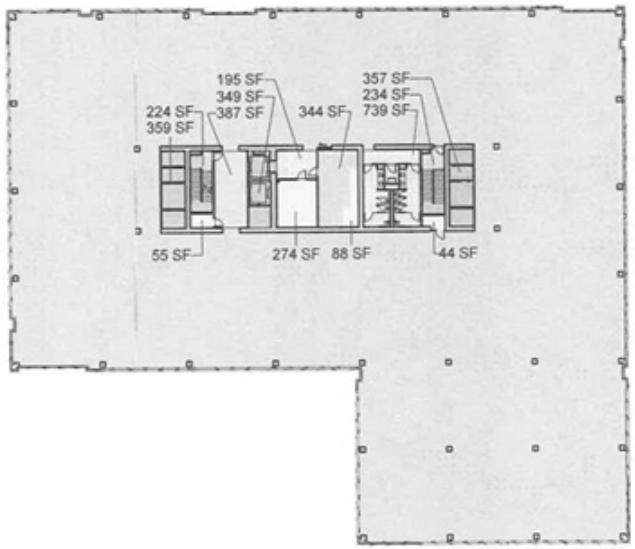
150 Second Street
Cambridge, Massachusetts

SECOND FLOOR PER 05/31/11 CONSTRUCTION DOCUMENTS - ONE TENANT
08/31/12

1/32" = 1'-0"

SKANSKA

ELKUS | MANFREDI



- Gross Building Area (GBA) 36,822 SF
- Gross Measured Area (GMA) 36,081 SF
- Building Common Area (BCA)
- Floor Common Area
- Major Vertical Penetrations
- Tenant #1 32,776 SF

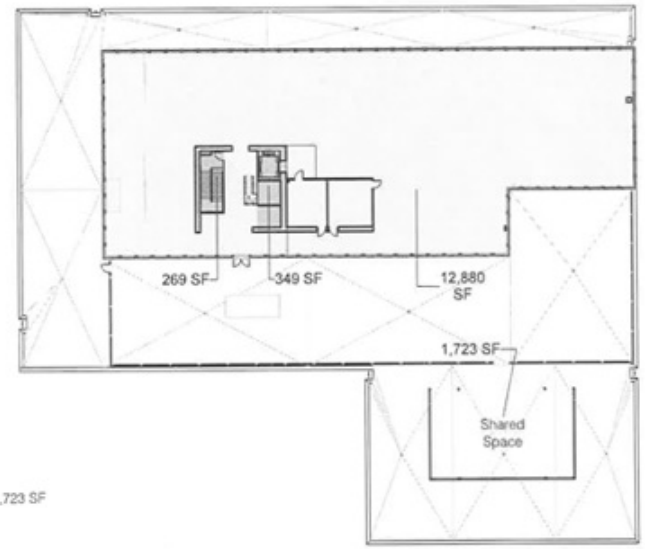
150 Second Street
Cambridge, Massachusetts

THIRD FLOOR PER 05/31/11 CONSTRUCTION DOCUMENTS - ONE TENANT
08/31/12

1/32" = 1'-0"

SKANSKA

ELKUS | MANFREDI



- Gross Building Area (GBA) 14,078 SF
- Gross Measured Area (GMA) 13,498 SF
- Building Common Area (BCA)
- Major Vertical Penetrations
- Shared Space / Tenant Penthouse Screen Area 1,723 SF

150 Second Street
Cambridge, Massachusetts

PENTHOUSE FER 05/31/11 CONSTRUCTION DOCUMENTS
08/31/12

1/32" = 1'-0"

SKANSKA

ELKUS | MANFREDI ARCHITECTS

EXHIBIT B TO LEASE

DESCRIPTION OF PROJECT

That certain parcel of land with the buildings thereon situated in Cambridge, Middlesex County, Massachusetts being bounded and described as follows:

65 Bent Street, Cambridge, Massachusetts

WESTERLY	on Second Street, two hundred (200) feet;
NORTHERLY	on Charles Street, three hundred (300) feet;
EASTERLY	on land of owners unknown, two hundred (200) feet;
SOUTHERLY	on Bent Street, three hundred (300) feet.

Containing 60,000 square feet of land, any or all of said measurements being more or less.

Subject to that certain Ground Lease dated November 12, 2010 by and between Bent Associates Limited Partnership, a Massachusetts limited partnership, as ground lessor, and 150 Second Street, LLC, a Delaware limited liability company, as ground lessee, notice of which Ground Lease is recorded with the Middlesex County South District Registry of Deeds in Book 55812, Page 1.

Being the same premises conveyed by Quitclaim Deed dated December 26, 1985 and recorded with said Deeds in Book 16676, Page 105.

EXHIBIT C TO LEASE

ACKNOWLEDGMENT OF LEASE COMMENCEMENT DATE

This **ACKNOWLEDGMENT OF LEASE COMMENCEMENT DATE** is made this _____ day of _____, _____, between **150 SECOND STREET, LLC**, a Delaware limited liability company ("**Landlord**"), and _____, a _____ corporation ("**Tenant**"), and is attached to and made a part of the Lease dated _____, _____ (the "**Lease**"), by and between Landlord and Tenant. Any initially capitalized terms used but not defined herein shall have the meanings given them in the Lease.

Landlord and Tenant hereby acknowledge and agree, for all purposes of the Lease, that the Lease Commencement Date of the Base Term of the Lease is _____, _____ and the termination date of the Base Term of the Lease shall be midnight on _____, _____. The Rent Commencement Date is _____, _____. In case of a conflict between the terms of the Lease and the terms of this Acknowledgment of Commencement Date, this Acknowledgment of Lease Commencement Date shall control for all purposes.

IN WITNESS WHEREOF, Landlord and Tenant have executed this Acknowledgment of Lease Commencement Date to be effective on the date first above written.

TENANT:

_____,
a _____ corporation

By: _____
Its: _____

LANDLORD:

150 SECOND STREET, LLC,
a Delaware limited liability company

By: _____
Name: _____
Title: _____

EXHIBIT D TO LEASE

RENT CERTIFICATE

150 Second Street, LLC
c/o Skanska USA Commercial Development Inc.
253 Summer Street
Boston, MA 02210

Re: Lease dated as of _____ by and between Rivertech Associates II, LLC ("Landlord"), and Bluebird Bio, Inc. ("Tenant"), pertaining to the _____ floor consisting of _____ rentable square feet of the building (collectively, the "Premises") located at 840 Memorial Drive, Cambridge, Massachusetts ("Lease").

The undersigned hereby certifies, represents and warrants to 150 Second Street, LLC and its successors, assigns, affiliates and lenders (together, the "New Landlord"), as follows and acknowledges that this certification, representation and warranty are being relied upon by the New Landlord in connection with provisions of Section 4.2 of the Lease Agreement dated as of _____, 2013 by and between New Landlord and Tenant pertaining to certain premises located at 150 Second Street, Cambridge, Massachusetts:

1. Tenant has previously delivered a true, accurate and complete copy of the Lease to the New Landlord and there have been no amendments, modifications, side letters or other agreements relating to the Lease since such delivery. The Lease is in full force and effect.

2. The term of the Lease expires on _____.

3. Tenant has paid to Landlord the monthly fixed rent of $_____ and monthly additional rent for operating costs and taxes of $ _____ due under the Lease through the period ended _____, 20__.

6. Tenant is not entitled to, and has made no agreement(s) with Landlord concerning, free rent, partial rent, rebate of rent payments, credit or offset or deduction in rent, or any other type of rental concession, including, without limitation, lease support payments, lease buy-outs, or rental concessions pertaining to any unfunded tenant improvement allowance.

7. Tenant has neither assigned its interest under the Lease, by operation of law or otherwise, nor entered into any sublease, concession agreement or license pertaining to the Premises or any portion thereof.

8. Tenant has no option to reduce the Premises or no right to terminate the Lease prior to the stated expiration date other than as specifically set forth in the Lease with respect to casualty and condemnation. The Landlord has no right to recapture any portion of the Premises prior to the stated expiration date other than as specifically set forth in the Lease with respect to casualty and condemnation.

9. [**If a Memorial Drive Rent Savings Event has occurred, in lieu of Sections 4, 5 or 6 above, as the case may be, insert in substantially the following form** : Tenant has entered into a sublease pertaining to the Premises. The monthly base rent and escalations due to Landlord is $ _____ for the period ended _____. The documented out of pocket transaction costs to Tenant in connection with the sublease is $ _____. The rent payable under the sublease is $_____ for the period ended _____.

Or in the alternative, as the case may be: Tenant's rent obligations under the Lease have terminated or been reduced by virtue of _____ (for example, lease termination agreement). The aggregate amount of rent savings under the Lease through the original expiration date of the term of the Lease is $_____. The documented out of pocket transaction costs to Tenant in connection with the (lease termination agreement) is $ _____.]

Executed under seal as of the _____ day of _____, 20 __.

BLUEBIRD BIO, INC.,
a Delaware corporation

By: _____
Name: _____
Title: _____

EXHIBIT E TO LEASE

BASE BUILDING SPECIFICATIONS

Base-Building Core & Shell Definition
150 Second Street – Cambridge, MA

1. GENERAL

Landlord is to deliver building for Use Group B and S-2, using Type I-B Construction in accordance with 780 CMR Massachusetts State Building Code – 8th Edition.

A. Basement Level – 12'-2" Floor-to-floor height.

B. Ground Floor – 14'-8" Floor-to-floor height.

C. Second Floor – 14'-8" Floor-to-floor height.

D. Third Floor – 14'-8" Floor-to-floor height.

E. Total area is approximately 123,210 RSF subject to final measurement.

F. Structure designed to accommodate finish ceiling height of 9'-4" AFF.

G. Slab to underside of beam dimension is 11' typical with ability for utilities to be run though open webbed joists.

H. General column spacing is 32' x 45'.

I. Building/Core and Shell Project designed to achieve LEED Gold Certification (NC).

2. FOUNDATIONS AND SLAB-ON-GRADE

A. Foundations consist of spread footings with a perimeter foundation wall. Basement slab consists of 5" reinforced concrete slab-on-grade.

B. All foundation, slab-on-grade, and slabs-on-deck concrete will be controlled and tested in accordance with applicable building codes and standards. Concrete compressive strengths will be as required to meet structural requirements, but no less than 4,000 psi.

C. Concrete reinforcing steel conforms to ASTM 615.

D. Welded wire mesh conforms to ASTM 185.

E. Slab-on-grade designed for a 100 psf live load.

3. STRUCTURE

A. The structure has been designed with the following live loads:

1. Wind and seismic loads in accordance with State Building Code.
2. Tenant area floors – 100 psf.
3. Mechanical equipment rooms – 150 psf
4. Penthouse Roof –20 psf Minimum Live Load and in accordance with governing building codes, plus allowances for specific snow drifting and equipment loads.

B. The structure consists of an internally-braced steel frame supporting composite 3" metal deck with 4 1/2 " NW concrete fill at tenant floors, reinforced with 6 x 6 W.W.F.

C. All steel is ASTM A36, A572 grade 50, A992 grade 50, A500 grade B, or as required. All shop and field-welded connections are welded in accordance with AWS standards. Bolted field connections have been made with ¾" diameter A325 high-strength bolts, minimum.

D. Floor deck at tenant floors consists of minimum 18 gauge steel or as engineered. All metal deck will conform to the Steel Deck Institute's Code of Recommended Standard Practice.

E. Composite steel floor deck concrete cover at floors have a minimum compressive strength of 4,000 psi and reinforced with welded wire mesh.

F. Structure is fireproofed where required by the Commonwealth of Massachusetts Building Code.

G. Fire exit stairs are standard steel pan stair assemblies with painted steel handrails and concrete treads.

H. Miscellaneous iron items (elevator sill angles, ladders, railings, access platforms, stairs for accessing all equipment in compliance with OSHA and applicable codes, loose lintels, expansion plates, toilet partition support frames, etc.) are provided as needed.

4. ROOFING AND WATERPROOFING

A. Roofing system is a loose-laid, mechanically-fastened or fully adhered, single-ply membrane, TPO type similar to Carlisle.

B. Roof insulation is extruded polystyrene board similar to Styrofoam by Dow, conforming to requirements of the Massachusetts State Energy Code and is acceptable for use with the roofing membrane specified.

C. Roof accessories such as bonding adhesive, splicing cement, lap sealant, tape, water cut-off mastic, etc., are compatible with the roofing membrane specified. Typical roof penetrations are flashed with material matching the roof system.

D. Metal flashing has been provided and a perimeter coping/gravel stop is anodized extruded or painted brake-formed aluminum.

E. Elevator pits are waterproofed as required.

F. Compatible roof walkway pads by the roofing manufacturer have been provided for base building equipment access and servicing.

G. Base building includes a prescribed method for exterior window. Equipment to be provided by property management personnel.

5. EXTERIOR WALLS

A. The Building is clad with a combination of cementitious fiberboard, strip windows, curtain wall and composite metal panels. All glass is new energy efficient "low E" glass.

B. Entrance doors are aluminum storefront doors. BOH doors are painted hollow metal.

C. Loading dock exterior doors are electronically operated, high-cycle aluminum doors by Rytec or similar.

6. INTERIOR FINISHES

A. Main entrance floor finish is terrazzo flooring. Lobby walls are finished with a combination of wood paneling/glass/resin synthetic panel feature wall and painted drywall and ceilings.

B. Core Toilet floors are ceramic tile or similar. Marble thresholds are provided at door openings where ceramic tile abuts other floor finishes. All toilet room wet walls are covered with ceramic tile or similar up to ceiling. Paint is provided for the remaining walls. Toilet ceilings are acoustical tegular tile suspended ceilings with an exposed suspension grid, or drywall. Lavatory counters are polished granite or similar with under mounted sinks. All toilet spaces throughout the building are of the same color and level of finish. Automatic flushometers and touchless faucets have been installed on all lavoratories, water closets, and urinals.

C. Door frames are hollow metal (cold-formed steel). Solid core, wood veneer doors are provided for common area amenities such as toilet rooms. Painted hollow metal doors are provided for Base Building service areas. All doors and hardware comply with regulations of the Massachusetts Architectural Access Board and The Americans with Disabilities Act.

D. Landlord has provided the Base Building mechanical rooms, electrical rooms, telephone/data riser closets and janitorial closets in core area on typical floors and ground floor.

E. Inside face of typical exterior walls consists of the back of the façade cladding system with insulation, fireproofed as required by code.

F. Lobby and Base Building interior lighting consists of architecturally specified efficient lighting.

G. Typical stair finishes include concrete floors and treads, painted steel risers and rails, primed and painted drywall surfaces.

7. SPECIALTIES & EQUIPMENT

A. Building Directory's will be provided by Base Building. Base Building will specify and install signage required by code, including City of Cambridge Inspectional Services and Fire Dept. for Base Building portion of construction.

B. Metal toilet partitions are steel panels with brushed stainless steel finish, and floor-mounted.

C. Toilet room accessories, brushed stainless steel, Bobrick Co., or equal: recessed paper towel dispenser; toilet paper holders; soap dispensers; grab bars.

8. VERTICAL TRANSPORTATION

A. Two (2) gearless, standard elevators based on the following quantities, speeds and capacity: One (1) 3,500 #, 200fpm passenger elevator serving Basement through 3rd floors and One (1) 4,000, 200fpm, double-sided combination service / passenger elevator serving Basement through penthouse floors. Interior cab finishes are similar in quality and context to ground floor lobby.

9. PLUMBING

A. Domestic water system supplied by dual metered service from public water mains. Piping is type "L" copper. Two (2) *125* gallon, gas-fired domestic water heaters are provide re-circulating hot water to accommodate core toilet rooms and tempered water risers.

B. Stormwater is reclaimed from a portion of the roof; collected in an underground storage tank and reused for toilet and urinal flushing to supplement potable water requirement. Overflow from tank and the remainder of the roof discharges to a storm infiltration system.

C. Low pressure gas service provided to all base building equipment. Gas riser is sized with additional capacity to supply tenant provided generators.

D. Typical toilet rooms on floors 1-3 have fixture count as required by code. All water closets and urinals are wall hung to facilitate floor cleaning. All fixtures are "low-flow" type, *hands-free*. Lavatory sinks are under mounted and have metered and motion sensor operated faucet controls with hot water flow restrictors.

E. Showers are provided on the first floor.

F. Non-potable cold water risers are provided to supply non-potable connection at each floor.

G. Clear water waste receivers aree provided at each floor to accept RO reject water, condensate and similar clean water. This water can also be collected in the above-mentioned tank for reuse.

10. FIRE PROTECTION SYSTEM

A. Fire protection is fed from a 6" service from the public water main. An in-line, vertical fire pump feeds two (2) 6" combined standpipes, to provide pressure for the sprinkler system.

B. Hose connections for Fire Department use will be provided as required by code for base building only. Piping will be black steel pipe schedule 10 for pipe 2 1/2" and larger and schedule 40 for pipe 2" and smaller. All piping, valves and equipment is UL-Listed and labeled. Tamper switches are provided on all control valves.

C. Automatic sprinkler system is supplied from the combination sprinkler/standpipe risers in each stair. The sprinkler systems on each floor is connected to the riser in each stair. All occupied space in the building is fully sprinklered using upright sprinkler heads, at a density in accordance with code. Sprinkler coverage is designed for light hazard protection in core and common areas, ordinary hazard group 1 protection in mechanical and storage areas, and up to ordinary hazard group 2 in tenant lab areas.

11. HEATING, VENTILATING AND AIR CONDITIONING

A. The cooling system includes a chilled water plan consisting of three (3) 300-ton water-cooled centrifugal chillers, associated pumps, and distribution to two (2) custom manufactured variable volume air handling units with a nominal capacity of 82,000CFM. Heat is rejected to the atmosphere by two (2) 625-ton cooling towers equipped with whisper quiet fans.

B. Heating is provided by hot water risers fed from four (4) 2,700-MBH gas-fired, condensing boilers. Valved branch lines on the hot water risers is provided to each floor for tenant use.

C. Laboratory exhaust is provided by two (2) 82,000 CFM variable volume exhaust air handlers with energy recovery systems to transfer heat from the exhaust to the outside air entering the building.

D. Space is provided for additional tenant dedicated air handlers, exhaust air handlers, cooling towers, boilers and chillers.

E. Tenant supplemental cooling capacity is provided by secondary condenser water risers connected to the building's cooling towers by 140 ton plate and frame heat exchanger providing approximately 45 tons of cooling to each floor.

F. Garage exhaust is equipped with a total capacity of 20,600CFM exhaust control with carbon monoxide sensors and VFD control.

G. The Building Automation System is equipped with Direct Digital Control (DDC). The DDC system incorporates a complete graphics interface package to monitor and control all HVAC systems. The system is expandable to include all tenant systems and equipment.

H. One 660 gallon double wall fuel storage tank is provided to feed the life-safety emergency generator in the mechanical penthouse.

G. Toilet areas have exhaust air systems maintaining an exhaust rate of 75CFM/fixture.

H. Base building provides infrastructure for approximately 75 degrees Fahrenheit, dry bulb at 55% relative humidity during the cooling season and approximately 70 degrees Fahrenheit during the heating season; both based on ASHRAE design conditions of the City of Boston.

OUTDOOR DESIGN CONDITIONS (ASHRAE 1%)

A. Summer: 91 F dry bulb
88 degrees Farhrenheit dry bulb, 73 degree Farhrenheit wet bulb

B. Winter: 6 degrees Fahrenheit Dry Bulb

INDOOR DESIGN CONDITIONS

A. Summer: 74 F dry bulb 50 % RH
B. Winter: 72 F dry bulb 20% RH

VENTILATION

Minimum Outside Air: In accordance with the Massachusetts State Building Code, 8th Edition

Anticipated occupancy:	7 people per 1000sf for office 50 people per 1000sf for conference room
Ventilation Rate:	1.7 CFM/sq ft

INTERNAL HEAT GAIN

Occupants:	108sf/person (useable sf)
Lighting	1.0 watts/useable sf
Power	7 watts/useable sf

G. Outside air for ventilation is provided by four ventilation riser ducts stubbed into 1 location on each floor in accordance with current codes and ASHRAE standards. Ventilation and exhaust airflows for Tenant needs shall be designed by Tenant designers. Available floor exterior static pressure allowance shall be 0.75”wc.

I. Base Building mechanical equipment is provided with necessary acoustical vibration isolation as recommended by an independent acoustical consultant to achieve a Sound Transmission Class in accordance with code.

12. ELECTRICAL

A. Base building service is a metered 3,000-amp 277/480V 3-phase, 4 wire electric service

B. Each tenant floor is served by a separately unmetered 800-amp 277/480V 3-phase, 4 wire electric service capable of providing 12w/sf of tenant floor power

C. Spare capacity is provided at the building switchgear for additional electric service as required.

D. A 250 KW, diesel engine generator to accommodate base building life safety requirements is provided.

E. One telephone/data closet per floor is provided in base building for tenant installed risers and distribution cabling, consisting of three (3) riser sleeves at 5” each

F. A fully addressable code compliant fire alarm system is installed with sufficient power supplies and infrastructure capacity at the head end for the future tenant tie-in. The tenant is responsible for electronic release devices and locking mechanisms at stair tower egress doors if the tenant intends to use stairwells for inter-floor travel. The tenant is to supply, install and coordinate all fire alarm notification and initiating devices within the tenant space connected to base building systems. Base Building egress stairwell doors will be passage type, unlocked.

G. Fire alarm system includes a City of Cambridge Master Box, all front end equipment, common area ADA notification and alarm initiating devices, elevator

recall, and terminal boxes on each floor for connection of tenant fire alarm and notification devices to the base building system. The fire alarm terminal cabinets shall be located in the electrical closets.

H. Base building security system provides building perimeter security with card readers and CATV. Tenant security system is to be designed by the tenant for its specific needs. Tenant will be responsible for system design, distribution wiring and installing all the cameras, access control, and related appurtenances as part of TI.

—END—

EXHIBIT F TO LEASE

LANDLORD TENANT MATRIX

Skanska Commercial Development Inc

150 Second Street

5.15.13

Allocation of Responsibility Between Landlord and Tenant Work

ELEMENT	DESCRIPTION	BASE BUILDING WORK	TENANT WORK
SITE IMPROVEMENTS:	Entrance Plaza, perimeter sidewalks, street trees, street lights and furniture in accordance with the Approved Project.	**X**	
	Telephone conduit from outside building into basement floor telephone room.	**X**	
	Cable/Data conduit from outside building into basement telephone room	**X**	
	Electrical Service to building	**X**	
	Gas Service to building for base building and tenant systems	**X**	
	Domestic sanitary sewer connection to street	**X**	
	Lab waste sanitary sewer connection from tenant pH room in basement floor to building drain.	**X**	
	Domestic and fire protection water service to building.	**X**	

CODE COMPLIANCE:	Building construction in accordance with requirements of Massachusetts State Building Code, 8th edition (as amended, restated, or superseded as applicable)	**X**	**X**
STRUCTURE:	Floor systems capable of supporting a live / partition load of 100 lbs. psf on all floors	**X**	
	14’8” Floor to floor heights, 12’ floor to floor height in B1	**X**	
	Floor construction to accommodate 100lbs/sf on floors 1 through 3. Penthouse floor construction to accommodate 150lbs/sf	**X**	
	Structural modifications to increase floor live load capacity		**X**
	Structural modifications to accommodate tenant specific openings including but not limited to shafts, risers, and interconnecting stairs		**X**
	Framed openings for base building supply air and tenant exhaust shafts	**X**	
	All catwalks and dunnage required to support and enable access to Base Building mechanical equipment.	**X**	
	All structural modifications, dunnage, catwalks and other requirements necessary to support and enable access to Tenant equipment in Penthouse		**X**

	Miscellaneous metal items such as brackets or supports and concrete housekeeping pads required for tenant supplied equipment		**X**
	Structural assemblies requiring fire-proofing to be sprayed with cementitious fireproofing system	**X**	**X**
BUILDING ENVELOPE:	Environmentally responsible sustainable building design that achieves LEED Gold Certification.	**X**	
	Facade of aluminum and glass window wall, cementitious rain screen and metal panels, with thermally insulated glass including light-gauge metal stud back-up with insulation where required	**X**	
	Overhead coiling doors at loading dock and at parking garage entry	**X**	
	Acoustic roof screen to conceal tenant exhaust fans and standby generators	**X**	
	Architecturally integrated, enclosed mechanical penthouse with space for tenant mechanical equipment.	**X**	
	Any modifications to façade, penthouse or screen wall system necessary to accommodate tenant requirements, provided that any such modifications must be approved by Landlord.		**X**
ROOFING:	TPO system with walking pads to all base building mechanical equipment.	**X**	

	Roofing penetrations for tenant equipment or systems, to be made in accordance with roofing manufacturer's details and warranty requirements		**X**
	Walking pads to tenant special mechanical equipment.		**X**
COMMON AREAS:	Entrance lobby with finishes that include stone, tile & carpet flooring, wood or stone wall accents, drywall and suspended ceilings and appropriate accent lighting.	**X**	
	Finished egress stairways and corridors as required for occupant circulation and emergency egress	**X**	
	Men's and Women's shower rooms located near first floor bathrooms	**X**	
	Exterior loading area with two truck bays with access and space for one rubbish dumpster	**X**	
	Loading Dock Lift (if required)		**X**
	Ground floor recycling room	**X**	
	Basement level parking area	**X**	
	Bike racks located in basement	**X**	
	Finished basement floor main electrical service rooms, water and fire pump room	**X**	
	Finished toilet rooms, janitor closets, telephone and electric closets, and egress stairways serving each floor.	**X**	

	Construction of code-required corridor system on each floor, including door packages, ready for Tenant finish if tenant occupies entire floor.		**X**
	Construction of and finish for common corridors and elevator lobbies on multi-tenant floors.	**X**	
	Rooftop mechanical penthouse and screened roof area for base building mechanical equipment. Rooftop expansion space allocated for tenant mechanical equipment in designated locations within the screen wall.	**X**	
	Doors and frames at common areas: hollow metal frames; hollow metal doors at service areas, solid core wood doors at other areas, and lever hardware	**X**	
	Doors, frames, and hardware to tenant areas		**X**
ELEVATORS	One gearless passenger elevator with 3,500 lb. capacity	**X**	
	One gearless combination freight/passenger elevator with 4,000lb capacity	**X**	
	Dedicated shaft way for third elevator	**X**	
	Third Elevator if required		**X**
WINDOW TREATMENT:	Supply and installation of building standard blinds for all windows		**X**
	Modifications to window wall system approved by Landlord		**X**

	Signage, lighting and other brand identity treatments approved by Landlord		**X**
TENANT AREAS:	Construction of and finishes for corridors and elevator lobbies for single tenanted floors		**X**
	Light gauge framing, insulation & vapor barrier on inside face of exterior walls.	**X**	
	Interior wall furring and sills (if applicable) and drywall finish at perimeter walls.		**X**
	Interior drywall soffit at perimeter of building with blocking for building standard window treatments.		**X**
	Partitions, ceilings, flooring, painting, doors, millwork and all related finishes for office and laboratory build out within Tenant premises		**X**
HVAC:	Processed condenser water system capable of providing 45 Tons per floor at 2.4 GMP per Ton per Floor	**X**	
	(2) Condenser Water Supply and Return Distribution Risers connected to a plate/frame heat exchanger with 2- 1/2" valves capped on floors 1 through 3 for tenant distribution and 1 1/2" valves capped in the basement on the east side of the building.	**X**	
	Condenser Water on-floor distribution		**X**

Central Chilled Water Plant sized to provide cooling with 100% outside air at 1.7CFM per usable sf	**X**	
Allotted space for future 150ton chiller to accommodate expansion of system to 2CFM per usable sf		**X**
Processed Chilled Water system capable of providing 45 Tons per floor with energy recovery taken into account	**X**	
Plate and Frame heat exchanger, associated piping and pumps to connect chilled water riser to existing chillers and/or future 150ton chiller		**X**
(2) Processed Chilled Water Supply and Return Distribution Risers	**X**	
Processed Chilled Water Supply and Return riser connection in penthouse to tenant provided chiller (if required)		**X**
Excess Capacity in base building chiller plant to provide chilled water to each floor (capacity subject to chilled water on floor use)	**X**	
Tenant Chiller for Tenant Process Chilled Water		**X**
Penthouse air handling units capable of providing 1.7 CFM per usable sf. Vertical supply ducts sized to accommodate 2.0CFM stubbed out in (2) locations per floor	**X**	
Additional AHU to exceed 1.7CFM/sf of supply		**X**

General laboratory exhaust fans capable of exhausting 1.7 CFM per usable sf. Vertical exhaust ducts sized to accommodate 2.0CFM stubbed out in (2) locations per floor	**X**	
Additional laboratory exhaust fans to exceed 1.7CFM/sf of exhaust		**X**
All on-floor supply and exhaust distribution in tenant spaces		**X**
Central Heating Plant consisting of condensing boilers supplying hot water to AHU's and other shell and core heating elements.	**X**	
Allotted space for future condensing boiler	**X**	
Future boiler and associated piping and pumps to accommodate expansion of system to 2CFM per usable sf		**X**
(2) Hot water supply and return distribution risers with 2- 1/2" valves capped on floors 1 through 3 for tenant distribution. 1 1/2" riser drops to basement level on the East side of the building.	**X**	
All hot water supply and return on-floor distribution for tenant use		**X**
Any additional mechanical equipment and/or any modifications to Base Building equipment to increase the mechanical capacity of the building.		**X**

Ductwork, VAV boxes, registers and controls for HVAC in lobby spaces and core areas, including toilet exhaust system.	**X**	
Supply and exhaust air distribution within the tenant space including all medium pressure and low pressure ducts, diffusers, registers, grilles, terminal volume control boxes, VAV boxes, fan powered units, reheat coils, baseboard radiation and hot water piping.		**X**
Toilet and/or shower ventilation requirements for additional tenant locker rooms and restrooms as required.		**X**
Central DDC computerized energy management system for applicable core and shell system with expansion capacity for tenant fit out systems.	**X**	
Temperature controls within tenant space, and links to base building system.		**X**
Dedicated kitchen exhaust system		**X**
All components of tenant exhaust systems, including fume hoods, floor distribution ductwork, specialty high corrosive system ducts and dedicated exhaust fans, controls, equipment dunnage and sound attenuation.		**X**
Dedicated air handler, additional cooling, additional heating and associated ductwork, equipment and controls if required for a Tenant Animal Care Facility.		**X**

	Specialized tenant systems and equipment including supplemental or spot cooling, steam boilers, dedicated rated exhaust for H2 or H3 storage rooms, air and vacuum systems and all related HVAC equipment.		**X**
	Additional sound attenuation necessary to ensure tenant's equipment complies with local noise regulations.		**X**
	Carbon Monoxide Monitored garage exhaust system	**X**	
	Fuel oil storage tank, transfer pumps and distribution piping for Base Building life safety emergency generator	**X**	
	Fuel oil system tenant provided stand-by generator.		**X**
	BTU Meters connected to BAS for hot, condenser, and processed chilled water at floor connections		**X**
	Air monitoring flow stations connected to BAS for exhaust		**X**
	Air monitoring flow stations connected to BAS for supply (at Floor take-offs or at terminal units if required by tenant)		**X**
GAS:	Gas service capable of providing low-pressure (10" w.g.) service.	**X**	
	Gas piping for Base Building equipment.	**X**	

	6” Gas service brought to tenant non-roofed penthouse for tenant provided generator capable of providing 8000 cfh (tenant premises to dictate allocation)	**X**	
	Gas Sub-meter for tenant use		**X**
	Gas connection to tenant generator		**X**
	Any and all tenant required gas service and distribution for on-floor use		**X**
PLUMBING:	Domestic water service, with back-flow prevention and duplex booster.	**X**	
	(2) Gas Fed Boilers providing hot water to restrooms and tempered water risers	**X**	
	Hot water supply and return risers and distribution to restrooms	**X**	
	Core and Restroom plumbing and fixtures to meet code requirements	**X**	
	(1) 4” Domestic Cold water riser with 1” connections valved and capped on floors 1 through 3	**X**	
	Water Sub-meter and on-floor distribution of domestic cold water		**X**
	Hot water plumbing including heaters, boilers, distribution and associated equipment for tenant use		**X**
	(2) 2” Tempered Water Risers valved and capped on floors 1 through 3 providing 70-90 degree water	**X**	
	Tempered Water Sub-meter and on-floor distribution for tenant use		**X**

(2) 3” Nonpotable Water risers fed from 2 booster pumps stubbed out on floors 1 through 3	**X**	
Nonpotable Water submeter and on-floor distribution		**X**
Installation of Tenant’s non-potable/potable water heaters.		**X**
Tenant metering, sub metering, distribution and backflow prevention at laboratory connections.		**X**
Waste and vent risers for tenant non-lab waste	**X**	
Connection to non-lab waste and vent		**X**
Shaft Space for lab waste and vent risers	**X**	
Lab waste and vent risers for tenant use		**X**
Domestic sanitary sewer, storm, and water to/from city	**X**	
Roof and canopy storm drains	**X**	
Production and distribution of clean steam including fuel source.		**X**
Steam generator, fuel source, floor by floor humidification associated steam piping and reducing stations.		**X**
All non-base building plumbing including kitchen, cafeteria and specialized equipment.		**X**

	Reserved, allocated space in basement for tenant's acid neutralization system	**X**	
	Acid waste neutralization equipment, lifting stations and laboratory waste lines including distribution, pumps, and risers.		**X**
	Manifolds, piping, floor drains, equipment and other requirements for laboratory gases, compressed air, vacuum systems and RO/DI water systems. Distributed vertical utility chases are provided.		**X**
	Waste stacks to receive base building and tenant clear water wastes (e.g., a.c. condensate, RO reject).	**X**	
ELECTRICAL:	Base building electric metered by Nstar at main switchboard	**X**	
	Tenant electric metered by Nstar on tenant floor		**X**
	Tenant submeter for any specialized and/or processed loads (data center, etc.)		**X**
	Life safety lighting and other "Legally Required" emergency power systems.	**X**	
	Automatic transfer switch for emergency and egress lighting	**X**	**X**
	Building electrical service to provide two 3,000 Ampere 480/277 Volt, 3 phase, 4 wire via main switchboards in main electrical room.	**X**	

Allocation of approximately 12 watts/sf for tenant distribution with 15 watts/sf for lab area and 5 watts/sf for office area based on 70%/30% lab to office ratio% office	**X**	
(2) 4” Conduits from unmetered switchboard in basement to 800AMP unmetered wireway	**X**	
Conductor from basement switchboard to 800 AMP wireway in each floor’s electric room		**X**
CT cabinet, utility meter, high voltage, low voltage and distribution for tenant power		**X**
All power for any and all systems within tenant space		**X**
Lighting & receptacles serving core areas.	**X**	
Building Exterior lighting package.	**X**	
Exterior and Interior Tenant Signage lighting package		**X**
Diesel fuel life safety generator to provide emergency power for MA code-required egress lighting, fire alarm systems, common area emergency egress lighting and exit signs, capacity to serve emergency egress and exit lighting in tenant areas and lab exhaust fans.	**X**	
Emergency Transfer switch(s) capable of providing power to code required emergency equipment.	**X**	

	Back-up generator and systems, including transfer switch, distribution, controls and associated appurtenances		**X**
	Emergency egress and exit lighting in core areas.	**X**	
	Emergency egress and exit lighting fixtures in tenant area, connected to Base Building life safety emergency generator.		**X**
FIRE PROTECTION:	Sprinkler service entrance including fire department connection, alarm valve, backflow protection and standpipe in each stair.	**X**	
	Fire Pump and all related controls	**X**	
	Core and stair area sprinkler heads and piping.	**X**	
	Flow control valve station in stair at each floor.	**X**	
	Primary sprinkler distribution on each floor.	**X**	
	All run outs, drops, heads and related equipment within tenant premises.		**X**
	All run outs, drops, heads and related equipment within unleased and unoccupied space within the building as required to obtain a building occupancy permit.	**X**	
	Special extinguishing systems.		**X**
	Fire Extinguisher Cabinets in core area with appropriate Fire Extinguisher	**X**	

	Fire Extinguisher Cabinets in tenant area (building standard) with appropriate Fire Extinguisher		**X**
	Additional hose connection in fit-up spaces to meet 150 foot distance requirements of Cambridge Fire Department.		**X**
FIRE ALARM:	Base building expandable addressable fire alarm system that meets all code requirements.	**X**	
	Detection and annunciation devices (i.e. horns and strobes) in core areas and stair entries.	**X**	
	Detection, annunciation and all wiring in tenant areas and as required to tie into base building system.		**X**
TELECOMMUNICATIONS	Main Distribution Frame (MDF) telephone room, core riser closets on each floor with sleeves through slab.	**X**	
	(4) 4” Conduits from City Service Ductbank into main tel/data closet in basement	**X**	
	Primary POS and distribution into tenant space		**X**
	Telephone and data wiring, conduits and outlets for Tenant areas from core closets.		**X**
	Audio-visual connections and systems for Tenant areas.		**X**
	Any special equipment needed to provide specific requirements for tenants telephone equipment.		**X**

SECURITY:	(Base) Building security network system for monitoring and access control.	**X**	
	Card access at Building main entries, service doors, and traveling cable for security in elevators.	**X**	
	Card access in elevator cabs if required		**X**
	Electric door hardware and wiring on interior emergency egress doors in Stair #1 only.	**X**	
	Electric door hardware and wiring on interior emergency egress does in Stair #2		**X**
	Card access and/or alarm systems into or within Tenant's premises. Emergency egress doors must be tied into Base Building Fire Alarm system.		**X**
	CCTV DVR surveillance in basement and at ground floor entries	**X**	
SIGNAGE:	Building and site exterior address, directional, and any common identity signage to owner standards.	**X**	
	Building common area interior signage.	**X**	
	Signage within tenant's space.		**X**
	Exterior Signage subject to Landlord Approval		**X**

EXHIBIT G TO LEASE

TENANT'S CONCEPT PLAN

lab

Third Floor Color Plan

Bluebird Bio Fitout

SK-2

EXHIBIT H TO LEASE

TENANT DESIGN AND CONSTRUCTION GUIDELINES

150 SECOND

CAMBRIDGE, MASSACHUSETTS

Tenant Design and Construction Guidelines

March 1, 2013

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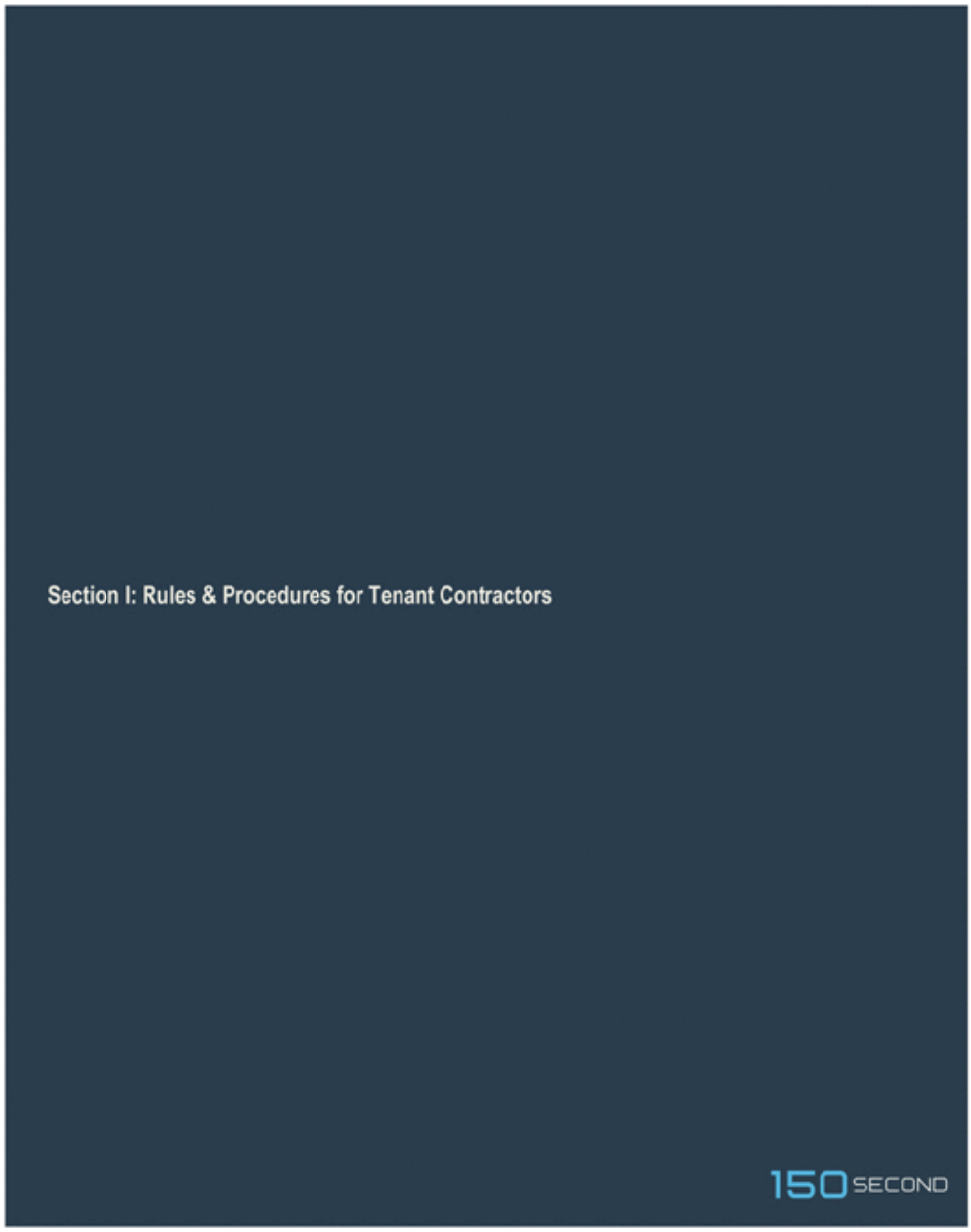
Section I: Rules & Procedures for Tenant Contractors
150 SECOND

Section I: Rules & Procedures for Tenant Contractors

Introduction

The following requirements apply only to Tenant's contractors and have been developed to ensure that modifications or improvements to the building and/or building systems and equipment are completed to building standards while maintaining a level of safety consistent with industry standards. The review of tenant plans and/or specifications by Landlord and its insurers, consultants or other representatives, does not imply that any plans so reviewed comply with applicable laws, ordinances, codes, standards or regulations. Nor does Landlord's review or approvals imply that any work is to be performed at Landlord's expense.

Landlord has the explicit right to remove from the project any person who does not comply with these rules after one day's notice.

Part A: General

1. No work will be performed until the Landlord has received two (2) sets of signed and sealed drawings and specifications and has given written approval.
2. All modifications to the building or to the building systems and equipment must comply with state, federal and local codes and ordinances.
3. Prior to the work commencing, a building permit must be obtained and displayed and a certificate of insurance from the contractor must be furnished to the Landlord naming the as additional insureds all parties specified in the Lease.
4. At the completion of the work, the Leasehold Contractor shall furnish to the Landlord two (2) hard copies of redlined "as builts" as installed by the Leasehold Contractor and one (1) complete CADD.DWG disk file showing the final architectural and engineering drawings.
5. The contractor must notify the Landlord of all work scheduled and must provide the Landlord with a list of all personnel working in the building.
6. The contractor must furnish the Landlord with a list of all subcontractors including emergency phone and/or pager numbers prior to commencing the work.
7. The contractor must provide an on-site project superintendent at all times that construction work is underway. This supervisor must be knowledgeable of the project's scope of work and have adequate on-site reference materials including plans, specifications and MSDS information on all materials used in the performance of the work.

8. All workers must be dressed appropriately (appropriate dress will include hard hat, appropriate foot ware, etc.) to meet building safety standards that have been provided to Tenant in writing. Shirts must be worn at all times. No shorts are permitted.
9. All carts must be furnished with pneumatic tires and rubber bumpers.
10. Smoking is not allowed in the building.
11. The use of radios is prohibited.
12. Prior to the start of work, all blinds must be raised and bagged, all windowsills and other base building components must be adequately protected and the protection must be maintained. Workers must not stand on windowsills or other building components.
13. Any work that requires access to another tenant's space must first be coordinated through the Landlord.
14. Dumping of construction debris into building drains, mop sinks, trash dumpsters, etc. is strictly prohibited. If this does occur, the contractor shall be charged 200% of the cost of clearing any drain, including administrative time, where evidence of this is found.
15. Base building restrooms within the construction area will be available for use by the contractor unless landlord dedicates an alternate location. Contractor shall be responsible for any damage to the restrooms and for cleaning and stocking during construction. All other base building restrooms shall be locked and are not to be used by construction personnel.
16. Use of the building stairwells for moving construction materials and construction personnel shall be limited to the stairwell designated by Landlord. No material may be brought through the Building lobby. Any damage done to the stairwell (rails, doors and frames, sheetrock, ceilings etc.) shall be repaired by the Tenant contractor at its sole expense to the satisfaction to the Landlord.
17. The contractor shall repair all construction disturbed by the new tenant work or damaged by the contractor's or subcontractor's personnel.
18. After initial occupancy of the building, no work will be performed from 8:00 am to 8:00 pm Monday through Friday and 9:00 am to 4:00 pm Saturday that will disturb or inconvenience any existing tenants in the building (e.g. core drilling, shooting track, noxious odors, etc.). The Landlord must preapprove any work that entails noise, vibration or noxious odors.
19. All structural revisions, including but not limited to penetrations of slabs, are to be reviewed by Landlord's engineer.
20. Any roof related work must be performed by the roofing contractor designated by the Landlord.

21. The contractor shall immediately report all accidents to the Landlord in writing after first notifying the Landlord by telephone.
22. Landlord shall provide the name of the manufacturer of lockset and key cores for compatibility with building master keying system.

Part B: Life Safety

1. Contractor shall furnish Landlord one set of sprinkler shop drawings and hydraulic calculations for approval by the Landlord's insurance company once they are completed by subcontractor and ready for submittal to the Fire Marshall. Once approved by the Fire Marshall, the contractor shall furnish Landlord one set of the approved sprinkler shop drawings.
2. Contractor will not disconnect, tamper with, delete, obstruct, relocate, or expand any life safety equipment, except as indicated on drawings approved by the Landlord. Contractor shall not interfere with or delay any other inspections scheduled prior to Contractors inspections or testing.
3. The contractor must take necessary precautions to prevent accidental fire alarms. Any fees or costs charged to the Landlord by the local fire department that arise from accidental fire alarms caused by the contractor will be paid by the contractor. The Landlord strongly suggests that, during any work that increases the likelihood of an accidental fire alarm such as demolition or sprinkler work, a person approved by the Landlord be designated to "watch" the fire alarm panel.
4. Any unit or device temporarily incapacitated will be red-tagged "Out of Service" and the Landlord will be alerted prior to the temporary outage.
5. The base building fire alarm system shall monitor all tenant installed special fire extinguisher/alarm detection systems. The connections to the base building fire alarm system will be at the tenant's expense. To the extent the Premises are occupied, or same is otherwise required under Legal Requirements, fire "watch" shall also be provided by tenant contractor during any period fire alarm system is placed out of service for work or connection to base building.
6. All Tenant installed fire alarm initiation and notification devices that connect with the base building fire alarm system shall match the base building system and be approved by the Landlord.
7. All connections to the building's existing fire alarm system are to be made only by the subcontractor specified by the Landlord.
8. All fire alarm testing will be scheduled at least 72 hours in advance with the Landlord and other contractors and must occur after normal business hours if the building is occupied.

9. Combustible and hazardous materials are not allowed to be stored in the building without prior written approval of the Landlord. Material safety data sheets on all materials to be stored in the building must be kept on site and a copy submitted to the Landlord.
10. Dust protection of smoke detectors must be installed and removed each day (if operational). Dust protection is required during construction to avoid false fire alarms and damaging of detector system. Filter media must be installed over all return air paths to any equipment rooms prior to demolition. The media must be maintained during construction and removed at substantial completion.
11. The building is to be fully protected by automatic sprinkler systems in accordance with Landlord's standards and specifications.
12. All sprinkler systems and equipment are to be designed and installed in accordance with the current standards of the National Fire Protection Association.
13. All equipment, devices and materials used in the installation must be listed by UL and FM Approved.
14. Connections to the base building sprinkler system/standpipe riser shall be provided with a control valve and water flow alarm device. Sprinkler system control valves shall be UL Listed and FM Approved, clockwise closing, indicating valves with supervisory switches.
15. All corrective work to the fire alarm system due to the contractor's work shall be charged to the contractor.
16. All fire alarm wiring in public areas (outside of Tenant demising walls) shall be in rigid conduit.

Part C: Parking – Loading Dock

1. Contractors, subcontractors and their personnel will not use the loading dock area for parking without first obtaining permission from the Landlord 24 hours in advance to assure dock availability. Unauthorized vehicles will be ticketed and towed.
2. Use of the loading dock for deliveries/trash removal must be scheduled through the Landlord.
3. Material that does not fit into the service elevator must be delivered through a window opening. The contractor will be required to properly remove and replace the glass and to adequately protect the window framing with prior approval from the Landlord.
4. Any instance that requires the removal and replacement of exterior glass, must be approved by Landlord and performed by Landlord approved contractor.

Part D: Utilities

1. Utilities (i.e. electric, gas, water, telephone/cable) must not be cut off or interrupted without 48 hour notice and written permission of the Landlord.

Part E: Security

1. The contractor will be responsible for controlling any keys or access cards furnished by the Landlord and will return them to the Landlord.
2. The contractor will be responsible for locking any secure area made available to the contractor whenever that area is unattended.
3. Contractors may be required to wear identification badges, in which case the badges will be issued by the Landlord to the contractor.

Part F: Elevators

1. No passenger elevators will be used to move construction material or construction personnel.
2. The passenger/service elevator can be used to move construction personnel at any time during the day, provided the elevator doors are not held open. The service elevator can not be used to move construction materials into the building during building operating hours between the hours of 8:00 am and 8:00 p.m. unless approved in writing by Landlord. All other usage must be scheduled with the Landlord with at least 48 hours notice.
3. Any costs to repair damage to the elevators including dust or dirt in machine rooms or shaft or costs for service calls resulting from the contractor's operations will be charged to the contractor.
4. Any work on the elevators, call buttons and signal lanterns must be approved by Landlord and coordinated with building management.

Part G: Cleaning

1. The contractor will remove all trash and debris daily or as often as necessary to maintain cleanliness in the building. The building trash compactors or containers are not to be used for construction debris.
2. Walk-off mats or other protection must be provided at door entrances where work is being performed.

3. Carpeting shall be protected by plastic runners or hardboard as necessary to maintain cleanliness and to protect carpets from damage.
4. Tile, terrazzo and wood floors shall be protected from damage as necessary.
5. Contractor will furnish a vacuum(s) with a supply of clean bags and an operator to facilitate ongoing clean-up.
6. Trash removal will be scheduled and coordinated with the Landlord and undertaken only through the service elevator.
7. Contractors must remove all food cartons and related debris from the work area on a daily basis.
8. Driveway and street cleaning by Contractor will be required when Contractor's work has created mud or debris.

Part H: Mechanical and Electrical Work

1. Before any new electrical or mechanical equipment is installed in the building, the contractor must submit a copy of the manufacturer's data sheets along with complete shop drawings and submittals to the Landlord for approval.
2. Any installation or modification to building HVAC or electrical systems must be first submitted to the Landlord for review. This includes base building systems as well as supplemental units and/or exhaust systems.
3. The mechanical and electrical plans must be prepared by a licensed engineer and engineer and must show size and location of all supply and return grilles. We may require that the Landlord's MEP engineer review the MEP drawings. In that event the tenant will pay for the cost of this review. We will notify the tenant prior to engaging the Landlord's engineer.
4. Contractors modifying ductwork, air grilles, VAV boxes, etc., must balance the air and water systems as necessary. All air balancing is to be done in the presence of the Landlord. Two copies of all balance reports shall be submitted to Landlord for review and approval.
5. Any domestic or condenser water connections made to the building's piping system, must include a high quality isolation valve, (brass bodied gate or ball-type) and adequate system drain valves. If the system piping is of a different material a dielectric union must be installed. All valves and equipment must be easily accessible; access doors are required in drywall or other fixed construction.
6. Exhaust fans from cooking areas may not discharge into a return ceiling plenum. Such fans will be ducted to the outside via exhaust shafts or other routes as approved by the Landlord.

7. Where independent tenant-owned air conditioning units are installed, an electric submeter with a output that is compatible with the base building management system must be used or a flat rate electricity charge will be paid by the Tenant based on anticipated consumption.
8. The installation of tenant equipment (except emergency lighting per code) on the base building emergency power supply systems is not permitted. Tenant may seek Landlord review and approval for special circumstances.
9. Any existing mechanical or electrical systems and their controls that are to remain shall be properly commissioned. That is, at the beginning of the job the systems will be turned over to the contractor in working condition by the Landlord. Before beginning any work, the contractor should inspect the mechanical or electrical systems and their controls to ensure their working condition. The contractor should advise the Landlord of any noted deficiencies. At the end of the job, the contractor will be responsible for the proper operation of the mechanical and electrical systems. If the contractor fails to note any deficiencies at the outset of the job, the contractor will, nevertheless, be required to correct the problems before the Landlord accepts the system.
10. All circuit breaker panels must be clearly and accurately identified with typed labels.
11. Tenant shall properly protect any of its mechanical equipment with prefilters, dust covers etc. prior to start of work, and shall not disturb any similar prefilters and covers covering base building mechanical equipment. Protection shall be removed and equipment wiped down at completion.
12. Energy management and building control work is to be performed by Landlord's designated subcontractor.
13. Tenant installed equipment that supplements existing base building equipment such as VAV boxes, fire alarm devices, control work etc., shall be identical to the existing base building equipment to facilitate warranty and maintenance operations.
14. All concealed equipment shall be located with necessary accessibility for maintenance and repair.
15. Contractor shall contract Landlord 48 hours in advance for Landlord wall and ceiling close-in inspectors.
16. No flexible conduit installed in the electrical closets. All runs inside the closet must be electrical metallic tubing (EMT).

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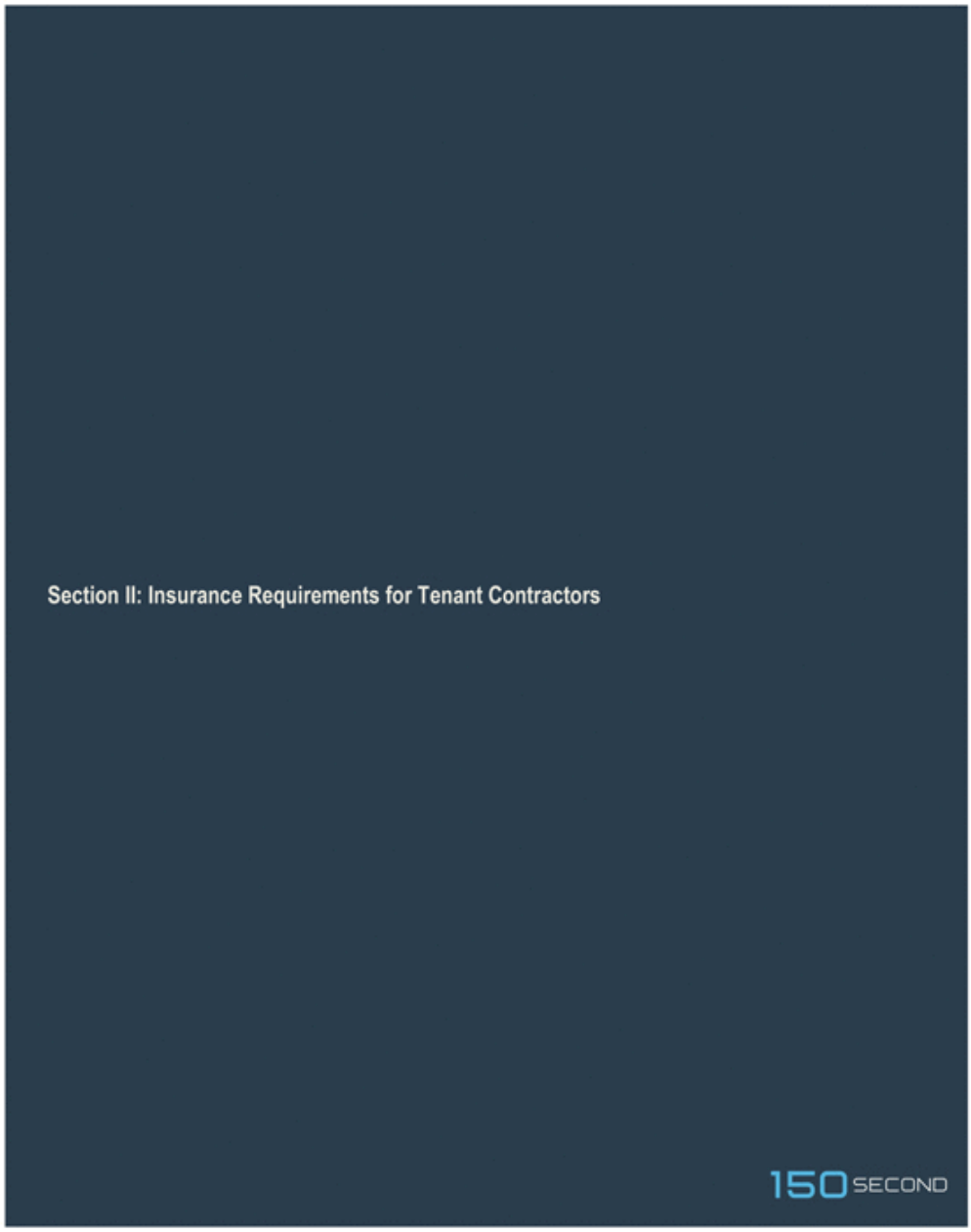

Section II: Insurance Requirements for Tenant Contractors
150 SECOND

Section II: Insurance Requirements for Tenant Contractors

Introduction

Tenant's Contractors shall procure and maintain for the duration of the contract insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by the contractor, his agents, representatives, employees, or subcontractors. The cost of such insurance shall be included in the contractor's bid, unless otherwise specified.

Part A: Minimum Scope of Insurance

Coverage shall be at least as broad as:

1. Insurance Services Office "occurrence" form CG 00 01 (ed. 10/93) covering commercial general liability or its equivalent.
2. Insurance Services Office form CA 00 01 (ed. 6/92) covering automobile liability, coverage must apply to all owned, non-owned and hired vehicles.
3. Workers compensation insurance as required by labor code of the jurisdiction in which the Building is located, and employers liability insurance.

Part B: Minimum Limits of Insurance

Contractor shall maintain limits no less than:

1. Commercial general liability: $1,000,000 combined single limit per occurrence for death, bodily injury and property damage. Minimum $2,000,000 aggregate. (The general aggregate limit shall apply separately to this project/location or the general aggregate shall be twice the required limit.).
2. Automobile liability: $1,000,000 per person/$2,000,000 per accident for death, bodily injury and property damage.
3. Workers compensation and employers liability: Workers compensation limits as required by the labor code of the jurisdiction in which the Building is located and employers liability limits of $1,000,000 per accident.
4. Umbrella Liability: $5,000,000 per occurrence and $5,000,000 aggregate (The aggregate limit shall apply separately to this project/location).

Part C: Coverages

1. General Liability and Automobile Liability Coverage

(a) The managing agent of the Building, the holder of any mortgage, and their respective officers and employees are to be covered as additional insureds as

respects: liability arising out of activities performed by or on behalf of the contractor; products and completed operations of the contractor; premises owned, leased, or used by the contractor; or automobiles owned, leased, hired, or borrowed by the contractor.

The coverage shall contain no special limitations on the scope of protection afforded.

(b) The contractor's insurance coverage shall be primary insurance as respects the Landlord, its officers, officials, and employees. Any other insurance or self-insurance maintained by the Landlord, its officers, officials, and employees shall be excess of and not contribute with the contractor's insurance.

(c) Any failure to comply with reporting provisions of the policies shall not affect coverage provided to the agency, its officers, officials, and employees.

(d) The contractor's insurance shall apply separately to each insured against whom claim is made or suit is brought except with respect to the limits of the insurer's liability.

The insurer shall agree to waive all rights of subrogation against the Landlord, its officers, officials, and employees for losses arising from work performed by the contractor for the Landlord.

Part D: All Coverages

Each insurance policy required by this clause shall be endorsed to state that coverage shall not be suspended, voided, canceled by either party, reduced in coverage or in limits except after 30 days' prior written notice by certified mail, return receipt requested, has been given to the city.

Part E: Acceptability of Insurers

Insurance is to be placed with insurers licensed to do business in the jurisdiction in which the Building is located, that have been approved in advance by the Landlord, with a Best's rating of no less than A:XI unless specific approval has been granted by the Landlord.

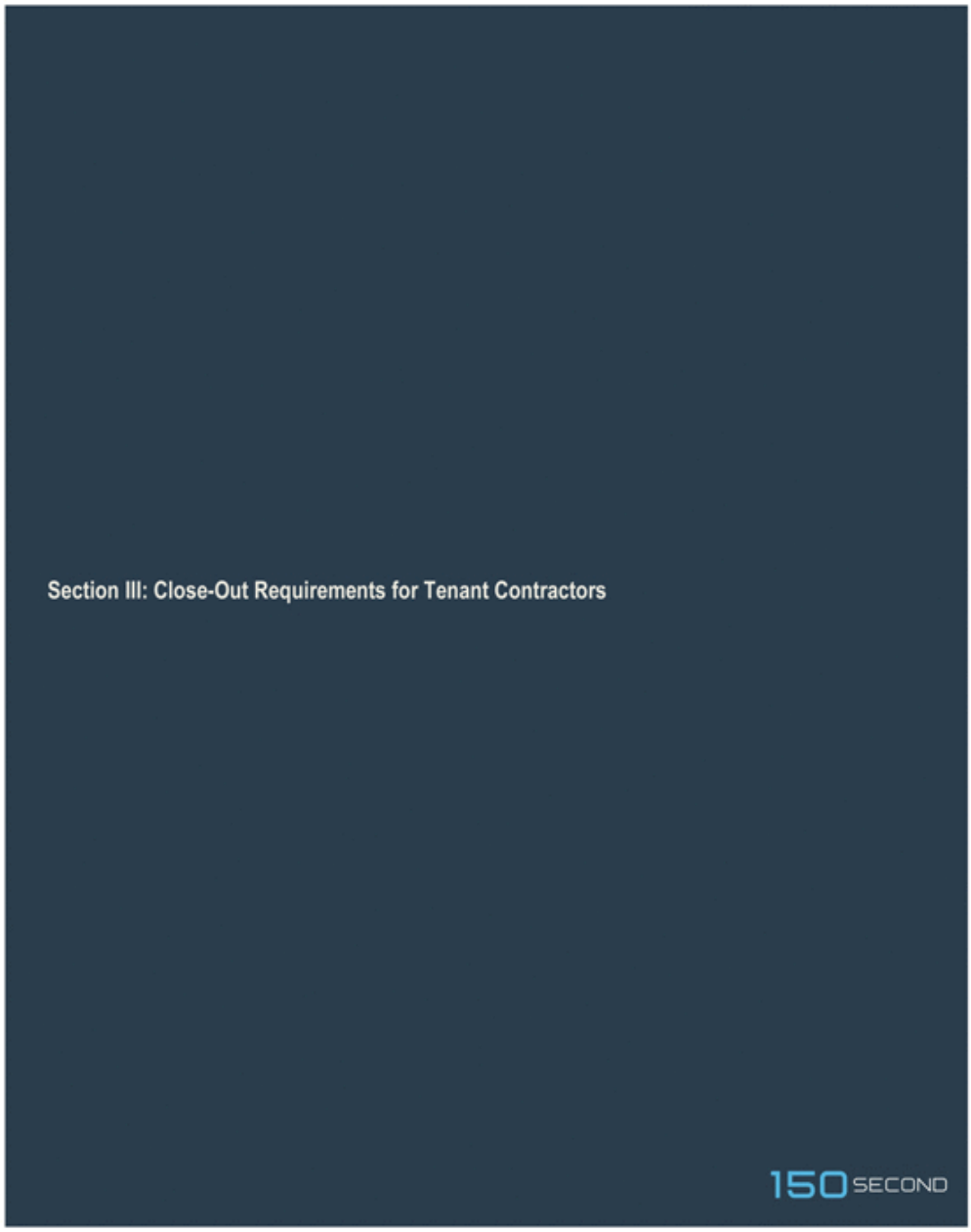
Part F: Verification of Coverage

Contractor shall furnish the Landlord with certificates of insurance evidencing the coverages required by this Article. The certificates for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf. The certificates are to be on ACORD Form 27 and/or ACORD Form 25-S, or other forms

that are similarly binding on insurers, which forms are to be received and approved by the Landlord before work commences. In addition, the Landlord shall require an endorsement naming the Landlord, the managing agent of the Building, the holder of any mortgage and their respective officers and employees as additional insureds or loss-payees (whichever is applicable). The Landlord reserves the right to require Tenant to deliver complete, certified copies of all required insurance policies, at any time.

Part G: Subcontractors

Contractors shall include all subcontractors as insureds under their policies or shall furnish separate certificates for each subcontractor in the form described in clause E above. All coverage for subcontractors shall be subject to all of the requirements stated herein. Commercial general liability coverage shall include independent contractors coverage, and the contractor shall be responsible for assuring that all subcontractors are properly insured.


Section III: Close-Out Requirements for Tenant Contractors
150 SECOND

Section III: Close-Out Requirements for Tenant Contractors

The following are required from the general contractor prior to final payment being made:

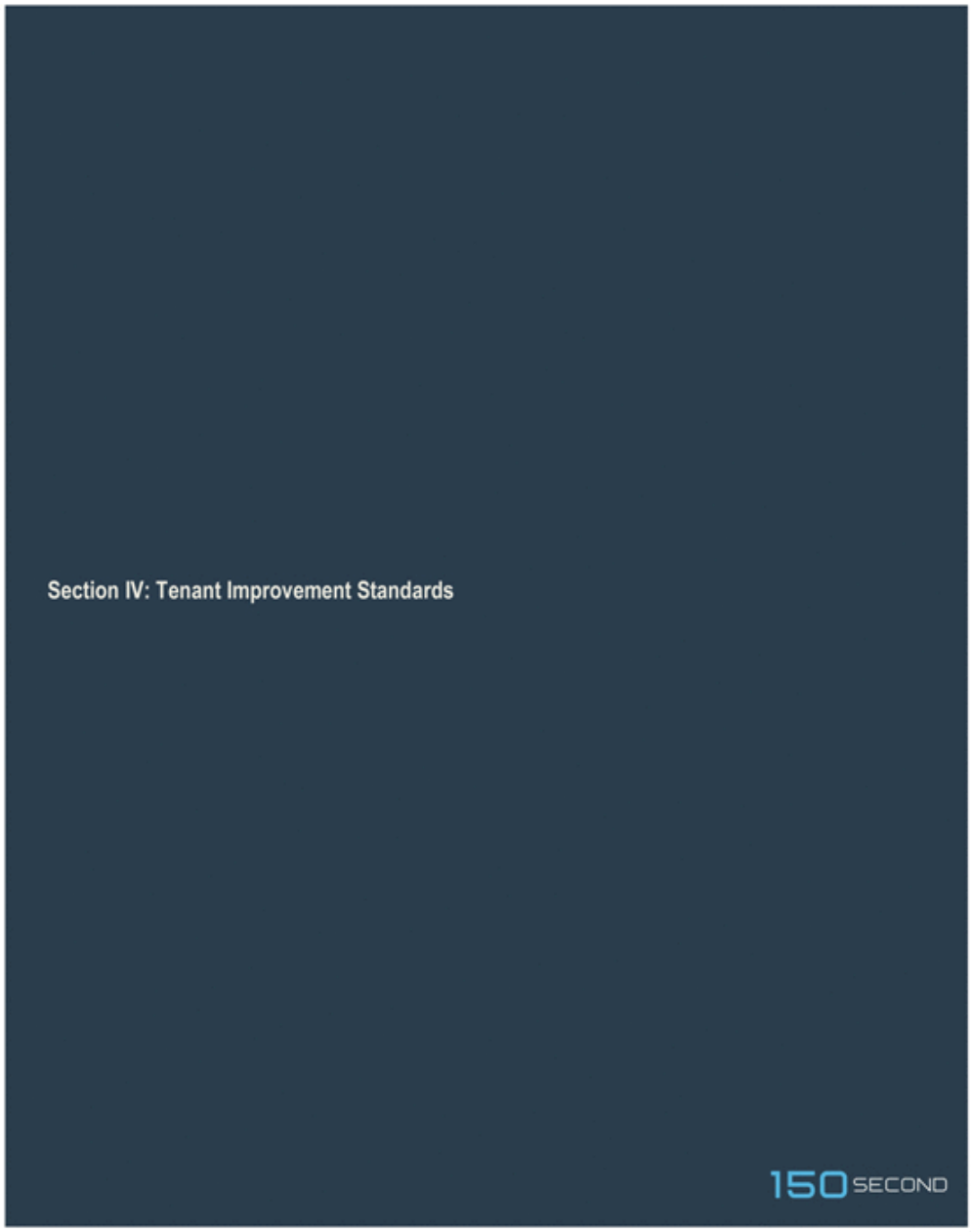
1. Two complete sets of all Operations and Maintenance Manuals bound in notebooks with an index, as specified in the project manuals.
2. Two sets of blackline prints and one(1) CADD.DWG disk file including architectural, structural, plumbing, fire protection, elevator, mechanical, and electrical drawings. The as-built drawings must include modifications made to the specifications, schedules and details and all changes initiated by requests for information and field orders.
3. Copies of all building permits and certificates of occupancy, or occupancy permits.
4. Final Releases of Liens from the general contractor and all subcontractors.
5. One copy of all warranties bound in notebooks with a corresponding warranty log.
6. One complete set of all approved submittals and shop drawings and a copy of the final submittal log.
7. A complete list of all persons, including names, addresses, phone numbers and contact persons that will be providing warranty service during the warranty periods.
8. One copy of NEBB certified air and water balancing reports.
9. When the general contractor considers the work to be ready for final acceptance, written certification from the general contractor shall be submitted stating the following:

(a) Work has been completed in accordance with the contract documents and Tenant Plans;

(b) All punch list items and other deficiencies identified by the Certificate of Substantial Completion have been corrected;

(c) Work has been inspected for compliance with the contract documents and Tenant Plans;

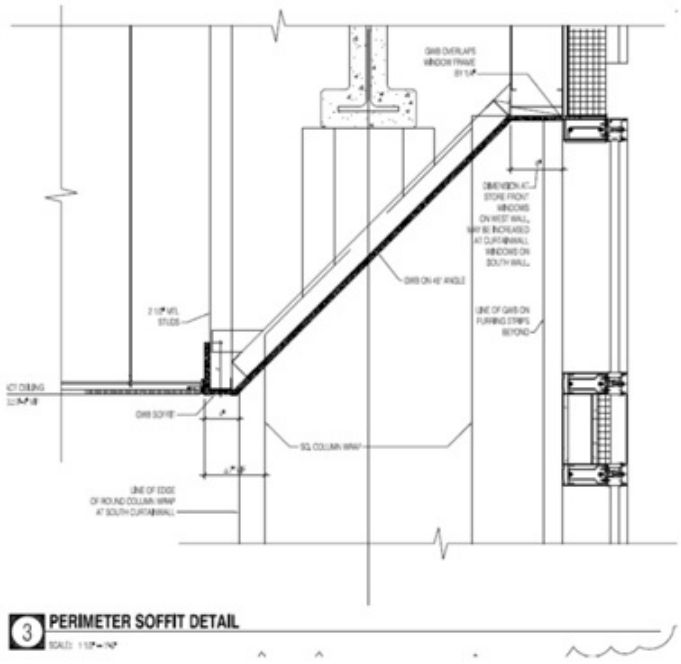
(d) All mechanical and electrical equipment and systems have been tested in the presence of the Landlord’s representative and are operational.


Section IV: Tenant Improvement Standards
150 SECOND

1.0 Ceiling

1.1 All tile and grid shall be standard white, Class A fire rated, and contain recycled content.

1.2 Perimeter Soffit detail shall be constructed as follows:



2.0 Wall Finishes

Suggested Guidelines

2.1 All partitions shall be finished with paint and standard base unless alternate is proposed.

(a) Standard resilient wall base shall be 2 ½" high. Cove base shall be used at all resilient or exposed flooring. Straight base shall be used at all carpeted flooring.

3.0 Doors/Hardware

Suggested Guidelines

3.1 Suite Entry – Glass Double Doors. Doors shall be 3'x8', ½" frameless glass with polished edges and top and bottom rails. Hardware shall include vertical pull bar with back to back mounting through door, a recessed and concealed header, and door closer. Standard hardware to be brushed stainless steel.

3.2 Corridor Wood Doors. Doors shall be 3'x8'. Doors shall be flush, solid-core, paint-grade wood door with aluminum frame assembly. Doors shall have mortised locksets and be equipped with a recessed, concealed header and door closer. Standard hardware to be brushed stainless steel.

3.3 Interior Wood Doors. Doors shall be 3'x8'. Doors shall be flush, solid-core, paint-grade wood door with aluminum frame assembly. Doors shall have butt hinges, cylindrical locksets and be equipped with a surface mounted door closer. Standard hardware to be brushed stainless steel.

4.0 Lighting

Suggested Guidelines

Use of indirect pendant mounted ambient lighting system to reflect off high ceiling is preferred, with a design work surface illumination level of 25 – 30 foot-candles.

Use of LED lighting is recommended for task lighting;

Use light colored ceiling materials to reflect indirect lighting

5.0 Partitions

Suggested Guideline

Use low partitions (below 42") to promote better lighting/day lighting and allow views to perimeter whenever possible

In an attempt to maximize natural day lighting the use of light shelves and reflective ceiling materials is encouraged to bounce light deep within the building.

6.0 Suite Entry Signage

Subject to Article 24 of the Lease.

7.0 Window Blinds

In accordance with landlord specified treatments.

8.0 Flooring

Carpet and vinyl flooring adhesive to be low VOC.

9.0 HVAC

9.1 See Building Shell Definition

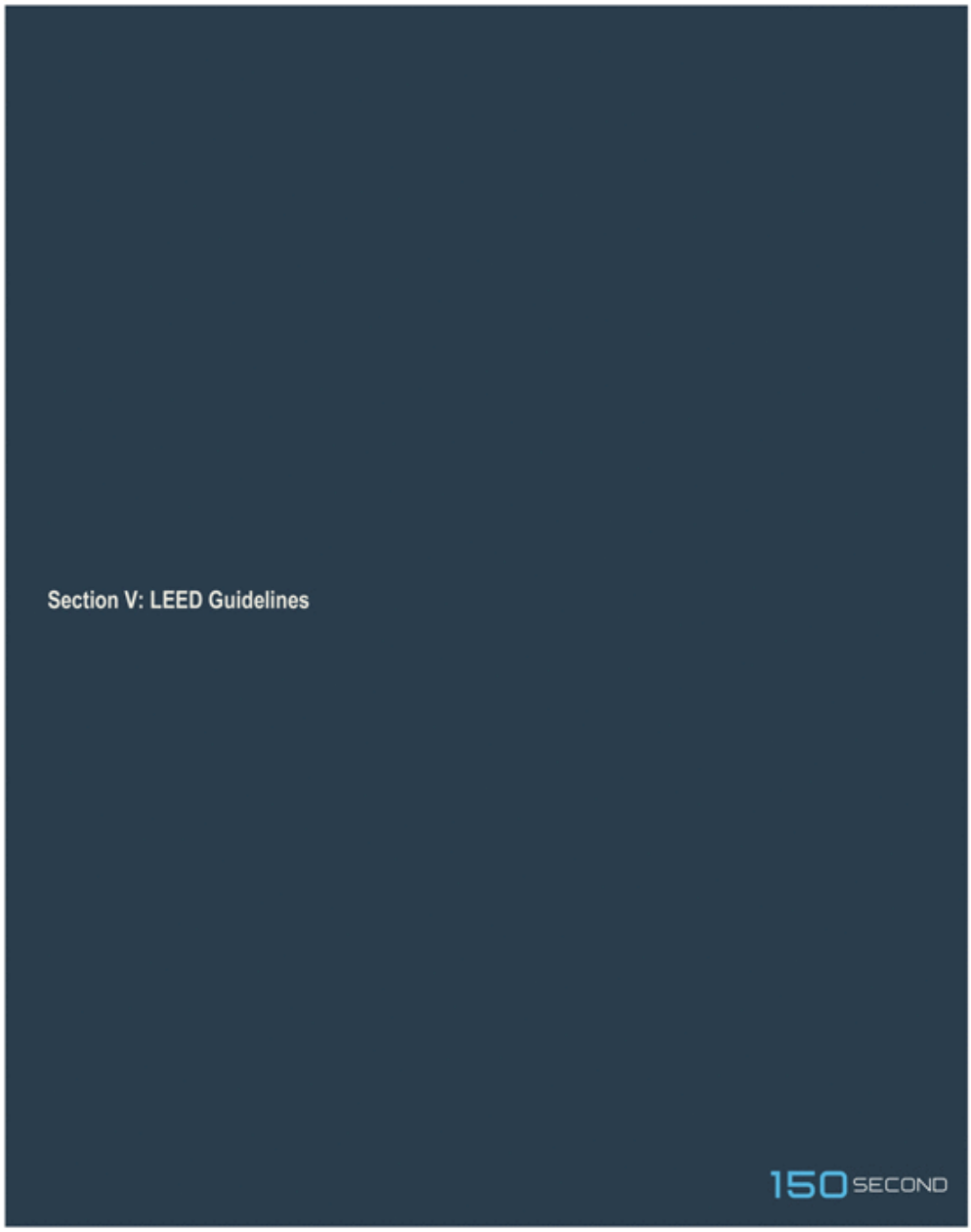
9.2 Subject to Landlord approval, Tenant may elect to install supplemental HVAC systems. All supplemental HVAC systems shall be sub metered. Supplemental HVAC is not included in the turnkey cost – and would be paid for by Tenant.

10.0 Telephone/Data

10.1 Pull string and trim ring at locations determined by Tenant. Entire cable plant will be contracted for directly between the Tenant and their vendor.

10.2 All necessary communications equipment is the responsibility of the Tenant and shall be located completely with Tenant space.

11.0 General Plumbing Requirements


Section V: LEED Guidelines
150 SECOND

Part A: Introduction and General Information

Why Green?

Buildings in the United States consume over 80% of the total electricity and more than 30% of total energy used annually. Buildings also utilize significant amounts of fresh water during both construction and occupancy. Material waste during construction accounts for up to 53% of landfill waste, depending on location. A well designed, sustainable building works to reduce impact on the environment while garnering financial and health-related benefits for the Owner and Tenants.

Currently, people spend over 90% of their time in buildings – much of that time at work. One benefit of a green building for occupants is the more comfortable and controllable environment designed into sustainable buildings. The impact of such an attribute can be manifested in increased employee retention and productivity.

United States Green Building Council and LEED

The United States Green Building Council (USGBC) is a nonprofit organization committed to expanding sustainability in the built environment. Its mission is to transform the way buildings and communities are designed, built and operated, enabling an environmentally and socially responsible, healthy, and prosperous environment that improves the quality of life. LEED (Leadership in Energy and Environmental Design) is a voluntary, consensus-based national rating system for developing high-performance, sustainable buildings.

Developed by the USGBC, LEED addresses all building types and emphasizes state- of-the-art strategies for sustainable site development, water savings, energy efficiency, materials and resource selection, and indoor environmental quality. LEED is a voluntary rating system for green building design and construction that provides immediate and measurable results for building owners and occupants.

Opportunities for Tenants

Tenants at 150 Second have a remarkable opportunity to help lead the shift to sustainability in buildings, and in the process define a new kind of workplace. By locating in a LEED Gold building, tenants will benefit from a high performance building with excellent indoor air quality and ample daylight and views. These and other elements combine to create a healthier workplace and improve the indoor environment for all

employees. In addition, 150 Second has set a higher standard with high-performance technologies that use less energy, consume less water, and leave a smaller footprint on the city's resources. Some of the building's innovative features will be noticed at once: low flow plumbing fixtures and the zero irrigation rain garden. Others, such as energy-saving base building mechanical systems will exist behind the scenes, quietly but significantly setting the building apart from its neighbors.

The LEED Guidelines that follow summarize the measures that Skanska has taken to achieve LEED Gold certification for 150 Second. These guidelines are intended to help tenants understand and take full advantage of the high-performance features of the building, and to provide guidance in ways that tenants can reinforce these features
in their own workplaces.

Skanska set a goal of achieving LEED Gold for the base building at 150 Second using LEED for Core and Shell (LEED-CS) version 2009. We can only design and build the building, however. It is up to our tenants to fit it out and operate it in an environmentally friendly way. To do this, we recommend you use the LEED for Commercial Interiors (LEED-CI) rating system. The intent of LEED-CI is to assist in the creation of high-performance, healthy, durable, affordable and environmentally sound commercial interiors. Together LEED-CS and LEED-CI address the commercial office real estate market for both developers and tenants enabling significant benefits through improved indoor air quality, maximized day lighting and lower energy costs. A copy of the LEED -CI 2009 Scorecard and link to the Rating System are included in Appendix A for reference by tenants who wish to explore more information on timing and detailed strategies.

Project Data

Floor Area:	123,210 rentable square feet (total)
Occupancy Group:	Group S-2, Low Hazard Storage (Parking Garage)
	Group B, (30%) and Lab areas (70%)
Construction Type:	IB
Building Address:	150 Second Street Cambridge, MA 02141

Part B: LEED-CD and LEED-CI Certification

Base Building Certification at 150 Second

The LEED Guidelines that follow summarize the measures Skanska has undertaken to achieve LEED certification under the LEED for Core and Shell (LEED-CS) rating system. It is intended to help tenants understand and take full advantage of the high-performance features of the building, and to provide guidance to assist tenants in reinforcing these features in their own workplaces. It will also provide tenants with guidance and information on achievement of LEED for Commercial Interiors (LEED-CI).

Sustainable Sites (SS)

The LEED requirements for the Sustainable Sites category are predominantly base-building responsibilities. A tenant applying for LEED for Commercial Interiors (LEED-CI) certification automatically gains five credits simply by choosing to be a tenant in the LEED-CS building at 150 Second.

SSp1: Erosion and Sedimentation Control

Intent Reduce pollution from construction activities by controlling soil erosion, water-way sedimentation and airborne dust generation.

LEED-CS This prerequisite is normally required as a routine part of the site design and city entitlement process. 150 Second complied with the requirements of this prerequisite

by developing and adhering to a Stormwater Pollution Prevention Plan as required by the United States Environmental Protection Agency. Tenants benefit by knowing that the construction process of the LEED-CS building had minimal negative impact on the local environment in terms of loss of soil, sedimentation of local storm-sewer systems, and localized air pollution.

LEED-CI No related LEED-CI credit.

SSc1: Site Selection

Intent Avoid development of inappropriate sites and reduce the environmental impact from the location of a building on the site.

LEED-CS 150 Second meets all of the stated criteria for this credit. By developing in a dense, urban neighborhood, urban sprawl is reduced, as is the pressure to develop in environmentally sensitive areas. The LEED-CS building did not develop on prime farmland, within a flood plain, near wetland areas, on land protected for endangered species, or on former public parkland. Location by the tenant in 150 Second helps to preserve these valuable environmental resources.

LEED-CI No related LEED-CI credit. Tenants attempting LEED-CI at 150 Second will earn five points for locating in a LEED-CS building. This is associated with LEED-CI SSc1: Site Selection.

SSc2: Development Density and Community Connectivity

Intent Channel development to urban areas with existing infrastructure to protect greenfields, and persevere habitat and natural resources.

LEED-CS 150 Second is located on a previously developed site, within one-half mile of a dense residential zone and within close pedestrian access to more than ten basic community services. Pedestrians also have easy access to all community services. Tenants benefit from the close proximity of numerous services such as restaurants, shopping, and groceries. The close proximity of neighborhood and community services help to reduce pollution caused by the use of motor vehicles. 150 Second also meets the development density path of this credit.

LEED-CI Tenants attempting LEED-CI at 150 Second will earn six LEED-CI points through SSc2: Development Density and Community Connectivity.

SSc3: Brownfield Redevelopment

Intent Remediate and redevelop sites deemed as contaminated in order to restore the health of the site and avoid development of greenfield sites.

LEED-CS 150 Second is located on a site that was previously contaminated. The site has been remediated. Remediation and redevelopment of brownfield sites is a huge undertaking by a developer, and Skanska is proud to have redeveloped this site and make it suitable for living and working conditions.

LEED-CI Brownfield redevelopment is covered under LEED-CI SSc1: Site Selection, where tenants earn five points for locating in a LEED-CS building.

SSc4.1: Alternative Transportation-Public Transportation Access (LEED-CI SSc3.1)

Intent Locate project near public transportation to reduce the number of vehicles on the road and to reduce land redevelopment for parking.

LEED-CS 150 Second is located within one-quarter mile walking distance of the Lechmere T stop and multiple bus lines. Locating in close proximity to rail and multiple bus lines is beneficial to tenants and their visitors because of the convenience of public transit access. This also reduces the need to drive cars to the site, thereby reducing environmental impacts associated with pollution and development.

LEED-CI Tenants attempting LEED-CI at 150 Second will earn six points meeting the credit requirements of SSc3.1: Alternative Transportation-Public Transportation Access in the LEED-CI rating system.

SSc4.2: Alternative Transportation – Bicycle Storage and Changing Rooms

(LEED-CI SSc3.2)

Intent Include bike racks and showering facilities to encourage building occupants to bike to the site, in an effort to reduce the number of vehicles on the road and to reduce land development for parking.

LEED-CS 150 Second provided 22 long-term and 8 exterior bike storage spaces for an estimated >8% of the assumed building users and provided 2 shower and changing rooms. This exceeds the requirement of racks for 3% of all building users and provided showering for an estimated 0.5% of full-time equivalent (FTE) occupants

LEED-CI Tenants attempting LEED-CI at 150 Second may be able to earn two points for LEED-CI SSc3.2: Alternative Transportation-Bicycle Storage and Changing Rooms. However, LEED-CI projects must provide bike racks for 5% of tenant occupants and showers for 0.5% of FTE. Tenants should verify that the bike racks and showers provided in the base building meet the required numbers for the tenant space. The base building provides sufficient bike storage to satisfy the requirements for 600 total peak users and changing facilities for 400 total FTE’s.


Sun shades
Bike rack
Efficient lighting
Rain garden
150


Shower/
Changing

15QsECOND

SSc4.3 Alternative Transportation – Low-Emitting and Fuel-Efficient Vehicles

Intent Encourage the use of low-emitting and fuel-efficient (LE/FE) vehicles by providing preferred parking spaces for LE/FE vehicles.

LEED-CS 150 Second will offer 5 preferred spaces for vehicles that meet the LEED definition of Low-Emitting and Fuel Efficient Vehicles.

LEED-CI There is no related LEED-CI credit.

SSc4.4: Alternative Transportation – Parking Capacity (LEED-CI SSc3.3)

Intent Minimize parking spaces and provide preference to carpool and vanpool vehicles, in an effort to reduce the number of vehicles on the road and to reduce land development for parking.

LEED-CS 150 Second minimized the total parking capacity to not exceed local zoning requirements but was not required to provide preferred parking for carpools or vanpools to meet the credit requirements. Parking capacity was minimized in an effort to reduce land development.

LEED-CI Tenants attempting LEED-CI at 150 Second may be able to earn two points for LEED-CI SSc3.3: Alternative Transportation – Parking Availability, which requires minimized parking for tenants and preferred parking for carpools and vanpools. Tenants in a LEED-CS building do not automatically meet this credit and will have to determine the maximum number of parking spaces available to them and provide the preferred parking spaces. See the LEED-CI Rating System for exact requirements.

SSc5.1: Site Development – Protect or Restore Habitat

Intent Conserve native habitat in an effort to promote biodiversity.

LEED-CS 150 Second did not pursue this credit.

LEED-CI There is no related LEED-CI credit.

SSc5.2: Site Development – Maximize Open Space

Intent Provide a high ratio of open space to development footprint to promote biodiversity.

LEED-CS Although 150 Second did not pursue this LEED credit, the Project increased the amount of vegetated open space which provides tenants with added amenities and park space.

LEED-CI There is no related LEED-CI credit.

SSc6.1: Stormwater Design – Quality Control

Intent Limit disruption of natural hydrology by reducing impervious cover, increasing onsite infiltration, and managing stormwater runoff quantities.

LEED-CS 150 Second implemented a stormwater management plan that reduced the stormwater runoff by 25% compared to pre-development volumes. Tenants and the local community benefit from the stormwater management plan due to less stormwater runoff and less contamination entering local waterways. Post development conditions show 44.92% reduction in 2 year, 24-hour design storm.

LEED-CI Stormwater management is covered under LEED-CI SSc1: Site Selection, where tenants earn five points for locating in a LEED-CS building.

SSc6.2: Stormwater Design – Quality Control

Intent Limit disruption of natural hydrology by reducing impervious cover, increasing on-site infiltration, and managing the quality of stormwater runoff.

LEED-CS 150 Second has provided a new stormwater technology that captures and treats stormwater runoff from 90% of the annual rainfall and removes at least 95.58% of total suspended solids. Tenants and the local community benefit from the stormwater management plan due to less stormwater runoff and less contamination entering local waterways.

LEED-CI Stormwater management is covered under LEED-CI SSc1: Site Selection, where tenants earn five points for locating in a LEED-CS building.

SSc7.1 Heat Island Effect – Nonroof

Intent Reduce heat island effect (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimate, and human and wildlife habitat.

LEED-CS 150 Second has placed 84% of the total parking capacity under a white roof in an effort to reduce the heat island effect. By placing the majority of parking spaces under one cover in a stacked parking garage, 150 Second is able to reduce the amount of asphalt required for the same number of parking spaces and therefore minimize local heat island effects.

LEED-CI The heat island effect is covered under LEED-CI SSc1: Site Selection, where tenants earn five points for locating in a LEED-CS building.

SSc7.2: Heat Island Effect – Roof

Intent Reduce heat island effect (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimate, and human and wildlife habitat.

LEED-CS 150 Second installed a light colored roof which reduces the heat island effect. Tenants will benefit from more efficient operations of the HVAC system in the building, which is passed on to the tenants in reduced energy costs.

LEED-CI The heat island effect is covered under LEED-CI SSc1: Site Selection, where tenants earn five points for locating in a LEED-CS building.

SSc8: Light Pollution Reduction

Intent Reduce the impacts of lighting on nocturnal environments, reduce glare, and minimize light trespass from interior windows.

LEED-CS 150 Second did not pursue this credit.

LEED-CI Light pollution reduction is covered under LEED-CI SSc1: Site Selection, where tenants earn five points for locating in a LEED-CS building.

SSc9: Tenant Design and Construction Guidelines

Intent Provide tenants with a descriptive tool that both educates and helps implement sustainable design and construction features in their tenant improvement build-out.

LEED-CS Tenant Design and Construction Guidelines benefit the LEED-CS certified project for two important reasons. First, the Guidelines help tenants design and build sustainable interiors and adopt green building practices; second, the Guidelines help in coordinating LEED-CI and LEED-CS certifications. These Guidelines are a tool to enable tenants of 150 Second to design and implement sustainable, green building interiors that will benefit the overall health and quality of life for building occupants.

LEED-CI No related LEED-CI credit.

Water Efficiency (WE)

WEp1: Water Use Reduction – 20% Reduction and WEc3: Water Use Reduction

Intent Maximize water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

LEED-CS 150 Second installed base building fixtures to achieve the prerequisite of
20% water reduction but also earned additional points and achieved an overall water use reduction of 39% for showers, low-flush toilets and low-flush urinals. In total, these measures will reduce water consumption of the building by approximately
250,000 gallons per year.

LEED-CI Tenants attempting LEED-CI at 150 Second will also need to meet the 20% water use reduction prerequisite. This prerequisite addresses only toilets, urinals, lavatory faucets, prerinse spray valves and showerheads. 150 Second has ultra low-flow metering lavatories, low-flow showers, low-flow toilets and low-flush urinals that tenants will be using and can take advantage of in compliance with LEED-CI. The tenant's participation in this credit guideline could further support reduction of water use.
150 Second encourages tenants to employ water efficient fixtures in other areas of their space such as installing ultra flow faucets (0.5 gpm) in pantry/kitchenette laboratory and/or prerinse spray valves below the baseline. By employing similar strategies for the tenant space, the tenant has the opportunity to achieve up to 11 points for WEc1: Water Use Reduction within the LEED-CI rating system.

Goals for Tenant Water Fixtures:

- Low Flow Water Closets (1.28 gpf) – Already in core toilet rooms.

- Pint Flush Urinals (0.125 gpf) – Already in core toilet rooms.
- Ultra Low Flow Metering Lavatories (0.83 g/cycle) – Already in core toilet rooms.
- Ultra Low Flow Kitchen and Janitorial Sinks (1.0 gpm)
- Ultra Low Flow Shower Fixtures (1.5 gpm) – Already in core shower rooms.
- Residential Dishwashers (Energy Star)
- Commercial Dishwashers (1.0 gallons/rack)
- Residential Clothes Washers [4.5 WF (gallons/ft³/cycle)]
- Commercial Clothes Washer [7.5 WF (gallons/ft³/cycle)]

WEc1: Water Efficient Landscaping

Intent Reduce potable water consumption for irrigation through the use of high-efficient technologies and low-water consuming plantings.

LEED-CS 150 Second installed limited turf grass and drought-resistant plants that require no permanent irrigation. These measures have resulted in a 100% potable water use reduction for irrigation.

LEED-CI Water-efficient landscaping is covered under LEED-CI SSc1: Site Selection, where tenants earn five points for locating in a LEED-CS building.

WEc2: Innovative Wastewater Technologies

Intent Reduce wastewater generation and minimize the impact on municipal wastewater treatment plants.

LEED-CS 150 Second installed an onsite rainwater storage system that treats water to tertiary standards. The treated rainwater is then reused for the toilets and urinals. This rainwater storage system reduces water use for toilets and urinals by 85%.

LEED-CI Innovative wastewater technologies are covered under LEED-CI SSc1: Site Selection, where tenants earn five points for locating in a LEED-CS building.

Energy and Atmosphere (EA)

EAp1: Fundamental Commissioning and EAc3: Enhanced Commissioning

(LEED-CI, EAc2: Enhanced Commissioning)

Intent

Fundamental: To verify that the project's energy-related systems are installed, calibrated and perform according to the owner's project requirements, basis of design and construction documents. Benefits of commissioning include reduced energy use, lower operating costs, reduced contractor callbacks, better building documentation, improved occupant productivity and verification that the systems perform in accordance with the owner's project requirements.

Enhanced: To begin the commissioning process early in the design process and execute additional activities after systems performance verification is completed.

LEED-CS 150 Second performed enhanced commissioning of all base building energy systems, including base building HVAC system and controls, domestic hot water, core and lobby lighting systems and controls and building management system. This process helped to assure all energy-related systems are operating as intended.

LEED-CI Tenants attempting LEED-CI at 150 Second are required to perform fundamental commissioning of their energy-related systems. Additionally, tenants can achieve five points if they elect to perform enhanced commissioning (EAc2).

EAp2: Minimum Energy Performance

Intent To establish the minimum level of energy efficiency for the proposed building and systems to reduce environmental and economic impacts associated with excessive energy use.

LEED-CS 150 Second performed whole building energy simulation using ASHAE 90.1-2007 Appendix G and has met the requirements for energy performance. 150 Second energy simulation demonstrated an improvement of 43% over ASHRAE 90.1-2007. The building envelope was designed to improve energy efficiency and reduce the cost of energy for the entire building, these savings are passed on to the tenant.

LEED-CI Minimum Energy Performance of the tenant space is a prerequisite in the LEED-CI rating system CAp2. Tenants attempting LEED-CI at 150 Second are required to comply with the mandatory provisions and prescription requirements of ASHRAE 90.1-2007, as well as reduce connected lighting power density by 10% from ASHRAE 90.1-2007 and install Energy Star appliances for at least 50% of eligible equipment. Tenants occupying space in 150 Second will benefit from the energy efficiencies of the base building systems but will not be automatically guaranteed credit compliance.

EAp3: Fundamental Refrigerant Management

Intent To reduce stratospheric ozone depletion.

LEED-CS 150 Second installed new HVAC systems which contained no Chlorofluorocarbon (CFC)-based refrigerants which thereby reduce the buildings impact on the ozone.

LEED-CI Tenants attempting LEED-CI at 150 Second are required to comply with this prerequisite through either the purchase of new HVAC equipment which contains no CFC-based refrigerants or upgrading of existing equipment which contains CFC-based refrigerants.

EAc1: Optimize Energy Performance

Intent To achieve increasing levels of energy performance beyond the prerequisite standard and to reduce environmental and economic impacts associated with excessive energy use.

LEED-CS 150 Second performed whole building energy simulation using ASHAE 90.1-2007 Appendix G and has met the requirements for energy performance. 150 Second energy simulation demonstrated an improvement of 43% over ASHRAE 90.1-2007.

LEED-CI Tenants attempting LEED-CI at 150 Second can earn points for further enhancing energy efficiency. These combined strategies will contribute toward further reductions in environmental and economic impacts for the project. Points are achievable across different areas of energy related systems as follows:

EAc1.1: Optimize Energy Performance – Lighting Power: Projects can achieve up to five points for further reductions in lighting power density below ASHRAE 90.1-2007.

Recommendations for Tenant Lighting Systems:

- Display lighting: metal halide, fluorescent, or LED lamps rather than halogen.

EAc1.2: Optimize Energy Performance – Lighting Controls : Projects that install lightning controls such as daylight and occupancy sensors can achieve up to three points in and contribute towards increased energy conservation.

Recommendations for Tenant Lighting Controls:

- Install daylight responsive controls in all regularly occupied spaces within 15 feet of windows and under skylights.

EAc1.3: Optimize Energy Performance – HVAC: Through increased HVAC equipment efficiencies and appropriate zoning and controls, which result in HVAC performance above ASHRAE 90.1-2007, projects are eligible for up to 10 points.

Recommendations for Tenant HVAC Systems:

- High SEER condensing units – minimum 14 SEER.
- Air source heat pump heating.
- Electronically Controlled Motors (ECM) in fan coils.
- Demand ventilation controls with CO2 sensors.

EAc1.4: Optimize Energy Performance – Equipment and Applications : Selecting energy-efficient equipment and appliances, as qualified by EPA's Energy Star Program, can contribute up to 4 points.

EAc2: On-Site Renewable Energy

Intent To encourage and recognize increasing levels of on-site renewable energy self-supply to reduce environmental and economic impacts associated with fossil fuel energy use.

LEED-CD 150 Second did not pursue this credit.

LEED-CI On-site renewable energy is covered under LEED-CI SSc1: Site Selection, where tenants earn five points for locating in a LEED-CS building.

EAc5: Measurement and Verification (LEED-CI, EAc3)

Intent To provide for the ongoing accountability of building energy consumption over time.

LEED-CS 150 Second did not pursue this credit.

LEED-CI Tenants attempting LEED-CI at 150 Second can earn points by providing ongoing accountability and optimization of their energy and water consumption over time. 150 Second has provided tenants a lease agreement in which energy costs are paid by the tenants and not included in the base rent, making the tenants eligible for three points in LEED-CI (EAc3-Measurement & Verification). Furthermore, the base building central monitoring system allows tenants the ability to easily install submetering devices within their space.

EAc6: Green Power (LEED-CI, EAc4)

Intent To encourage the development and use of grid-source, renewable energy technologies on a net-zero pollution basis.

LEED-CS 150 Second did not pursue this credit.

LEED-CI Tenants attempting LEED-CI at 150 Second can earn five points by engaging in a 2 year renewable energy contract through LEED-CI EAc4. The contract amount must be for at least 50% of the energy consumed in the tenant space for at least 8 kilowatt hours per square foot of tenant space.

Materials and Resources (MR)

MRp1: Storage and Collection of Recyclables

Intent Facilitate the reduction of waste generated by building occupants that is hauled to and disposed of in landfills.

LEED-CS 150 Second provides a centrally located, easily accessible area for recycling of paper, cardboard, glass, plastics and metals, for the base building and tenant occupants. The recycling storage area is located at Room 119 near the loading dock.

LEED-CI Tenants attempting LEED-CI at 150 Second are provided with an easily accessible dedicated area for tenants recycling (paper, corrugated cardboard, glass, plastics and metals). This is a prerequisite in the LEED-CI rating system (MRp1) and LEED-CI projects will automatically earn this prerequisite. Tenants are strongly encouraged to create a dedicated recycling area on each floor to facilitate efficient sorting and recycling of waste materials.

MRc1.1: Tenant Space – Long-term Commitment (LEED-CI Only)

Intent To encourage choices that conserve resources, reduce waste and the environmental impacts of tenants related to materials, manufacturing and transportation.

LEED-CS There is no related LEED-CS credit.

LEED-CI Tenants attempting LEED-CI at 150 Second are encouraged to pursue a ten-year lease. Doing so will help earn LEED-CI MRc1.1.

MRc1.2: Building Reuse – Maintain Interior Nonstructural Elements

Intent To reduce the environmental impact of new construction by salvaging old building stock.

LEED-CS 150 Second did not pursue this credit.

LEED-CI Tenants LEED-CI at 150 Second may earn a point for the interior salvage of the floors, walls and doors, as long as tenants preserve these elements during fit-out. Projects can up to two points for MRc1.2: Building Reuse-Maintain Interior Nonstructural Components for maintain 40% or 60% of interior components.

MRc2: Construction Waste Management

Intent Divert Construction and demolition debris from disposal in landfills and incinerators. Redirect recyclable recovered resources back to the manufacturing process. Redirect reusable materials to appropriate sites.

LEED-CS 150 Second implemented a Construction Waste Management Plan that resulted in diverting over 95% of the project's construction and demolition waste from being disposed in landfills.

LEED-CI Tenants attempting LEED-CI at 150 Second can develop and implement their own construction waste management plan during the construction of the tenant space, and by recycling 50% or 75% of construction, demolition and packaging debris, tenants can qualify for up to two points for MRc2.1: Construction Waste Management.

MRc3: Materials Reuse (LEED-CI, MR3.1)

Intent To reduce the environmental impact of new construction by salvaging materials.

LEED-CS 150 Second did not pursue this credit.

LEED-CI Tenants attempting LEED-CI at 150 Second can earn up to two LEED-CI points under MRc3.1: Materials Reuse by using salvaged old doors and windows to make interior partitions, and an additional credit for MRc3.2: Materials Reuse – Furniture and Furnishing for reusing furniture.

MRc3.2: Materials Reuse – Furniture and Furnishing (LEED-CI Only)

Intent To reduce the environmental impact of new construction by salvaging materials.

LEED-CS There is no related LEED-CS credit.

LEED-CI Tenants attempting LEED-CI at 150 Second can refurnish, reuse or salvage 30% of their total furniture cost to earn an additional LEED-CI point.

MRc4: Recycled Content

Intent Increased demand for building products that incorporate recycled content materials, thereby reducing impacts resulting from extraction and processing of virgin materials.

LEED-CS 150 Second specified the use of a minimum of 20% of building materials (by cost) as recycled materials, containing post-consumer or post-industrial recycled content.

LEED-CI Tenants attempting LEED-CI at 150 Second can specify 10% – 20% of materials to have recycled content, out of the total amount of construction materials and furnishings, the tenant can achieve two LEED points through MRc4: Recycled Content. Consider specifying products such as structural steel, gypsum board and concrete to have high-recycled content.

MRc5: Regional Materials

Intent Increase demand for building materials and products that are extracted and manufactured within the region, thereby supporting the use of indigenous resources and reducing the environmental impacts resulting from transportation.

LEED-CS 150 Second specified the use of a minimum of 10% of building materials (by cost) to be regionally extracted and manufactured (within 500 miles of the site).

LEED-CI Tenants attempting LEED-CI at 150 Second can specify 20% of the combined value of construction materials and furnishings to be manufactured regionally (within 500 miles of the site) to earn a LEED-CI point for MRc5: Regional Materials. If 10% of those materials are also extracted, harvested or recovered from within 500 miles of the project, tents earn an additional point under MRc5, Option 2.

MRc6: Rapidly Renewable Materials (LEED-CI Only)

Intent To reduce the environmental impact of finite raw materials that have long-cycles of growth.

LEED-CS There is no related LEED-CS credit.

LEED-CI Tenants attempting LEED-CI at 150 Second are encouraged to specify a minimum of 5% of the total value of all building materials from rapidly renewable sources to earn a LEED-CI point through MRc6: Rapidly Renewable Materials. Rapidly renewable materials are agricultural products, either fiber or animal, which take ten years or less to grow or raise and then harvested in an ongoing and sustainable fashion. Bamboo, wool, carpets, cork, rubber, strawboard and wheatboard are all examples of rapidly renewable resources.

MRc6: Certified Wood (LEED-CI, MRc7)

Intent Encourage environmentally responsible forest management.

LEED-CS 150 Second specified a minimum of 50% of wood-based products to be harvested in accordance with the Forest Stewardship Council's (FSC) Principles and Criteria, for base building wood components. FSC certification means that the forest managers employed environmentally and socially responsible forest management practices. FSC wood has been specified for base building finishes such as the lobby wall paneling and cabinetry.

LEED-CI Tenants attempting LEED-CI at 150 Second are encouraged to specify certified wood for new wood products and materials for their space. A minimum of 50% of certified wood used in the project is required to achieve a LEED-CI point through
MRc7: Certified Wood.

Indoor Environmental Quality (IEQ)

IEQp1: Minimum Indoor Air Quality Performance

Intent To establish minimum indoor air quality (IAQ) performance to enhance indoor air quality in buildings, thus contributing to the comfort and well-being of the occupants.

LEED-CS 150 Second has met the requirements of Section 4 through 7 of ASHRAE Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality for the base building, and goes beyond the ventilation rates required by the prerequisite to provide 30% more ventilation than required by the ASHRAE standard. The base building HVAC system supports this design by providing at least 20 cubic feet per minute of outside air per person, based on standard occupancy densities. The tenants from this by increased productivity.

LEED-CI Tenants attempting LEED-CI at 150 Second are required to supply minimum levels of ventilation through compliance with ASHRAE 62.1-2007. Depending on the location of the tenant spaces, tenants may need to provide adequate ventilation for their spaces to meet LEED-CI IEQp1: Minimum Indoor Air Quality Performance. Some spaces in the tenant building will automatically comply, others will need to provide ventilation in their own spaces. Contact building management for details on your tenant space.

IEQp2: Environmental Tobacco Smoke Control

Intent To minimize exposure of building occupants, indoor surfaces and ventilation air distribution systems to environmental tobacco smoke (ETS).

LEED-CS 150 Second has prohibited smoking inside the building, and prohibited smoking on the property from within 25 feet of entries, outdoor air intakes and operable windows.

LEED-CI Tenants attempting LEED-CI at 150 Second will automatically comply with this prerequisite, through LEED-CI IEQp2: Environmental Tobacco Smoke Control,

due to the building's no smoking policy. Tenants are prohibited from smoking within the building and have ben provided designated smoking areas which are at least 25 feet away from building entries, outdoor air intakes and operable windows. Signage indicating that smoking is not allowed within 25 feet of the all entrances will be provided for the entire building.

IEQc1: Outdoor Air Delivery Monitoring

Intent To provide capacity for ventilation system monitoring to help promote occupant comfort and well-being.

LEED-CS 150 Second has installed a permanent monitoring system to ensure that ventilation systems in all public spaces maintain design minimum requirements. This has been accomplished through the incorporation of CO2 monitoring devices and outdoor airflow measurement devices within the base building. Furthermore, the installed system in the base building is capable of being expanded to provide CO2 monitoring within the tenant spaces.

LEED-CI Tenants attempting LEED-CI at 150 Second can achieve one point for installing permanent ventilation monitoring systems within their tenant space, through IEQc1: Outdoor Air Delivery Monitoring.

IEQc2: Increased Ventilation

Intent To provide additional outdoor air ventilation to improve indoor air quality (IAQ) and promote occupant comfort, well-being and productivity.

LEED-CS 150 Second has increased breathing zone outdoor air ventilation rates to all occupied spaces by at least 30% above the minimum rates required by ASHRAE 62.1-2007 for the base building. Furthermore, the base building systems have provided tenants with the ability to achieve LEED-CI, IEQc2: Increased Ventilation within their space by providing increased ventilation for each zone.

LEED-CI Tenants attempting LEED-CI at 150 Second can achieve one point, through LEED-CI IEQc2: Increased Ventilation, by providing additional air ventilation through appropriate mechanical or natural ventilation design strategies. The base building has provided the ability to easily facilitate increased ventilation within the tenant space.

IEQc3: Construction Indoor Air Quality Management Plan – During Construction

(LEED-CI, IEQc3.1)

Intent To reduce indoor air quality (IAQ) problems resulting from construction or renovation and promote the comfort and well-being of construction workers and building occupants.

LEED-CS 150 Second has developed and implemented an IAQ management plan for the construction and pre-occupancy phases for the base building. As a result, the base building has provided a healthy indoor environment for tenants as they commence occupancy in their space. Measures taken as part of the IAQ plan included enclosed space ventilation, protection of absorption materials from moisture damage, replacement of filters prior to occupancy, among other requirements from the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) guidelines.

LEED-CI Tenants attempting LEED-CI at 150 Second may achieve one point, through LEED-CI IEQc3.1: Construction IAQ Management Plan – During Construction, for developing and implementing their own IAQ management plan for the construction and preoccupancy phases of the tenant space.

IEQc3.2: Construction Indoor Air Quality Management Plan – Before Occupancy

Intent To reduce indoor air quality (IAQ) problems resulting from construction or renovation to promote the comfort and well-being of construction workers and building occupants.

LEED-CS There is no related LEED-CD credit.

LEED-CI Tenants attempting LEED-CI at 150 Second may achieve one point by performing a building flush-out or air testing the tenant space to ensure a healthy indoor environment.

IEQc4.1: Low-Emitting Materials-Adhesives & Sealants

Intent To reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.

LEED-CS 150 Second has complied with the applicable volatile organic compound (VOC) requirements for all adhesives and sealants installed within the weather barrier for the base building. As a result, the base building has provided a healthy indoor environment for tenants as they commence occupancy in their space.

LEED-CI Tenants attempting LEED-CI at 150 Second may achieve one point by ensuring that all adhesives and sealants installed within the tenant space comply with the applicable VOC limits.

IEQc4.2: Low-Emitting Materials – Paints and Coatings

Intent To reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.

LEED-CS 150 Second has complied with the applicable volatile organic compound (VOC) requirements for all paints and coatings installed within the weather barrier for the base building. As a result, the base building has provided a healthy indoor environment for tenants as they commence occupancy in their space.

LEED-CI Tenants attempting LEED-CI at 150 Second may achieve one point by ensuring that all paints and coatings installed within the tenant space comply with the applicable VOC limits.

IEQc4.3: Low-Emitting Materials – Flooring Systems

Intent To reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.

LEED-CS 150 Second has complied with the applicable standards for all flooring systems installed within the weather barrier for the base building. As a result, the base building has provided a healthy indoor environment for tenants as they commence occupancy for their space.

LEED-CI Tenants attempting LEED-CI at 150 Second may achieve one point by ensuring that all flooring systems installed within the tenant space comply with the applicable standards.

IEQc4.4: Low-Emitting Materials – Composite Wood and Agrifiber Product

Intent To reduce the quantity of indoor air contaminant that are odorous, irritating and/ or harmful to the comfort and well-being of installers and occupants.

LEED-CS All composite wood and agrifiber products used on the interior of 150 Second have contained no added urea-formaldehyde resins for the base building. As a result, the base building has provided a healthy indoor environment for tenants as they commence occupancy in their space.

LEED-CI Tenants attempting LEED-CI at 150 Second may achieve one point by ensuring that all composite wood and agrifiber products installed within tenant space contain no added urea-formaldehyde resins.

IEQc4.5: Low-Emitting Materials – Systems Furniture and Seating (LEED-CI Only)

Intent To reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.

LEED-CS No related LEED-CS credit.

LEED CI Tenants attempting LEED-CI at 150 Second may achieve one point by ensuring that all systems furniture and seating installed within the tenant space comply with the applicable standards.

IEQc5: Indoor Chemical and Pollutant Source Control

Intent To minimize building occupant exposure to potentially hazardous particulates and chemical pollutants.

LEED-CS 150 Second has complied with the applicable measures for indoor chemical and pollutant source control for the base building.

LEED-CI Tenants attempting LEED-CI at 150 Second may achieve one point by minimizing and controlling the entry of pollutants into the tenant space through the employment of all applicable requirements of LEED-CI IEQc5: Indoor Chemical and Pollutant Source Control. The base building has provided a permanent entryway system at all major entrances, sufficient exhaust and sealing of housekeeping and janitorial rooms, MERV-13 filtration on air handling units and closed containment systems for all hazardous liquid wastes. In addition, tenants are required to provide a 10-foot long entryway system for all main entrances.

IEQc6.1: Controllability of Systems – Lighting

Intent To provide a high level of lighting system control by individual occupants or groups in multi-occupant spaces (e.g., classrooms and conference areas) and promote their productivity, comfort and well-being.

LEED-CS There is no related LEED-CS credit.

LEED-CI Tenants attempting LEED-CI at 150 Second may achieve one point by providing individual lighting control for at least 90% of occupants of the tenant space and for all multi-occupant spaces.

IEQc6: Controllability of Systems – Thermal Comfort (LEED-CI, IEQc6.2)

Intent To provide a high level of thermal comfort control by individual occupants or groups in multi-occupant spaces (e.g. classrooms and conference areas) and promote their productivity, comfort and well-being.

LEED-CS 150 Second did not pursue this credit.

LEED-CI Tenants attempting LEED-CI at 150 Second may achieve one point by providing individual thermal comfort controls for at least 50% of occupants of the tenant space and for all multi-occupant spaces.

IEQc7: Thermal Comfort – Design (LEED-CI, IEQc7.1)

Intent To provide a comfortable thermal environment that promotes occupant productivity and well-being.

LEED-CS 150 Second has designed and installed the HVAC system and building envelope to meet the requirements of ASHRAE-55-2004 for the base building. ASHRAE-55 requires the regulation of temperature and humidity levels within the building based on climate zone. The base building has provided the ability for tenants to comply with the requirements of ASHRAE 55-2004 during build-out of their tenant space.

LEED-CI Tenants attempting LEED CI at 150 Second will achieve one point by demonstrating that the HVAC system meets the requirements of ASHRAE-55-2004.

IEQc7.2: Thermal Comfort – Verification (LEED-CI Only)

Intent To provide for the assessment of building occupants' comfort over time.

LEED-CS There is no related LEED-CS credit.

LEED-CI Tenants attempting LEED-CI at 150 Second can achieve one point by meeting the following requirements:

- Achieving IEQc7.1
- Providing a permanent monitoring system and process for corrective action to ensure that building performance meets the desired comfort criteria.
- Conduct a thermal comfort survey of tenant space occupants within 6-18 months after occupancy.

IEQc8.1: Daylight and Views – Daylight

Intent To provide occupants with a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the building.

LEED-CS 150 Second did not pursue this credit.

LEED-CI Tenants attempting LEED-CI at 150 Second will achieve one point by providing sufficient daylight to at least 75% of regularly spaces. To do so tenants must be sure that their fit-out does not compromise the daylight provided by the base building, new simulations may need to be run.

IEQc8.2: Daylight and Views – Views

Intent To provide occupants with a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the building.

LEED-CS 150 Second has achieved direct views to the outdoor environment through vision glazing for 91% of regularly occupied areas. The calculation of views for tenant spaces was done using a feasible tenant layout per the default occupancy counts.

LEED-CI Tenants attempting LEED-CI at 150 Second will achieve one point by providing direct views to the outdoor environment through vision glazing for at least 90% of regularly occupied areas. To do so tenants must be sure that their fit-out does not compromise the views provided by the base building. Tenants should consider using an open plan, desk partitions less than 42” in height in areas where views to the outside area possible, and glass partitions around common meeting areas.

Innovation in Design (ID)

IDc1: Innovation in Design

Intent To provide design teams and projects the opportunity to be awarded points for exceptional performance above the requirements set by LEED and to develop innovation ideas in green building categories not specifically addressed by LEED.

LEED-CS 150 Second has four points in the LEED ID category:

- The base building has achieved exemplary performance under SSc4.1.
- The base building has achieved exemplary performance under MRc2.
- The base building has achieved exemplary performance under SSc2.
- The base building participated in Pilot Credit 12 Reduced Automobile Dependence.

LEED-CI Tenants attempting LEED-CI at 150 Second are encouraged to achieve all four ID credits through creative design and management of their built-out space.

IDc2: LEED Accredited Professional

Intent To support and encourage the design integration required by LEED green buildings and to streamline the application and certification process.

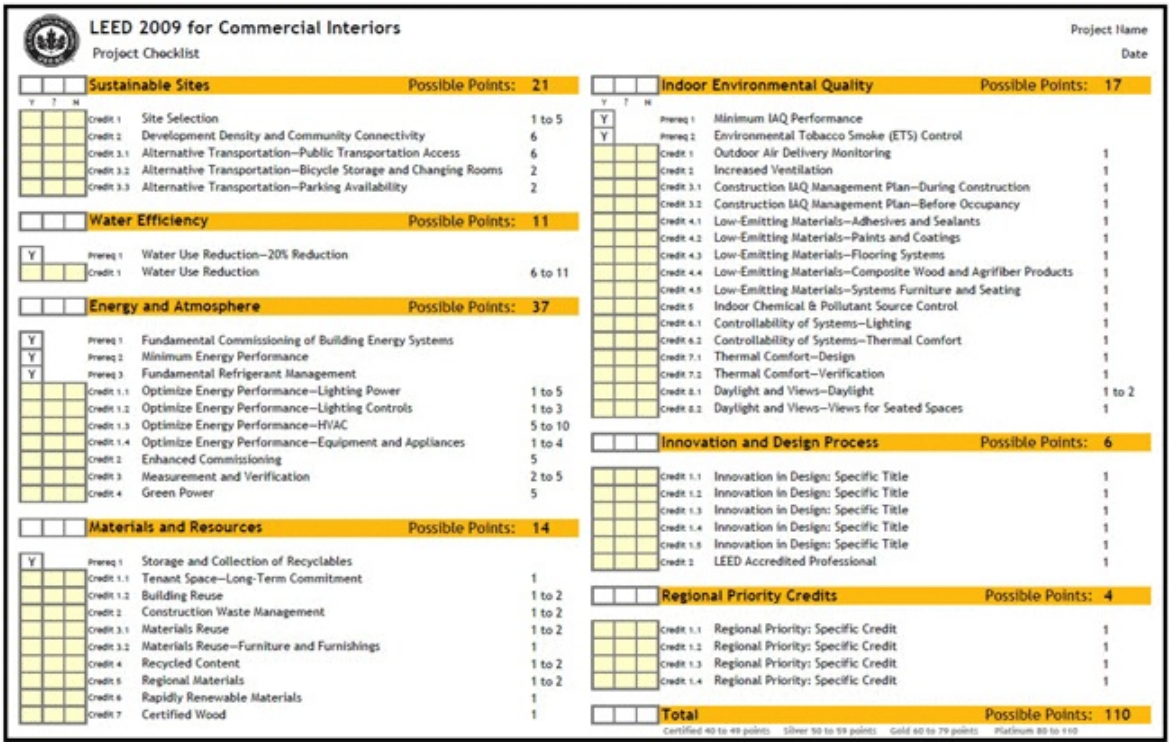
LEED-CS 150 Second has accomplished this through the participation of many LEED Accredited Professionals on the design team and a sustainability consultant. The use of a LEED-AP as a responsible member of the design team for the base building and any tenant improvements will help ensure that the design and material specifications for the project will properly address the established sustainable design criteria for the project.

LEED-CI Tenants attempting LEED-CI at 150 Second are encouraged to include at least one principle participant on the project team, who has successfully completed the LEED Accredited Professional exam. Tenants can achieve one point for LEED-CI.

Appendix A: Reference Material

Tenants should refer to the link below for a reference guide for the LEED 2009 for Commercial Interiors (LEED-CI) Rating System.
http://www.usgbc.org/ShowFile.aspx?DocumentID=5543

For reference, tenants should see to the LEED-CI 2009 Scorecard below.



LEED 2009 for Commercial Interiors

Project Checklist

Project Name

Date

Y	?	N			
			Sustainable Sites	**Possible Points:**	**21**
			Credit 1	Site Selection	1 to 5
			Credit 2	Development Density and Community Connectivity	6
			Credit 3.1	Alternative Transportation—Public Transportation Access	6
			Credit 3.2	Alternative Transportation—Bicycle Storage and Changing Rooms	2
			Credit 3.3	Alternative Transportation—Parking Availability	2
			Water Efficiency	**Possible Points:**	**11**
Y			Prereq 1	Water Use Reduction—20% Reduction	
			Credit 1	Water Use Reduction	6 to 11
			Energy and Atmosphere	**Possible Points:**	**37**
Y			Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
			Credit 1.1	Optimize Energy Performance—Lighting Power	1 to 5
			Credit 1.2	Optimize Energy Performance—Lighting Controls	1 to 3
			Credit 1.3	Optimize Energy Performance—HVAC	5 to 10
			Credit 1.4	Optimize Energy Performance—Equipment and Appliances	1 to 4
			Credit 2	Enhanced Commissioning	5
			Credit 3	Measurement and Verification	2 to 5
			Credit 4	Green Power	5
			Materials and Resources	**Possible Points:**	**14**
Y			Prereq 1	Storage and Collection of Recyclables	
			Credit 1.1	Tenant Space—Long-Term Commitment	1
			Credit 1.2	Building Reuse	1 to 2
			Credit 2	Construction Waste Management	1 to 2
			Credit 3.1	Materials Reuse	1 to 2
			Credit 3.2	Materials Reuse—Furniture and Furnishings	1
			Credit 4	Recycled Content	1 to 2
			Credit 5	Regional Materials	1 to 2
			Credit 6	Rapidly Renewable Materials	1
			Credit 7	Certified Wood	1

Y	?	N			
			Indoor Environmental Quality	**Possible Points:**	**17**
Y			Prereq 1	Minimum IAQ Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
			Credit 1	Outdoor Air Delivery Monitoring	1
			Credit 2	Increased Ventilation	1
			Credit 3.1	Construction IAQ Management Plan—During Construction	1
			Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
			Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1
			Credit 4.2	Low-Emitting Materials—Paints and Coatings	1
			Credit 4.3	Low-Emitting Materials—Flooring Systems	1
			Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1
			Credit 4.5	Low-Emitting Materials—Systems Furniture and Seating	1
			Credit 5	Indoor Chemical & Pollutant Source Control	1
			Credit 6.1	Controllability of Systems—Lighting	1
			Credit 6.2	Controllability of Systems—Thermal Comfort	1
			Credit 7.1	Thermal Comfort—Design	1
			Credit 7.2	Thermal Comfort—Verification	1
			Credit 8.1	Daylight and Views—Daylight	1 to 2
			Credit 8.2	Daylight and Views—Views for Seated Spaces	1
			Innovation and Design Process	**Possible Points:**	**6**
			Credit 1.1	Innovation in Design: Specific Title	1
			Credit 1.2	Innovation in Design: Specific Title	1
			Credit 1.3	Innovation in Design: Specific Title	1
			Credit 1.4	Innovation in Design: Specific Title	1
			Credit 1.5	Innovation in Design: Specific Title	1
			Credit 2	LEED Accredited Professional	1
			Regional Priority Credits	**Possible Points:**	**4**
			Credit 1.1	Regional Priority: Specific Credit	1
			Credit 1.2	Regional Priority: Specific Credit	1
			Credit 1.3	Regional Priority: Specific Credit	1
			Credit 1.4	Regional Priority: Specific Credit	1
			Total	**Possible Points:**	**110**

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

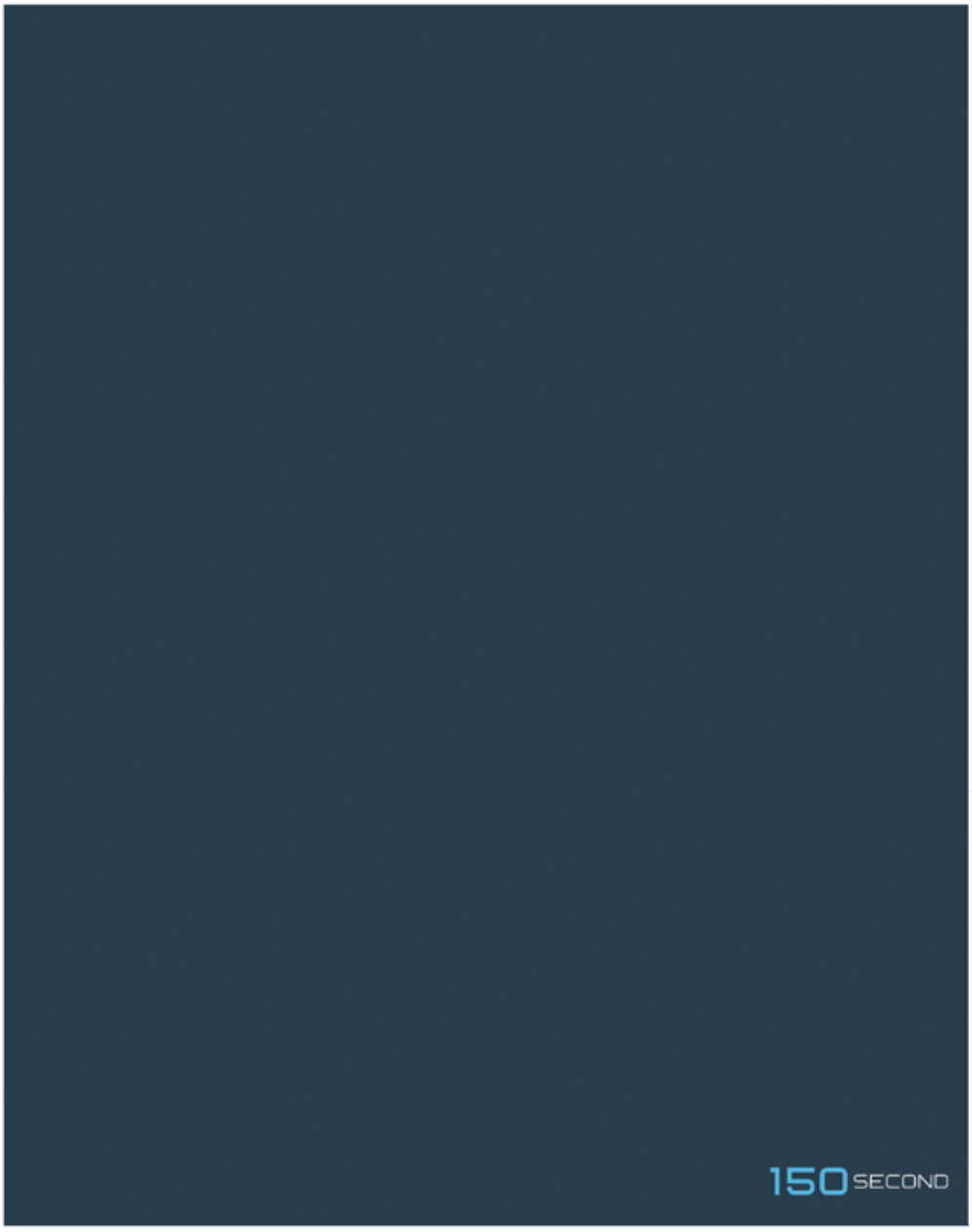

150 SECOND

EXHIBIT I TO LEASE

PARKING PLAN

Exhibit I

Surface Parking Spaces at 29 Charles Street

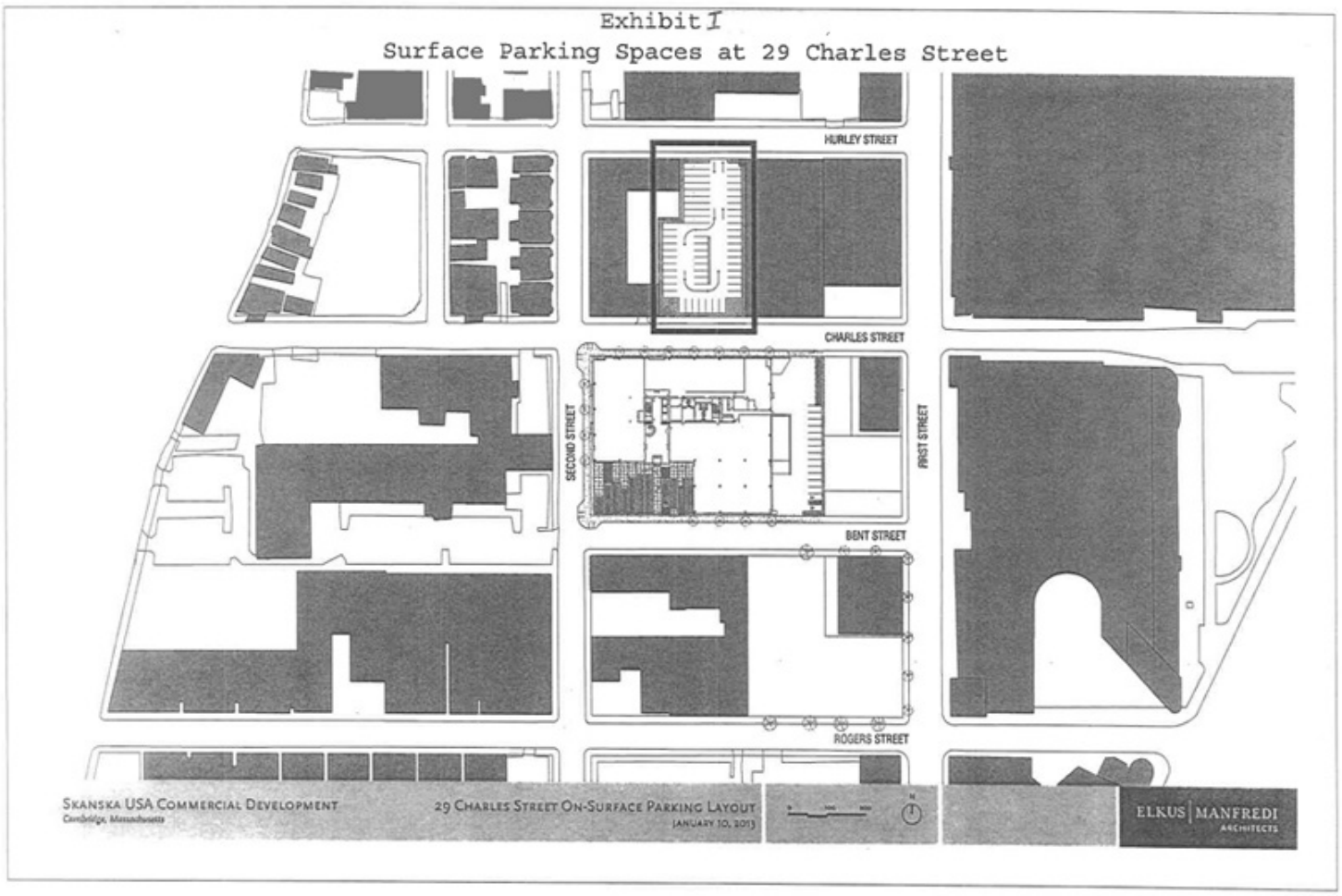


EXHIBIT J TO LEASE

RULES AND REGULATIONS

Tenant (and tenant employees and contractors) shall faithfully observe and comply with the following Rules & Regulations:

1. The sidewalks, entrances, service elevator lobby, corridors, stairwells, and fire exits of the building shall not be encumbered by any tenant or its agents, employees, licensees or guests or shall be used for tenant's premises provided that the stairwells may be so used.
2. All deliveries to and removals from the building of furniture, equipment and supplies shall be by way of the loading dock – a platform (delivery entrance) located at the ground level of the building and accessible from the street and then only during such hours as may be prescribed by the owner's representative (Monday through Friday, 7AM – 5PM). During such hours there shall be no separate charge to tenant for the normal use of the loading dock or freight elevator. Tenant shall be responsible for any loss, cost or damage suffered or incurred as a result of or arising from deliveries and/or removals after such hours.
3. The loading dock and service elevator are for pick ups and deliveries only. Due to limited space at the loading dock, there is a vehicle parking limit of thirty (30) minutes, provided other deliveries are waiting, unless special arrangements are made with the Property Management Office. Persons using service elevators will sign in at the security desk in the main lobby and be issued a floor pass. Each tenant will supply a list of authorized employees that require access to the freight elevators.
4. All incoming and outgoing shipments must be moved directly, by the delivery or pick up agent from the delivery entrance: such shipments will not be held at the delivery entrance. Building operating personnel are not authorized to sign receipt for shipments to or from the building.
5. Furniture, equipment and supplies and other packaged materials and items requiring the use of a hand truck, pallet truck or other type of wheeled transport, shall be moved only upon the service elevator.
6. All large deliveries, pick ups, moves and removal of demolition materials must be transported on the service elevator ***after hours***, with prior approval of the owner's representative and at the expense of the tenant. The removal of demolition material and the delivery of sheet rock will require the smoke detectors in the freight elevators to be disabled.

7. No hand truck, pallet truck or other type of wheeled transport shall be used in the lobbies, corridors or elevators of the building other than in the loading dock corridor to and including the freight elevator.

8. The owner's representative reserves the right to inspect all items to be brought into the building and to exclude from the building all items which violate any provision of the rules and regulations or which may, in the reasonable judgment of the owner's representative, constitute a hazard or danger to the building, its equipment or occupants.

9. Any damage to the building or any part thereof caused by the moving in our out of the building of furniture, equipment, supplies, or other items, shall be repaired by the owner's representative at the expense of the tenant responsible.

10. Tenant shall notify the property management office when safes or other heavy equipment, except in the ordinary course of tenant's business operations in accordance with its permitted use, are to be taken in or out of the building, and such moving shall only be done after written permission is obtained from the property management office on such conditions, as the property management office shall require. Additional costs related to the installation of such equipment, shall, as for elevator use or window removal, will be borne by tenant.

11. All construction and demolition work requires a written request to be approved by the property management office who will act reasonably in connection therewith. Tenant and tenant's contractor will be required to follow the 150 Second Street Tenant Improvement Rules and Regulations that is available upon request at the property management office. Upon completion of approved work, if applicable, Tenant must provide "As-Built" drawings in both CAD and black line form to the owner's representative.

12. Access to the area above the ceiling must be scheduled and approved by the property management office. All ceiling tiles must be back in place by the end of the working day.

13. The property management office reserves the right to control and operate the public portions of the building and the public facilities, as well as the facilities furnished for the common use of the tenants, in such manner as they deem best for the benefit of the tenants.

14. The property management office reserves the right to exclude from the building, during non-business hours, all persons who do not present a valid building access photo id card that are not otherwise escorted by a Tenant representative.

15. The property management office must be given advance written notification of any after-hour functions requiring access via loading dock or building services. Tenant shall reimburse the owner's representative for any third party out of pocket costs incurred in connection with these services.

16. No additional locks or bolts of any kind shall be placed upon any of the doors in any tenant's premises and no lock on any door therein shall be changed or altered in any respect without property management approval. In the case where tenant has equipment in the MEP rooms, card readers are to be installed by tenant, and a room access list provided to building management.

17. No acids, vapors, or other materials shall be discharged into non-designated waste lines, vents or flues of the building. The water wash closets and other plumbing fixtures in or serving any tenant's premises (not specifically designed for this purpose) shall not be used for any purpose other than that for which they were designed or constructed, and no sweeping shall be deposited therein. The property management office shall repair any damage resulting to the same from misuse by a tenant, at the expense of the tenant.

18. If a tenant's premises becomes infested with vermin, such tenant, at its sole cost and expense, unless it is clearly determined that the same has been caused entirely by others, shall cause it premises to be exterminated by such exterminators as shall be approved by the property management office at such times and to such extent as the property management office deems necessary.

19. No part of the tenant's premises shall be occupied at any time as sleeping quarters and no part of the building shall be used for gambling or for any immoral or unlawful purposes or practices. No intoxicating liquor shall be sold in any part of the building unless allowed by the lease agreement.

20. No animals or birds, bicycles, skate boards, in-line skater or other vehicles shall be allowed in the corridors, lobbies, elevators, sidewalks, walkways, gardens, or elsewhere in or around the building (provided that animals related to vivarium usage may be housed in the vivarium in tenant's premises and transported in the freight elevator). Bicycle storage is available at the designated areas in the garage and at the front entrance by the canopy.

21. Canvassing, soliciting or peddling in the building is prohibited and each tenant shall cooperate to prevent the same.

22. A building directory with the names of the tenants will be provided and maintained by the property management office. The property management office at the tenant's expense will make changes in the directory, within a reasonable time period after written notice from the tenant.

23. Tenants may be requested to assign from their employees, personnel to perform specific tasks required by the building's emergency evacuation plan. Person so assigned shall be made available from time to time for instructions by the building life safety director.

24. Access to building tele/com centers and closets will be provided by building security only. Anyone requesting access must have a valid id from the telecommunication company that employs them or be listed on the approved access list that is maintained at the property management office. Tenant may elect to install a card reader and provide documentation of appropriate personnel training to allow authorization for room access.

25. Building maintenance will provide access to the building electric closets. Tenants will be required to notify the property management office by electronic mail should a vendor require access. All tenant vendors must have a valid id from the company that employees them or be listed on the approved access list that is maintained at the property management office. Tenant may elect to install a card reader and provide documentation of appropriate personnel training to allow authorization for room access.

26. Portable electric heaters, fans or desktop heating appliances (coffee cup warmers) are not allowed inside any tenant spaces or common areas within the building, unless approved by the property management office.

27. Prior written approval, which shall be at the sole discretion of the property management office, must be obtained for installation of any window shades, blinds, drapes or any other window treatment of any kind; provided however, the foregoing restriction shall not apply to any of such items that are installed as part of Tenant's Work in conformity with the Plans.

28. Plumbing, fixtures and appliances shall be used only for the purpose for which constructed, no other unsuitable material shall be placed therein.

29. Owner and property management office shall have the right to prescribe the weight and position of heavy equipment or objects, which may overstress any portion of the floors of the premises. All damage done to the building by the improper placing of such heavy items will be repaired at the sole expense of the tenant.

30. No nails, hooks or screws shall be driven into or inserted in any part of the building except as approved by the property management office, permitted by tenant's lease, or as reasonably necessary to permit tenant to hang pictures and other wall decorations or wall hangings (e.g., whiteboards, corkboards, signs, shelves, etc.) within the premises.

31. Tenant shall comply with all requirements necessary for the security of the premises, including the use or property removal passes for the removal of office equipment/packages, and use of security control cards for access to the building at all times.

32. Smoking is not permitted in the 150 Second Street common areas including exterior entrances, vestibules, corridors, restrooms, stairwells and parking garage. Additionally, smoking is not allowed within 25 feet of the front of the entrance of the building as well as the loading dock entrance. Tenant must comply with requests by the owner's representative concerning informing their employees of items of importance to the owner.

33. All doors opening to public corridors shall be kept closed at all times except for normal ingress and egress to the premises, unless electrical holdbacks have been installed.

34. Owner reserves the right to close and keep locked all entrance and exit doors during hours when the building is closed. Access to the building may be refused unless person seeking access has proper identification or has previously arranged a pass for access to the building. The owner and its representative shall in no case be liable for damages for any error with regard to the admission to or exclusion from the building of any person. In case of invasion, mob, riot, public excitement or other commotion, owner reserves the right to prevent access to the building during the continuance of it by any means it deems appropriate for the safety and protection of life and property.

35. No furniture, freight, equipment or other bulky matter will be brought into or removed from the building or carried up or down in elevators, except upon prior notice to the property management office and in such manner, in such specific elevator, and between such hours as shall be reasonably designated by the owner; *provided however*, (i) the foregoing restrictions shall not apply to items brought into the building in connection with Tenant's Work, or (ii) for items delivered to the Premises on a recurring basis, such approval need only be obtained from Landlord once. Tenant shall provide the property management office with reasonable prior notice of the need to utilize the elevator for any such purpose, so as to provide owner with a reasonable period to schedule such use and to install such padding or take such other actions or prescribe such procedures as are appropriate to protect against damage to the elevators or other parts of the building.

36. Tenant shall not disturb, solicit or canvass any occupant of the building and shall cooperate with the owner or owner's agent to prevent it.

37. The toilet rooms, urinals, wash bowls and other apparatus shall not be used for any purpose other than that for which they were constructed and no foreign substance of any kind whatsoever shall be thrown therein.

38. Tenant shall not use any method of heating or air conditioning other than that which is supplied by the owner without the prior written consent of the owner.

39. Cooking shall not be permitted or done by any tenant on the premises, nor shall the premises be used for the storage of merchandise for lodging of for any improper objectionable or immoral purposes. Notwithstanding the foregoing, laboratory approved equipment and microwave ovens and/or small toaster ovens may be used on the premises for heating food and brewing coffee, tea, hot chocolate and similar beverages, provided that such use is in accordance with applicable federal, state and city laws, codes, ordinances, rules and regulations, and does not cause odors which are objectionable to owner and other tenants.

40. Owner will approve where and how telephone wires are to be introduced to the premises. No boring or cutting for wires shall be allowed without the consent of the owner. The location of telephone, call boxes and other office equipment affixed to the premises shall be subject to the approval of the owner.

41. Tenant, it's employees and agents shall not loiter in the entrances or corridors, nor in any way obstruct the sidewalks, lobby, halls, stairwells or elevators and shall use the same only as a means of ingress and egress for the premises.

42. Tenant shall store all trash and garbage within the interior of the premises. No material shall be placed in the trash boxes or receptacles if material is of such nature that it may not be disposed of in the ordinary and customary manner of removing and disposing of trash and garbage in the City of Cambridge without violation of any law or ordinance governing such disposal. All trash, garbage and refuse disposal shall be made only through entryways and elevators provided for such purposes at such times, as owner shall designate. Building has a compactor that is maintained and operated by building management.

43. Tenant shall assume any and all responsibility for protecting the premises form theft, robbery and pilferage, which includes keeping doors locked and other means of entry to the premises closed, when the premises are not occupied.

44. Owner may waive any one or more of these Rules and Regulations for the benefit of any particular tenant or tenants. This shall not prevent the owner from thereafter enforcing any such Rules and Regulations against any or all tenants of the building.

45. No awnings or other projects shall be attached to the outside walls of the building without the prior written consent of the owner. No curtains, blinds, shades or screens shall be attached to or hung in, or used in connection with any window or door of the premises without prior written consent of the owner. All electrical ceiling fixtures hung in offices or spaces along the perimeter of the building must be fluorescent and/or of a quality, type, design and bulb color approved by the owner.

46. Food vendors shall be allowed in the 150 Second Street building upon receipt of a written request from the tenant. The food vendor shall service only the tenants that have a written request on file in the property management office. Under no circumstances shall the food vendor display their products in a public or common area including corridors and elevator lobbies. Any failure to comply with this rule shall result in the immediate permanent withdrawal of the vendor from 150 Second Street.

47. Tenant shall comply with any non smoking ordinances adopted by any applicable governmental authority. In addition, owner reserves the right to designate in owner's sole discretion, the only outside areas of the premises where smoking shall be permitted.

48. Owner and its agent have the right to evacuate 150 Second Street in the event of an emergency or catastrophe.

49. Provided such changes are not in conflict with the terms of this Lease and that Landlord provides prior written notice of such change, Owner and its agent reserves the right at any time to change or rescind any one or more of these Rule and Regulations or to make such other further reasonable Rules and Regulations as in owner's judgment may from time to time be necessary for the management, safety, care and cleanliness of the premises and building, and for the preservation of good order therein, as well as for the convenience of other occupants and tenants. Owner shall not be responsible to tenant or to any other person for the non-observance of the Rules and Regulations and tenant shall agree to abide by these rules as a condition of its occupancy of the premises.

Exhibit 23.1

Consent of Independent Registered Public Accounting Firm

We consent to the reference to our firm under the caption “Experts” and to the use of our report dated March 21, 2013, except for Note 16(B), as to which the date is June 3, 2013, in Amendment No. 2 to the Registration Statement (Form S-1 No. 333-188605) and related Prospectus of bluebird bio, Inc.

/s/ Ernst & Young LLP

Boston, Massachusetts
June 3, 2013

Exhibit 23.2

Consent of Independent Registered Public Accounting Firm

We consent to the use in this Registration Statement on Form S-1 of bluebird bio, Inc. of our report dated March 21, 2013 (June 3, 2013 for Note 16(B)), relating to our audit of the consolidated financial statements, appearing in the Prospectus, which is part of this Registration Statement.

We also consent to the reference to our firm under the captions “Experts” in such Prospectus.

/s/ McGladrey LLP

Boston, Massachusetts
June 3, 2013