

bluebird bio, Inc.
Form S-1/A
June 04, 2013
Table of Contents

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) 840 Memorial Drive, 4th Floor Cambridge, MA 02139 (617) 491-5601	(I.R.S. Employer Identification Number)

(Address, including zip code, and telephone number, including area code, of registrant's principal executive offices)

Edgar Filing: bluebird bio, Inc. - Form S-1/A

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)

Copies to:

Michael H. Bison, Esq.

Goodwin Procter LLP

Exchange Place

53 State Street

Boston, MA 02109

(617) 570-1000

Patrick O Brien, Esq.

Ropes & Gray LLP

Prudential Tower

800 Boylston Street

Boston, MA 02199

(617) 951-7000

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.

Edgar Filing: bluebird bio, Inc. - Form S-1/A

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	Proposed	Amount of Registration Fee(3)
		Maximum Offering	Maximum Aggregate Offering Price(2)	
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.

Table of Contents

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
, 2013

Wedbush PacGrow Life Sciences

Table of Contents**Table of contents**

	Page
<u>Prospectus summary</u>	1
<u>The offering</u>	9
<u>Summary consolidated financial data</u>	11
<u>Risk factors</u>	13
<u>Cautionary note regarding forward-looking statements</u>	53
<u>Use of proceeds</u>	55
<u>Dividend policy</u>	57
<u>Capitalization</u>	58
<u>Dilution</u>	60
<u>Selected consolidated financial data</u>	62
<u>Management's discussion and analysis of financial condition and results of operations</u>	64
<u>Business</u>	93
<u>Management</u>	150
<u>Executive and director compensation</u>	160
<u>Certain relationships and related party transactions</u>	172
<u>Principal stockholders</u>	175
<u>Description of capital stock</u>	179
<u>Shares eligible for future sale</u>	185
<u>Material U.S. federal income tax considerations for non-U.S. holders</u>	188
<u>Underwriting</u>	192
<u>Legal matters</u>	198
<u>Experts</u>	198
<u>Where you can find more information</u>	198
<u>Glossary</u>	199

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.

Table of Contents

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 β -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.

Table of Contents

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, β -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 β -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, β -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

Table of Contents

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.

Table of Contents

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

Table of Contents

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 β -thalassemia and SCD. β -thalassemia is a rare hereditary blood disorder caused by a genetic abnormality of the β -globin gene resulting in defective red blood cells. Symptoms of β -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 β -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 β -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 β -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 β -globin gene, referred to as T87Q, into the patient's own HSCs via an HIV-1 based lentiviral vector to restore expression of the β -globin protein required for hemoglobin production. The codon variant is also used as a biomarker to quantify expression levels of β -globin protein derived from the vector (β^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 β -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 β -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 β -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 β -thalassemia major, which we refer to as the HGB-204 Study. Up to 15 adults will be enrolled to evaluate production of hemoglobin containing

Table of Contents

β^A -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.

Table of Contents

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.

Table of Contents

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.

Table of Contents

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;

Table of Contents

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.

Table of Contents**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.

(in thousands, except per share data)	2011	Year ended December 31, 2012	2012	Three months ended March 31, 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