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

FORM 8-K

CURRENT REPORT

Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934

Date of Report (Date of earliest event reported): June 23, 2017

bluebird bio, Inc.
(Exact name of Registrant as Specified in Its Charter)

DELAWARE	001-35966	13-3680878
(State or Other Jurisdiction of Incorporation)	(Commission File Number)	(IRS Employer Identification No.)
60 Binney Street, Cambridge, MA (Address of Principal Executive Offices)		02142 (Zip Code)

Registrant's Telephone Number, Including Area Code: (339) 499-9300

Not Applicable
(Former Name or Former Address, if Changed Since Last Report)

Check the appropriate box below if the Form 8-K filing is intended to simultaneously satisfy the filing obligation of the registrant under any of the following provisions (see General Instructions A.2. below):

☐ Written communications pursuant to Rule 425 under the Securities Act (17 CFR 230.425)
☐ Soliciting material pursuant to Rule 14a-12 under the Exchange Act (17 CFR 240.14a-12)
☐ Pre-commencement communications pursuant to Rule 14d-2(b) under the Exchange Act (17 CFR 240.14d-2(b))
☐ Pre-commencement communications pursuant to Rule 13e-4(c) under the Exchange Act (17 CFR 240.13e-4(c))

Indicate by check mark whether the registrant is an emerging growth company as defined in as defined in Rule 405 of the Securities Act of 1933 (§ 230.405 of this chapter) or Rule 12b-2 of the Securities Exchange Act of 1934 (§ 240.12b-2 of this chapter).

Emerging growth company ☐

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

Item 7.01 Regulation FD Disclosure

On June 23, 2017, bluebird bio, Inc. ("bluebird") will be conducting meetings with investors in connection with its announcement of updated clinical data at the 22nd Congress of the European Hematology Association. As part of these meetings, bluebird will deliver the slide presentation furnished to this report as Exhibit 99.1 and which is incorporated by reference herein.

See Item 8.01 below, which is incorporated by reference herein.

The information in Item 7.01 of this Report on Form 8-K and Exhibit 99.1 attached hereto is intended to be furnished and shall not be deemed "filed" for purposes of Section 18 of the Securities Exchange Act of 1934 (the "Exchange Act') or otherwise subject to the liabilities of that section, nor shall it be deemed incorporated by reference in any filing under the Securities Act of 1933 or the Exchange Act, except as expressly set forth by specific reference in such filing.

Item 8.01 Other Events

On June 23, 2017, bluebird issued two press releases announcing updated clinical data from the Northstar-2 and HGB-205 studies of its LentiGlobin product candidate in transfusion-dependent β-thalassemia and severe sickle cell disease, being presented at the 22nd Congress of the European Hematology Association. The full text of bluebird's press releases regarding the announcements are filed as Exhibits 99.2 and 99.3 to this Current Report on Form 8-K and is incorporated herein by reference.

Item 9.01 Financial Statements and Exhibits.

(d) Exhibits

Exhibit No.	Description
99.1	Investor presentation provided by bluebird bio, Inc. on June 23, 217
99.2	Press release issued by bluebird bio, Inc. on June 23, 2017
99.3	Press release issued by bluebird bio, Inc. on June 23, 2017

SIGNATURES

Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned hereunto duly authorized.

Date: June 23, 2017

bluebird bio, Inc.

By:/s/ Jason F. Cole
Jason F. Cole
Chief Legal Officer

EXHIBIT INDEX

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Exhibit 99.1

bluebirdbio®

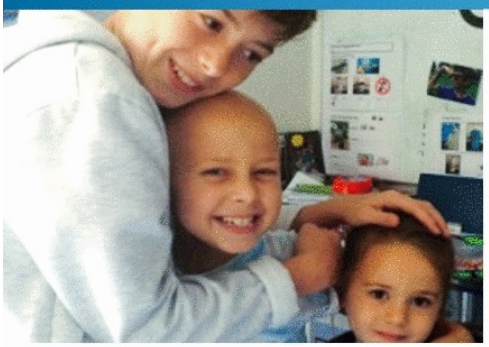
EHA 2017

June 23, 2017

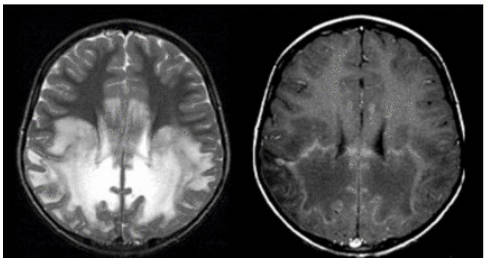
Forward Looking Statements

These slides and the accompanying oral presentation contain forward-looking statements and information. The use of words such as “may,” “might,” “will,” “should,” “expect,” “plan,” “anticipate,” “believe,” “estimate,” “project,” “intend,” “future,” “potential,” or “continue,” and other similar expressions are intended to identify forward-looking statements. For example, all statements we make regarding 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, and the timing or likelihood of regulatory filings and approvals are forward looking. All forward-looking statements are based on estimates and assumptions by our management that, although we believe to be reasonable, are inherently uncertain. All forward-looking statements are subject to risks and uncertainties that may cause actual results to differ materially from those that we expected. These statements are also subject to a number of material risks and uncertainties that are described in our most recent quarterly report on Form 10-Q, as well as our subsequent filings with the Securities and Exchange Commission. Any forward-looking statement speaks only as of the date on which it was made. We undertake no obligation to publicly update or revise any forward-looking statement, whether as a result of new information, future events or otherwise, except as required by law.

Our Vision: Make Hope a Reality

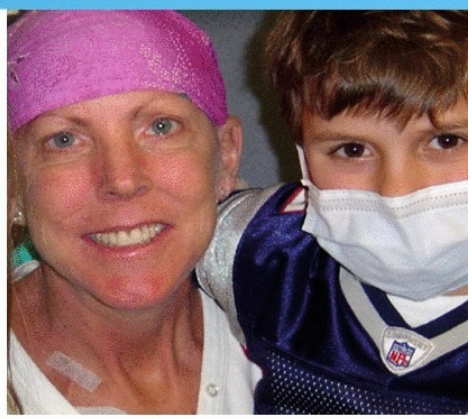


OUR PATIENTS

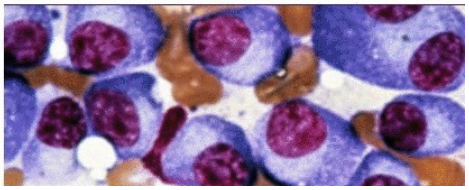


BLUE MOJO

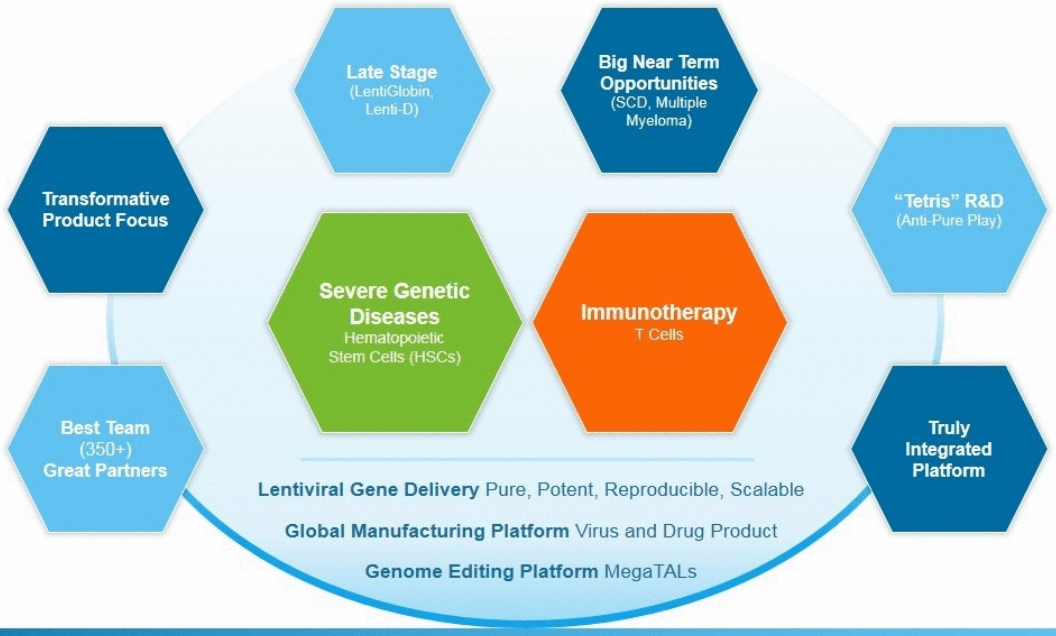
TRUE BLUE



OUR PEOPLE



Our Strategic Intent

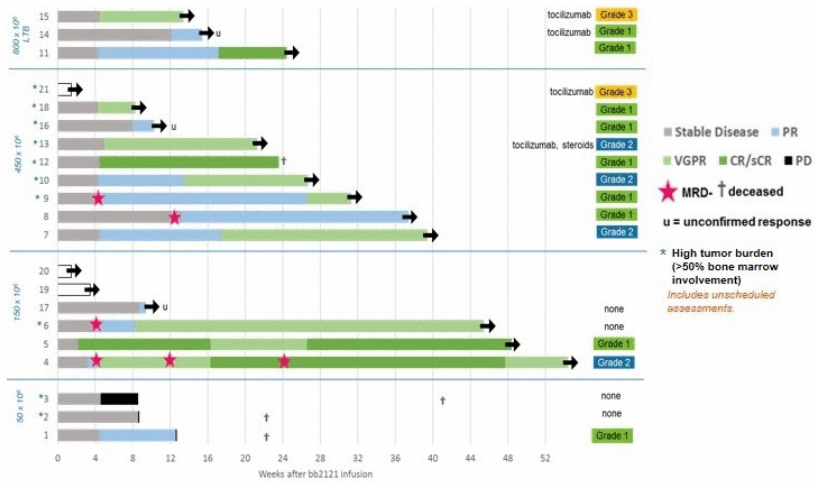



World-class Gene Therapy Platform and Integrated Global Capabilities
2022
THE GENE THERAPY PRODUCT COMPANY
Patient Impact
2+ Products on the Market
2+ Programs Nearing Commercialization
4+ Additional Programs in the Clinic

How Do We Get There?

Data, Execution and Development in 2017

CRB-401: All bb2121 Patients in Active Dose Cohorts Achieved an Objective Response, Duration up to 54 Weeks



bb2121 has induced durable and deepening responses in a heavily pre-treated population (median 7 prior therapies) with relapsed/refractory multiple myeloma, including:

- 100% ORR, 73% VGPR or better, 27% CR (at doses > 50 x 10^6)
- MRD negative results in all evaluable patients (N=4)
- No disease progression in patients treated with doses > 50 x 10^6, with 1 patient past 1 year and 8 patients past 6 months

To date, the safety profile of bb2121 has been manageable at all tested doses

- No DLTs
- The 2 reported events of grade 3 CRS resolved within 24 hours
- No grade 3/4 neurotoxicity reported

Data Presented at ASCO 2017; Data Cutoff of May 4, 2017

LentiGlobin Clinical Studies

NORTHSTAR (HGB-204)

- Phase 1/2 multicenter study; all genotypes
- All 18 patients treated, with ≥ 6 months follow-up
- 2 patients have completed 2-year analysis

HGB-205 (TDT and SCD)

- Phase 1/2 single-center study; all genotypes
- 4 TDT patients treated, with 11 – 33 months follow-up

HGB-206 (Severe SCD)

- Open label, multicenter, U.S. based study
- N=29 adults

NORTHSTAR-2 (HGB-207)

- Phase 3, global, multicenter study; non-β^0/β^0 genotypes
- N=15 adults and adolescents, and N=8 pediatric patients
- *First study to use new manufacturing process*

NORTHSTAR-3 (HGB-212)

- Phase 3, multicenter, global study; β^0/β^0 genotypes
- N=15 adults, adolescents and pediatric patients
- **Initiation planned for 2017**

Key Questions

Transfusion-Dependent β-thalassemia (TDT): Northstar-2 and HGB-205

- With our new manufacturing process in Northstar-2, are we able to consistently manufacture drug product (DP) with higher vector copy number (VCN) and proportion of transduced cells?
- How do the early results from Northstar-2…
  - Compare to the results seen in non-β^0/β^0 patients in HGB-204?
  - Read through to β^0/β^0 patients?
  - Read through to SCD patients?
- What can we learn from the HGB-205 TDT patients?

Severe Sickle Cell Disease (SCD)

- How do the data from the HGB-205 patients compare to ASH 2016 data?
- What does HGB-205 teach us regarding the potential impact of the protocol and manufacturing changes made in HGB-206?

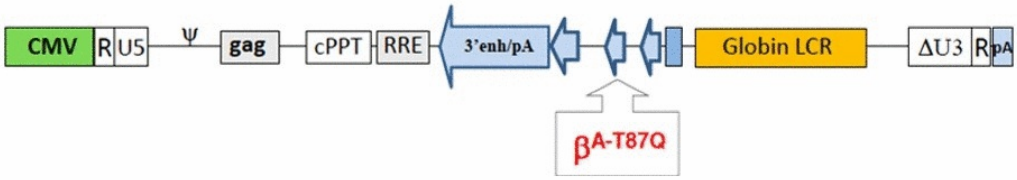
EHA 2017 Abstract S814

A Phase 3 Study to Evaluate Safety and Efficacy of LentiGlobin Gene Therapy for Transfusion-Dependent β-thalassemia in Patients with non-β^0/β^0 Genotypes: **The Northstar-2 (HGB-207) Trial**

Mark C. Walters, Alexis Thompson, Suradej Hongeng, Janet L. Kwiatkowski, Franco Locatelli, John Porter, Martin Sauer, Adrian Thrasher, Isabelle Thuret, Evangelia Yannaki, Alexandria Petrusich, Mohammed Asmal

Gene Therapy for Transfusion-Dependent β-thalassemia (TDT)

BB305 lentiviral vector



- Autologous gene therapy aims to correct TDT without the immunologic risks of allogeneic HSCT
- In Northstar (HGB-204) and HGB-205 phase 1/2 studies
  - LentiGlobin BB305 gene therapy has eliminated transfusions in most patients with non-β^0/β^0 genotypes
  - Patients with β^0/β^0 genotypes had a median 63% reduction in transfusion volume following treatment

  Key finding: Vector copy number (VCN) in drug product (DP) correlates with HbA^{T87Q} production
  - DP VCN in HGB-204 study was **0.3 – 1.5** copies/cell

Northstar-2 (HGB-207) Study of LentiGlobin BB305 Gene Therapy

- Investigating efficacy and safety of LentiGlobin BB305 in adolescents and adults with TDT and non-β^0/β^0 genotypes
- Uses refined manufacturing process to yield higher DP VCNs
- Primary endpoint: proportion of patients who achieve "transfusion independence" (TI)
  - TI = maintain an average Hb≥ 9 g/dL without RBC transfusions for ≥12 months

Data as of June 2, 2017

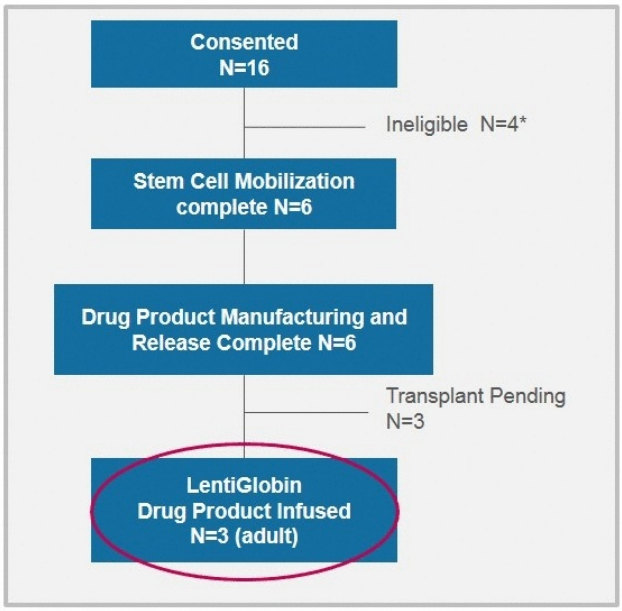
Current Status of Northstar-2 Study

Key enrollment criteria

- 12 to 50 years of age
- Non-β^0/β^0 genotype
- RBC requirement: ≥100 mL/kg/year (or ≥8 RBC transfusions/yr) for past 2 years
- Adequate organ function/performance status
- No previous stem cell transplant or gene therapy

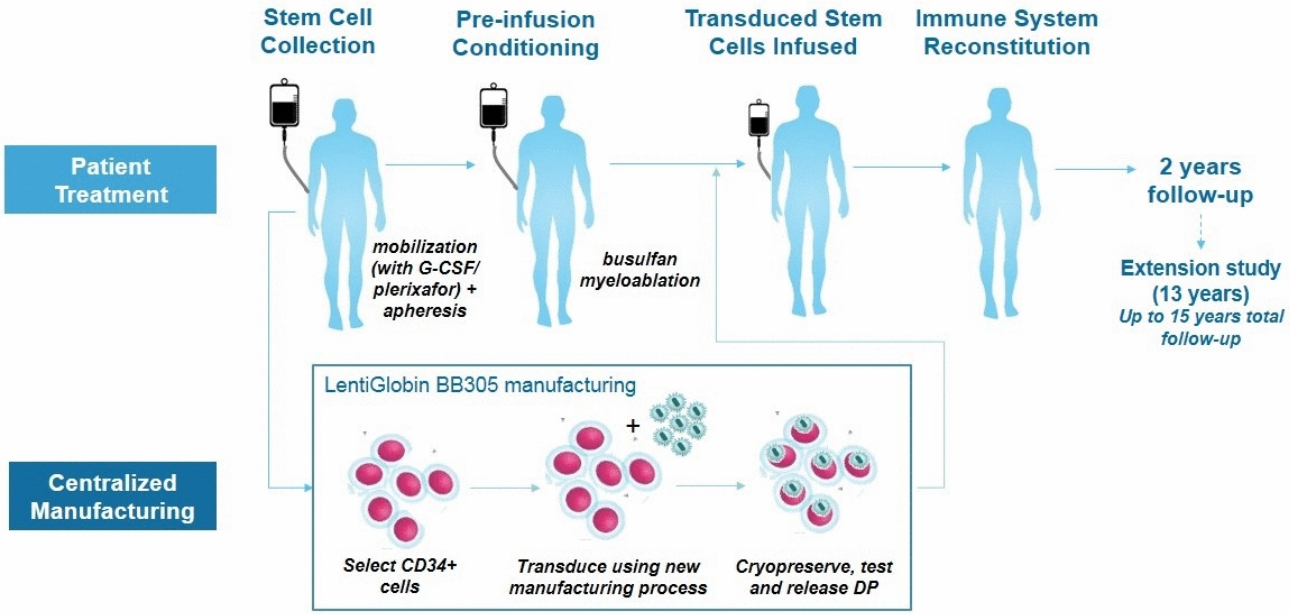
First patient infused December 2016

Target: 15 treated patients
(including ≥5 aged 12-17 years)



As of June 2, 2017
*reasons for ineligibility: 2 withdrew consent, 2 screen failure due to liver biopsy findings

Overview of the Northstar-2 Study Process



Northstar-2 Patient Characteristics

N=3 treated patients to date

Patient	1	2	3
Age (years)	20	20	22
Gender	F	F	F
Genotype	β^0/β^E	β^0/β^E	IVS-I-5 (G>C)
Pre-Treatment pRBC Transfusions (mL/kg/year)[1]	162.5	192.9	158.7
Liver Iron Concentration (mg/g) *(normal range <1.1 mg/g)*	18.8	19.6	1.4
Cardiac T2* (msec) *(normal range >20 msec)[2]*	42.5	45.3	36.3
Splenectomy	N	N	Y

[1] Garbowski, M. W. et al (2014). Journal of Cardiovascular Magnetic Resonance, 16:40
[2] Carpenter, J. P et al (2011). Circulation, 123:1519-1528

As of June 2, 2017

Initial Safety Summary & Treatment-related Parameters

N=3 treated patients

Patient	1	2	3
VCN in Drug Product[1]	2.9	2.4	3.2, 2.4
Vector positive cells	77%	53%	77%, 82%
CD34+ Cell Dose ($x10^6$/kg)	7.0	13.6	8.1
Busulfan AUC (μM*min)[2]	4286	4337	4562
Neutrophil engraftment, study day[3]	25	24	19
Platelet engraftment, study day[4]	44	45	35
Follow up (months)	6	3	2

As of June 2, 2017
1. VCN: vector copy number (vector copies per diploid genome)
2. Estimated average daily busulfan exposure over four days
3. ANC ≥ 500 for 3 consecutive days
4. Unsupported platelet count ≥ 20,000/μL

Grade ≥3 non-hematologic AEs [1, 2]

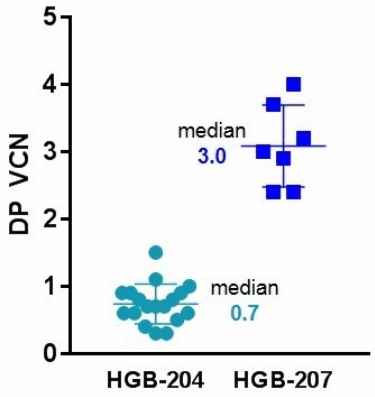
Patient	1	2	3
Follow up	**6 months**	**3 months**	**2 months**
Adverse events	none	**Hypotension** (SAE; Grade 3) **Epistaxis** (Grade 3)	**Mucositis** (Grade 3)

- No significant veno-occlusive disease (VOD) of the liver or infections post-treatment
- No drug product-related AEs

As of June 2, 2017
1. Hematological values typically decreased post-transplant are not shown
2. All AEs are reported from Day -8 to date of last contact (2-6 months)

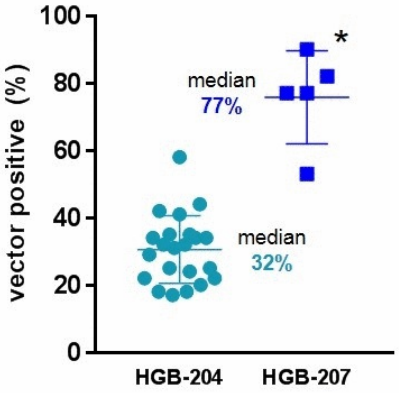
Improved Manufacturing Process Yields Higher Drug Product Vector Copy Number and Proportion of Transduced Cells

Vector copy number (VCN) in drug product



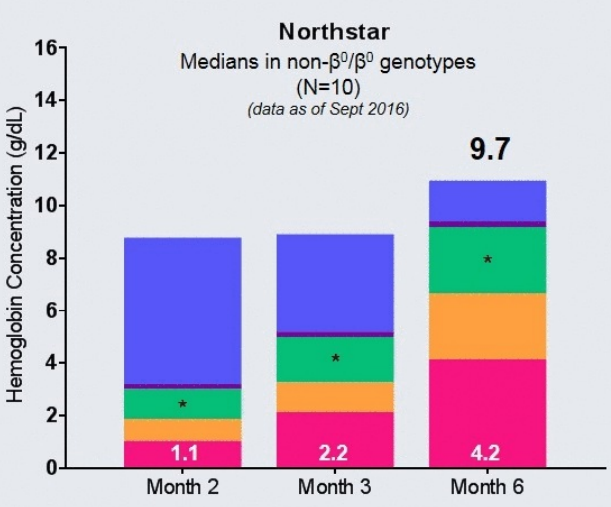
- DP VCN for initial 6 subjects manufactured in **Northstar-2** consistently higher than 18 subjects in **Northstar**
  - Northstar: median 0.7 (0.3 – 1.5)
  - Northstar-2 to date: **median 3.0** (2.4 – 4.0)
- Increased DP VCN in **Northstar-2** reflects higher proportion of transduced cells (% vector positive)
  - Northstar: median 32% (range 17% – 58%)
  - Northstar-2 to date: **median 77%** (range 53% – 90%)

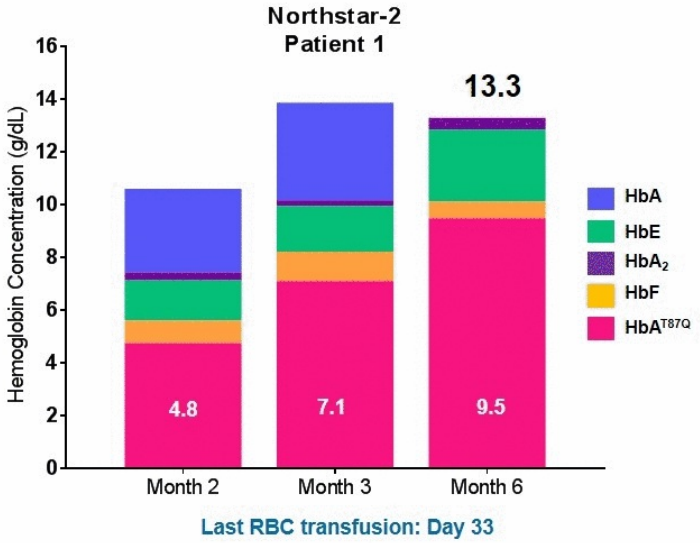
Proportion of CD34+ cells transduced



* Samples from EU manufacturing pending vector positive analysis

First Patient Treated in Northstar-2 with 6 Months Follow-up has Achieved Normal Total Hemoglobin After Discontinuing Transfusions

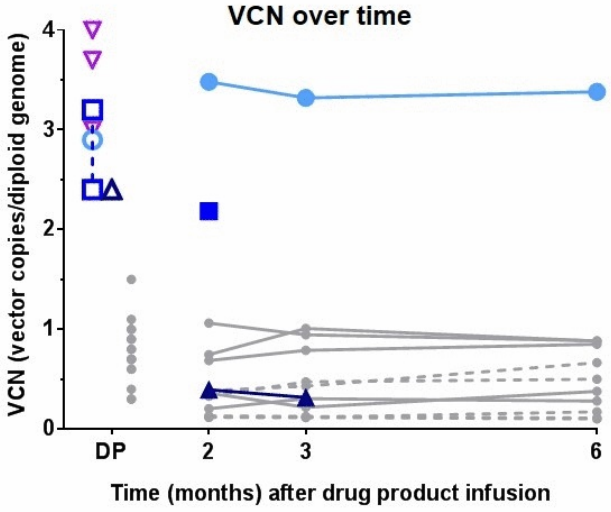


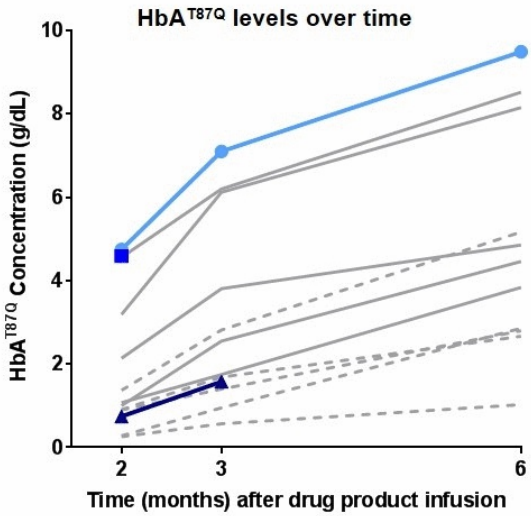


Last RBC transfusion: Day 33

* N=6 patients in Northstar study with HbE genotype

HbA^{T87Q} in Patients Treated in Northstar-2 Match or Exceed HbA^{T87Q} in Patients Achieving Early Transfusion Independence in Northstar



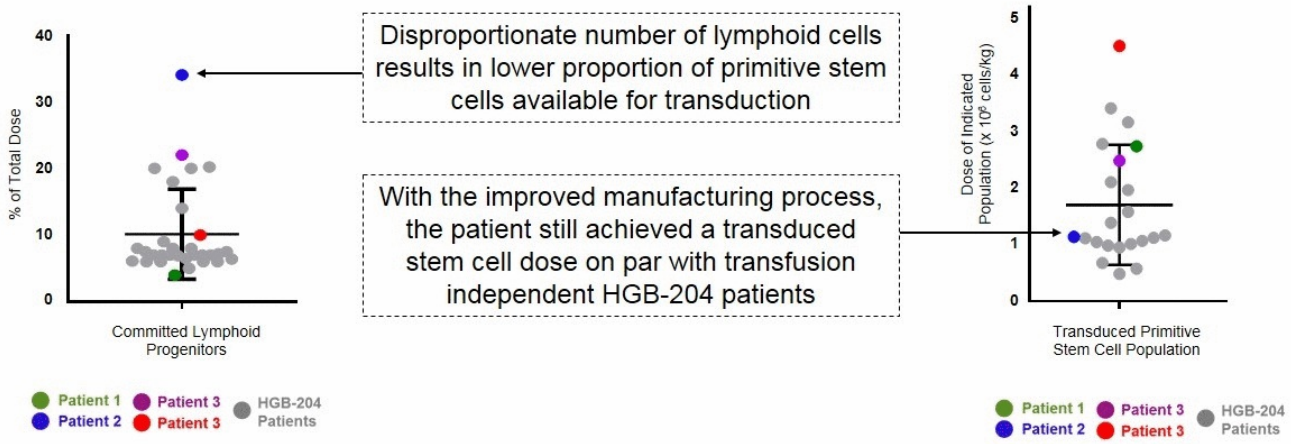


Northstar-2
Patient 1
Patient 2
Patient 3
DP lots for patients pending transplant

Northstar (non-β^0/β^0 patients only*)
DP lots for treated patients
Transfusion independent
Not yet TI evaluable

*Northstar data as of ASH 2016

Northstar-2 Patient 2: Phenotypic Profile of CD34+ Cells is Atypical



Summary and Next Steps

Northstar-2 Summary

- The improved manufacturing process in Northstar-2 consistently yields higher DP VCNs and proportions of cells transduced
- Initial results show that the 3 patients treated to date have achieved *in vivo* VCN and HbA^{T87Q} production as good or better than patients achieving transfusion independence in the first Northstar study
- No LentiGlobin-related AEs reported in Northstar-2 with 2 - 6 months follow-up
  - AE profile of LentiGlobin continues to appear similar to autologous HCT with myeloablative busulfan
  - Data on vector insertion pattern with higher DP VCN is pending

Next Steps

NORTHSTAR-3 STUDY

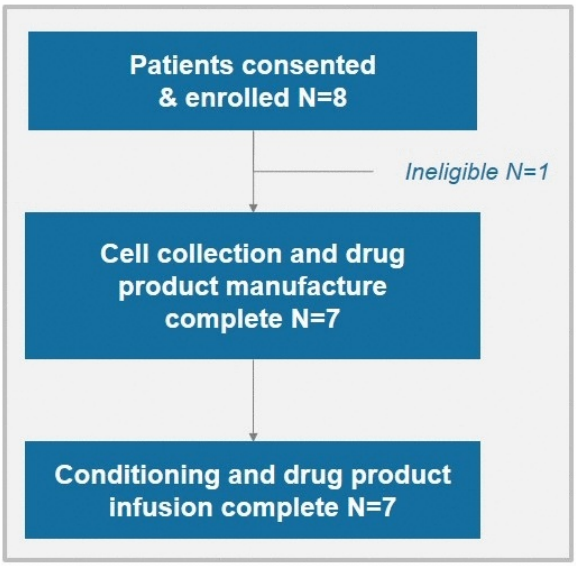
HGB-212
β^0/β^0 genotypes

Phase 3, multi-center, global study

- N=15 adults, adolescents and pediatric patients
- **Initiation planned for 2017**

HGB-205:
Transfusion-Dependent Thalassemia (TDT)

HGB-205: Study Status



Follow-up after drug-product infusion
for 7 treated patients
(4 TDT, 3 SCD)

Median: 23.4 months
range: 3.4 – 42.2 months

As of June 2, 2017

HGB-205 TDT: Patient and Drug Product Characteristics and Safety

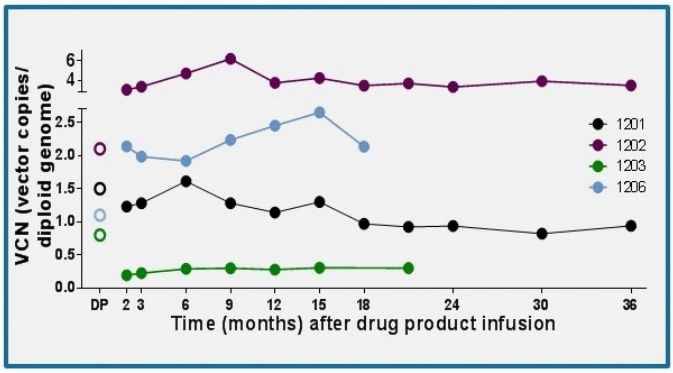
	1201	1202	1203	1206
Age at Enrollment (yrs)	18	16	19	17
Genotype	β^0/β^E	β^0/β^E	homozygous IVS1 nt 110 G>A	β^0/β^E
Pre-Treatment pRBC Transfusions (mL/kg/yr)[1]	139	188	176	189
VCN in Drug Product[2]	1.5	2.1	0.8	1.1
CD34+ Cell Dose ($x10^6$/kg)	8.9	13.6	8.8	12.0
Busulfan AUC (average, µM*min)	4,967	5,212	4,670	4,930
Follow-up (months)	**42.2**	**39.0**	**23.4**	**20.4**

[1]mean pRBC requirement per year, over the past 2 years prior to consent; [2]VCN = number of vector copies per diploid genome

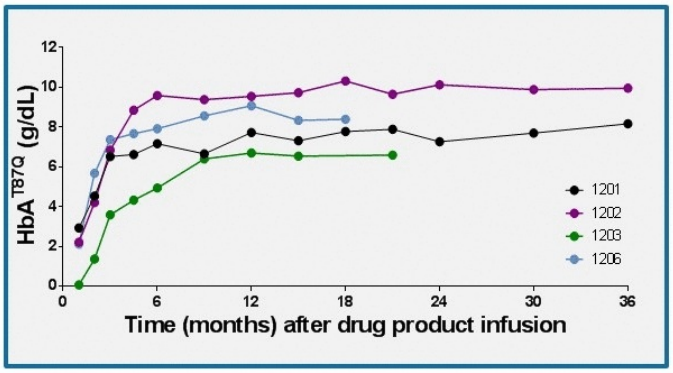
- Adverse events generally consistent with myeloablative conditioning
- No drug-product related non-hematologic AEs or SAEs
- No replication competent lentivirus (RCL) detected to date
- No evidence of insertional mutagenesis

HGB-205 TDT: Stable Peripheral VCN Over Time and Durable HbA^{T87Q} Production

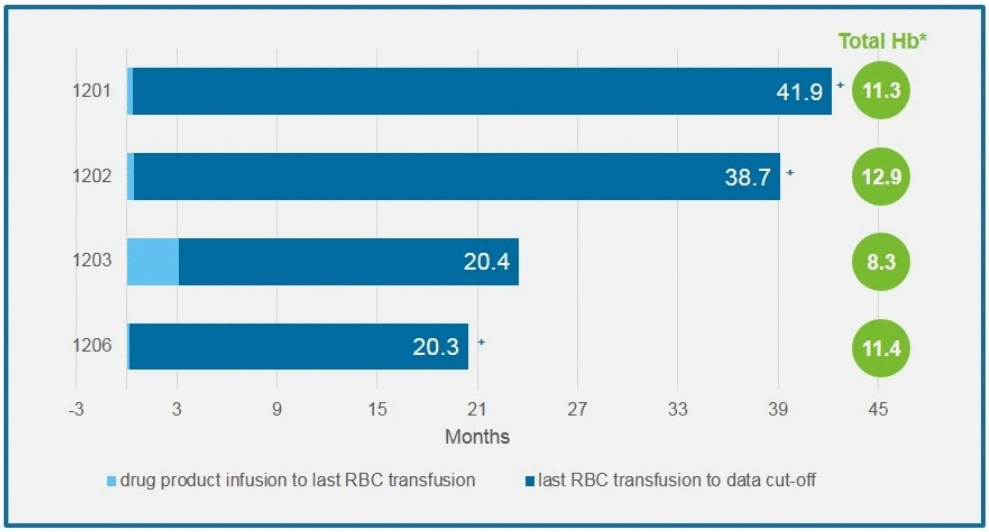
VCN over Time



HbA^{T87Q} Levels over Time



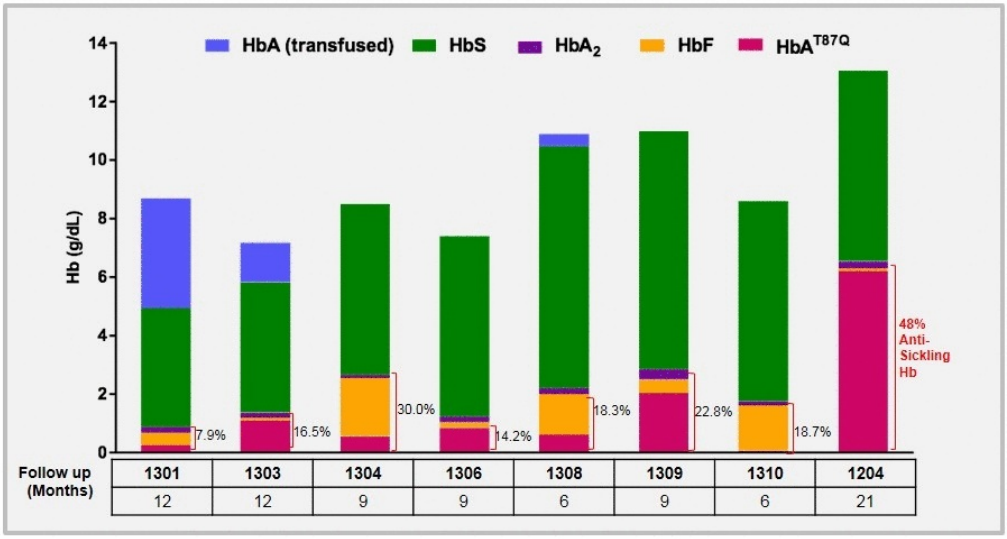
HGB-205 TDT: Consistent and Durable Transfusion Independence Up to 3.5 Years



*Hemoglobin (g/dL) at most recent study visit
+ Discontinued iron chelation and transitioned to therapeutic phlebotomy: Patients 1201 (started Aug. 2016), 1202 (started Nov. 2015), 1206 (started Oct. 2016)

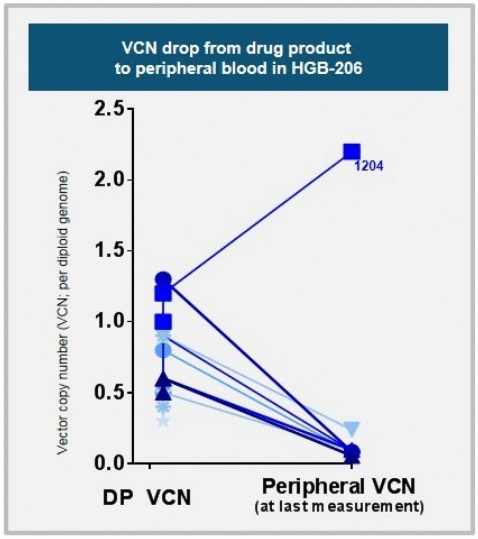
HGB-205:
Sickle Cell Disease (SCD)

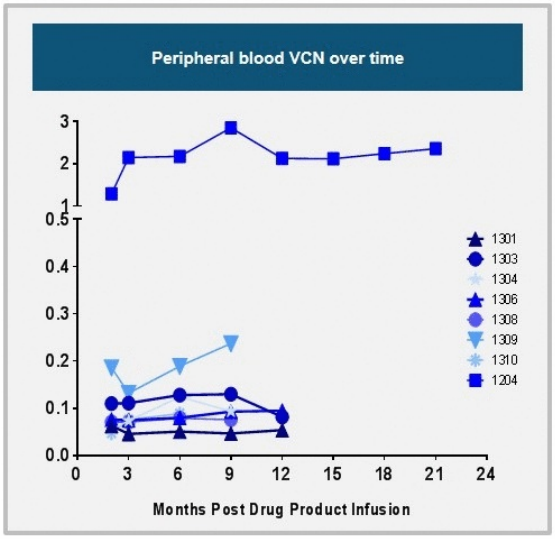
ASH 2016: 8% to 48% Anti-Sickling Hemoglobin at Last Follow Up



Data as of Sept 9, 2016 [HGB-205] and Nov 9, 2016 [HGB-206]

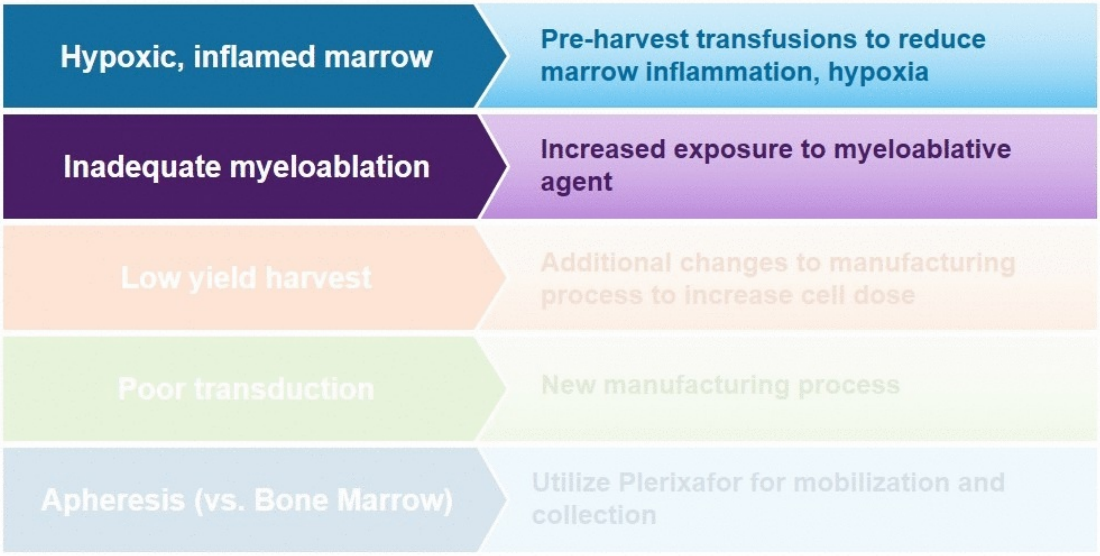
ASH 2016: Vector Copy Number (VCN) in Drug Product and Peripheral Blood





Data as of Sept 9, 2016 [HGB-205] and Nov 9, 2016 [HGB-206]

Protocol and Process Changes to Potentially Improve Outcomes in SCD Patients

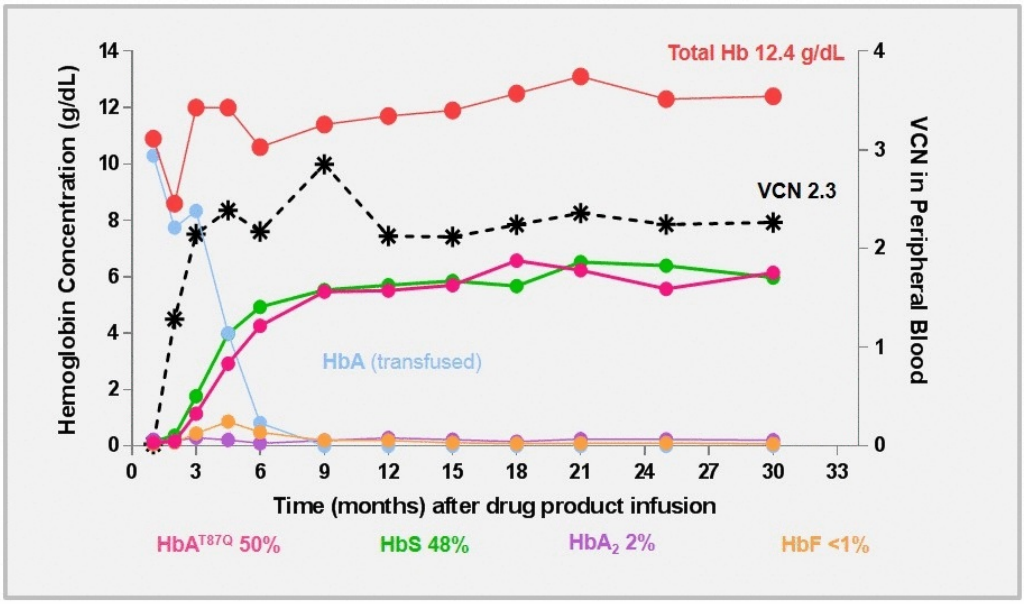


HGB-205 SCD: Patient and Drug Product Characteristics

	1204	1207	1208
Age at Enrollment (yrs)	13	16	21
Genotype	β^S/β^S	β^S/β^S	β^S/β^0
Busulfan AUC (average, μM*min)	4,841	5,022	5,447
CD34+ Cell Dose ($x10^6$/kg)	5.6	4.7	3.0
VCN in Drug Product[1]	1.0/1.2	0.7/1.0	0.8/0.5
Follow-up (months)	31.7	6.1	3.4
Neutrophil engraftment[2]	Day + 38	+ 27	+32
Platelet engraftment[3]	Day + 92	+ 51	+39

1. VCN: number of vector copies per diploid genome; 2. Absolute neutrophil count [AUC] ≥ 500 cells/μL for 3 consecutive days; 3. Unsupported platelet count ≥ 50,000/μL for 3 consecutive measures.

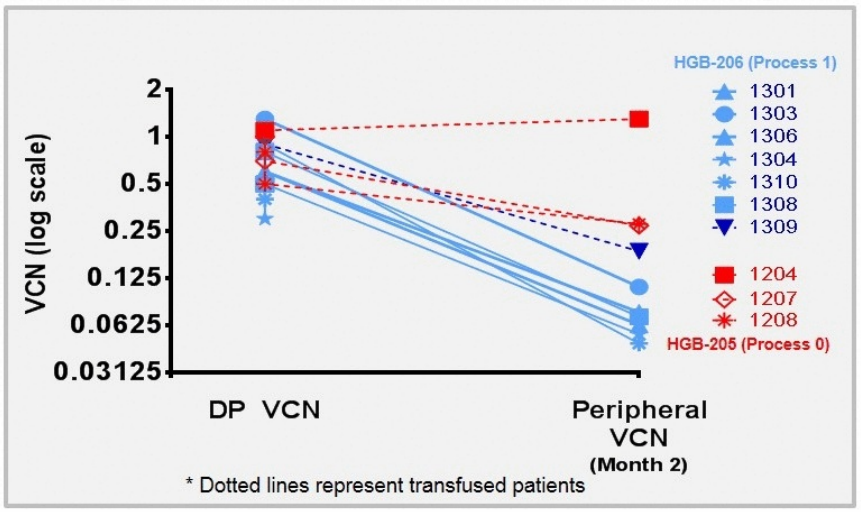
HGB-205 SCD: Durable Effect in Patient 1204



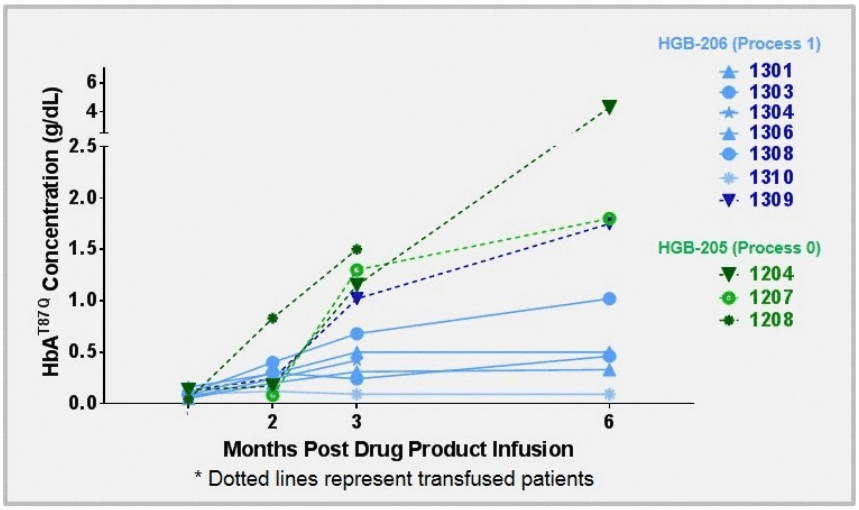
HGB-205 SCD: Safety and Clinical Status in Severe SCD Patients

- Adverse events generally consistent with myeloablative conditioning
  - No drug-product related non-hematologic AEs or SAEs
  - No replication competent lentivirus (RCL) detected to date
  - No evidence of insertional mutagenesis
- Patient 1204
  - One episode of acute gastroenteritis at 30 months post-treatment, with vomiting and 2 days of fever up to 40°C, followed by a vaso-occlusive crisis (VOC) and was hospitalized
  - HbA^{T87Q} and peripheral blood VCN levels have remained stable (HbA^{T87Q} 6.1 g/dL, VCN 2.3 at 30 months)
- Patient 1207
  - Pre-treatment history of frequent episodes of VOC and acute chest syndrome (ACS) despite hydroxyurea prior to beginning regular transfusions. Experienced an episode of ACS 6 months post-treatment and was hospitalized. HbA^{T87Q} continues to increase with 1.8 g/dL at 6 months.

SCD: Transfused Patients Have More Stable VCN

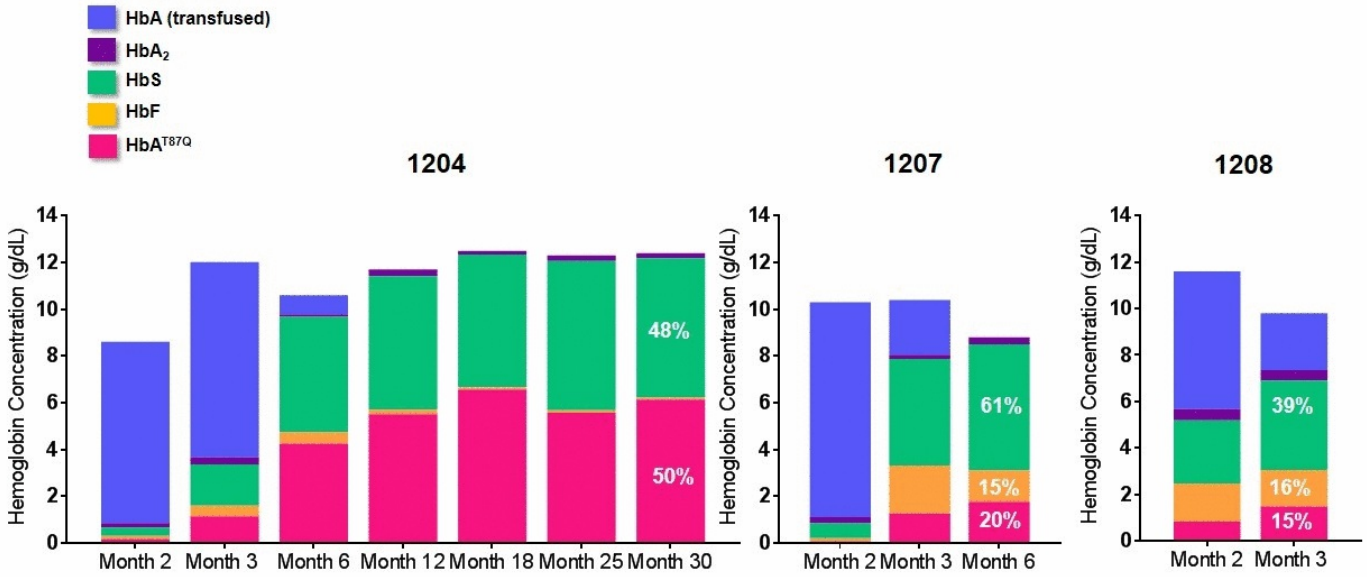


SCD HbA^{T87Q} Production Higher in Transfused Patients

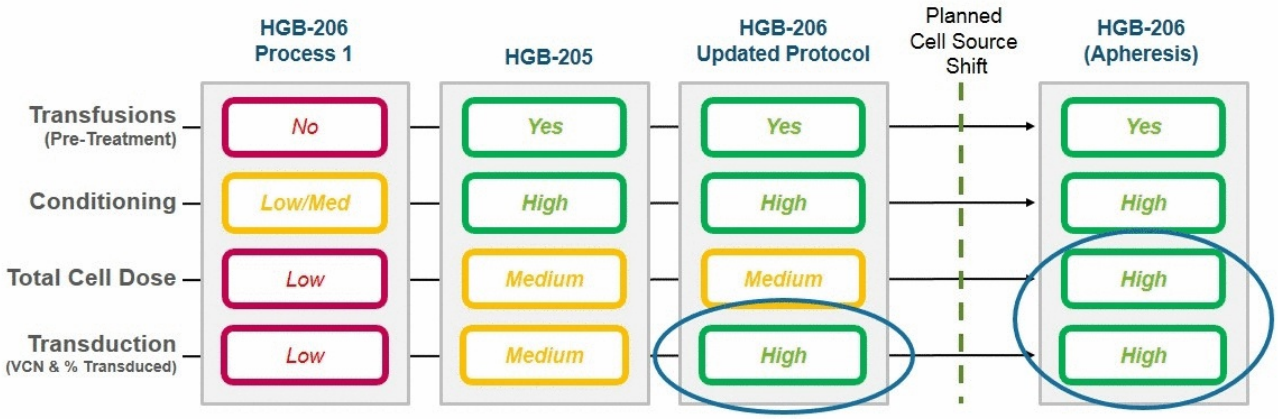


Data from transplant and other literature argue that as little as 3g/dL (~30%) of anti-sickling hemoglobin and gene marking as low as 20% could potentially achieve a disease-modifying effect

HGB-205 SCD: Levels of Anti-sickling Hemoglobin (HbA^{T87Q} + HbF) Above 30%



Evolution of LentiGlobin in SCD – More To Come at ASH 2017



Closing

Key Questions

Transfusion-Dependent β-thalassemia (TDT): Northstar-2 and HGB-205

- With our new manufacturing process in Northstar-2, are we able to consistently manufacture drug product (DP) with higher vector copy number (VCN) and proportion of transduced cells?
- How do the early results from Northstar-2…
  - Compare to the results seen in non- β^0/β^0 patients in HGB-204?
  - Read through to β^0/β^0 patients?
  - Read through to SCD patients?
- What can we learn from the HGB-205 TDT patients?

Severe Sickle Cell Disease (SCD)

- How do the data from the HGB-205 patients compare to ASH 2016 data?
- What does HGB-205 teach us regarding the potential impact of the protocol and manufacturing changes made in HGB-206?

Bringing & Valuing Hope

Go TRUE BLUE

Exhibit 99.2

bluebird bio Announces Early Data from Phase 3 Northstar-2 (HGB-207) Study of LentiGlobin™ Drug Product at European Hematology Association (EHA) Annual Meeting

- *Drug product vector copy number (DP VCN) and percentage of lentiviral vector positive cells (LVV+) for initial 7 drug product lots manufactured in Northstar-2 (HGB-207) are consistently higher than in Northstar (HGB-204) with median DP VCN of 3.0 –*
- *Initial results show that the three patients treated to date have achieved* in vivo *VCN and HbA^{T87Q} production as good as or better than patients achieving transfusion independence in Northstar –*
- *First patient treated in Northstar-2 with 6 months follow-up achieved normal total hemoglobin (13.3 g/dL) after discontinuing transfusions; producing 9.5 g/dl of HbA^{T87Q} at last follow-up –*
- *Safety profile to date consistent with autologous transplantation –*
- *Company to hold conference call and webcast today, June 23, at 8:00 a.m. ET –*

CAMBRIDGE, Mass., June 23, 2017 – bluebird bio, Inc. (Nasdaq: BLUE), a clinical-stage company committed to developing potentially transformative gene therapies for serious genetic diseases and T cell-based immunotherapies for cancer, announced early interim data from the ongoing Northstar-2 (HGB-207) Phase 3 clinical study of LentiGlobin drug product in patients with transfusion-dependent β-thalassemia (TDT) and non-β^0/β^0 genotypes. These data will be presented by Mark Walters, M.D., UCSF Benioff Children's Hospital, Oakland, California, in an oral session on Sunday, June 25 at the European Hematology Association (EHA) Annual Meeting in Madrid, Spain.

"Northstar-2 is our first study to utilize our improved LentiGlobin drug product manufacturing process to increase the drug product vector copy number and percent of cells transduced. The first patient treated in this study exemplifies the promise of gene therapy, discontinuing blood transfusions approximately a month after treatment and achieving a normal level of total hemoglobin production at six months post-treatment," said David Davidson, M.D., chief medical officer, bluebird bio. "These early results suggest that the improved manufacturing process results in consistently higher drug product vector copy numbers (VCN) and lentiviral vector positive (LVV+) cells, which is correlated with higher production of HbA^{T87Q} and ultimately may address known patient-to-patient variability."

"Although early, these data add to the growing body of clinical evidence that indicate that LentiGlobin may offer a transformative benefit for patients with TDT," said Alexis Thompson, MD, MPH, Ann & Robert H. Lurie Children's Hospital of Chicago, Illinois and a primary investigator on the study. "Patients with TDT are dependent on a burdensome cycle of transfusion and chelation, and for these patients, gene therapy with

LentiGlobin may offer a long-term solution with a one-time therapy that alleviates many of the complications of the current treatment paradigm."

A Phase 3 Study to Evaluate Safety and Efficacy of LentiGlobin Gene Therapy for Transfusion-Dependent β-thalassemia in Patients with non-β^0/β^0 Genotypes: The Northstar-2 (HGB-207) Trial (Abstract S814)

The Northstar-2 Study is an ongoing, open-label, single-dose, international, multicenter Phase 3 study designed to evaluate the safety and efficacy of LentiGlobin drug product for the treatment of patients with TDT and non-β^0/β^0 genotypes. As of June 2, 2017, drug product had been manufactured for six patients. The median DP VCN for these patients was 3.0 (range: 2.4 – 4.0), compared to a median DP VCN of 0.7 (range: 0.3 – 1.5) in Northstar. Results in treated patients, aged 20-22 years, as of June 2, 2017, include:

	Patient 1	**Patient 2**	**Patient 3**
DP VCN in each drug product lot (copies/diploid genome)	2.9	2.4	3.2, 2.4
LVV+ cells	77%	53%	77%, 82%
CD34+ cell dose (x10^6/kg)	7.0	13.6	8.1
HbA^{T87Q} (g/dl; at last follow-up)	9.5	1.6	4.6
Total hemoglobin	13.3	Not reported	Not reported
Days since last transfusion	140	Not reported	Not reported
Follow-up	6 months	3 months	2 months

- Follow-up on Patients 2 and 3 was not sufficient for total hemoglobin or days since last transfusion to be clinically relevant.
- The safety profile to date appears consistent with autologous transplantation. No Grade 3 or higher drug-product related adverse events have been observed.

Webcast Information
bluebird bio will host a live webcast at 8:00 a.m. ET on Friday, June 23, 2017. The live webcast can be accessed under "Calendar of Events" in the Investors and Media section of the company's website at www.bluebirdbio.com. Alternatively, investors may listen to the call by dialing (844) 825-4408 from locations in the United States or (315) 625-3227 from outside the United States. Please refer to conference ID number 39917037.

About Northstar-2 (HGB-207)
Northstar-2 is a Phase 3, global, multi-center study designed to evaluate the safety and efficacy of LentiGlobin drug product in patients with transfusion-dependent beta-thalassemia and non-β^0/β^0 genotypes. For this study, the manufacturing process by which

the patient's cells are transduced with the LentiGlobin viral vector has been improved, with the intent of increasing vector copy number and the percentage of cells successfully transduced.

The target enrollment of the study is 15 adult and adolescent patients and 8 pediatric patients. The study's primary endpoint is the proportion of treated subjects who meet the definition of "transfusion independence," defined as total hemoglobin levels of at least 9g/dL without any red blood cell (RBC) transfusions for a continuous period of at least 12 months at any time during the study.

About TDT
Transfusion-dependent β-thalassemia (TDT), also called β-thalassemia major or Cooley's anemia, is an inherited blood disease that can be fatal within the first few years of life if not treated.

Despite advances in the supportive conventional management of the disease, which consists of frequent and lifelong blood transfusions and iron chelation therapy, there is still a significant unmet medical need, including the risk for significant morbidity and early mortality. Currently, the only advanced treatment option for TDT is allogeneic hematopoietic stem cell transplant (HSCT). Complications of allogeneic HSCT include a significant risk of treatment-related mortality, graft failure, graft vs. host disease and opportunistic infections, particularly in patients who undergo non-sibling-matched allogeneic HSCT.

About bluebird bio, Inc.
With its lentiviral-based gene therapies, T cell immunotherapy expertise and gene editing capabilities, bluebird bio has built an integrated product platform with broad potential application to severe genetic diseases and cancer. bluebird bio's gene therapy clinical programs include its Lenti-D™ product candidate, currently in a Phase 2/3 study, called the Starbeam Study, for the treatment of cerebral adrenoleukodystrophy, and its LentiGlobin™ product candidate, currently in four clinical studies for the treatment of transfusion-dependent β-thalassemia, and severe sickle cell disease. bluebird bio's oncology pipeline is built upon the company's leadership in lentiviral gene delivery and T cell engineering, with a focus on developing novel T cell-based immunotherapies, including chimeric antigen receptor (CAR T) and T cell receptor (TCR) therapies. bluebird bio's lead oncology program, bb2121, is an anti-BCMA CAR T program partnered with Celgene. bb2121 is currently being studied in a Phase 1 trial for the treatment of relapsed/refractory multiple myeloma. bluebird bio also has discovery research programs utilizing megaTAL/homing endonuclease gene editing technologies with the potential for use across the company's pipeline.

bluebird bio has operations in Cambridge, Massachusetts, Seattle, Washington and Europe.

Forward-Looking Statements

This release contains "forward-looking statements" within the meaning of the Private Securities Litigation Reform Act of 1995, including statements regarding the Company's research, development, manufacturing and regulatory approval plans for its LentiGlobin product candidate to treat transfusion-dependent ß-thalassemia, and whether the manufacturing process changes for LentiGlobin will improve outcomes of patients with transfusion-dependent ß-thalassemia. Any forward-looking statements are based on management's current expectations of future events and are subject to a number of risks and uncertainties that could cause actual results to differ materially and adversely from those set forth in or implied by such forward-looking statements. These risks and uncertainties include, but are not limited to, the risks that the preliminary positive efficacy and safety results from our prior and ongoing clinical trials of LentiGlobin will not continue or be repeated in our ongoing, planned or expanded clinical trials of LentiGlobin, the risks that the changes we have made in the LentiGlobin manufacturing process will not result in improved patient outcomes, risks that the current or planned clinical trials of LentiGlobin will be insufficient to support regulatory submissions or marketing approval in the US and EU, the risk of a delay in the enrollment of patients in our clinical studies, and the risk that any one or more of our product candidates, will not be successfully developed, approved or commercialized. For a discussion of other risks and uncertainties, and other important factors, any of which could cause our actual results to differ from those contained in the forward-looking statements, see the section entitled "Risk Factors" in our most recent Form 10-Q, as well as discussions of potential risks, uncertainties, and other important factors in our subsequent filings with the Securities and Exchange Commission. All information in this press release is as of the date of the release, and bluebird bio undertakes no duty to update this information unless required by law.

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bluebird bio, Inc.
Elizabeth Pingpank, 617-914-8736
epingpank@bluebirdbio.com

Exhibit 99.3

bluebird bio Presents New Data from HGB-205 Study of LentiGlobin™ Drug Product in Patients with Transfusion-Dependent β-Thalassemia (TDT) and Severe Sickle Cell Disease (SCD) at European Hematology Association (EHA) Annual Meeting

- *Ongoing transfusion independence up to 3.5 years in patients with transfusion-dependent β-thalassemia (TDT); three patients have discontinued iron chelation –*
- *First patient with severe sickle cell disease (SCD) treated with gene therapy continues to show clinically meaningful improvement in symptoms of SCD and stable vector copy number and HbA^{T87Q} in peripheral blood –*
- *Two recently treated patients with severe SCD show increasing levels of hemoglobin (HbA^{T87Q}) and stable* in vivo *vector copy number (VCN) –*
- *Company to hold conference call and webcast today, June 23, at 8:00 a.m. ET –*

CAMBRIDGE, Mass., June 23, 2017 – bluebird bio, Inc. (Nasdaq: BLUE), a clinical-stage company committed to developing potentially transformative gene therapies for serious genetic diseases and T cell-based immunotherapies for cancer, announced new data from the ongoing HGB-205 clinical study evaluating its LentiGlobin gene therapy product candidate in patients with transfusion-dependent β-thalassemia (TDT) and severe sickle cell disease (SCD).

These data will be presented by Elisa Magrin, Ph.D., Necker Children's Hospital, Assistance Publique-Hôpitaux de Paris, Paris, France in a poster session on Saturday, June 24 at the European Hematology Association (EHA) Annual Meeting in Madrid, Spain. Marina Cavazzana, M.D., Ph.D., Professor of Medicine at Paris Descartes University and Research Director at the Centre for Clinical Research in Biotherapy, Necker Hospital, and at the Institute of Genetic Diseases, Imagine, Paris, France, is the primary investigator of the HGB-205 study.

"HGB-205 was designed as a proof-of-concept study to initially assess the feasibility of treatment with LentiGlobin gene therapy in patients with TDT and severe SCD. Results from this study to date demonstrate the potential for durable treatment effect of LentiGlobin, with stable HbA^{T87Q} production through 3.5 years of follow-up and sustained clinical benefit," said David Davidson, M.D., chief medical officer, bluebird bio. "The two most recently treated patients with SCD, both of whom show rising HbA^{T87Q} production, illustrate the potential benefit of some of the protocol modifications that we have made in our separate HGB-206 study in SCD. As with Patient 1204, the first patient with SCD treated in HGB-205, these two patients received a more stringent busulfan conditioning regimen and regular blood transfusions prior to stem cell harvest. Longer follow-up will be required to determine their eventual HbA^{T87Q} production and clinical outcome, but it is encouraging that their *in vivo* VCN shows evidence of early

stabilization at a higher level compared to the initial cohort of patients in HGB-206. It is also important to note that in our HGB-206 study, these modifications are further supplemented with manufacturing process improvements and evaluation of plerixafor for stem cell mobilization, which we believe may further optimize patient outcomes."

"We are beginning to see evidence of the long-term durability of benefit from treatment with LentiGlobin, with some TDT patients even transitioning off of chelation therapy," said Prof. Cavazzana. "It is exciting to see the outcome in the patient with TDT with the longest follow-up in HGB-205, who has gone from years of regular transfusions to 3.5 years without a single blood transfusion after a one-time treatment with LentiGlobin gene therapy."

Update on the First Patients with Severe Hemoglobinopathies Treated with LentiGlobin Gene Therapy (HGB-205) (Abstract P631)

Presenter: Elisa Magrin, Ph.D., Necker Children's Hospital, Assistance Publique-Hôpitaux de Paris, Paris, France
Poster Session Date & Time: Saturday, June 24, 5:30 – 9:00 p.m. CEST
Location: Poster area (Hall 7)

HGB-205 is an ongoing, open-label, single-center Phase 1/2 study designed to evaluate the safety and efficacy of LentiGlobin drug product in the treatment of patients with TDT and severe SCD. Four patients with TDT and three patients with severe SCD have undergone infusion with LentiGlobin drug product in this study as of June 2, 2017.

TDT:

- All patients with TDT have remained free of transfusions since shortly after receiving LentiGlobin treatment. At last study visit:
  - Patient 1201 (β^0/β^E genotype) has been free of transfusions for 41.9 months with total hemoglobin of 11.3 g/dL, of which 8.2 g/dL was HbA^{T87Q}
  - Patient 1202 (β^0/β^E genotype) has been free of transfusions for 38.7 months with total hemoglobin of 12.9 g/dL, of which 10.0 g/dL was HbA^{T87Q}
  - Patient 1206 (β^0/β^E genotype) has been free of transfusions for 20.3 months with total hemoglobin of 11.4 g/dL, of which 8.4 g/dL was HbA^{T87Q}
  - Patient 1203, who is homozygous for the severe β+ mutation IVS1-110, has been free of transfusions for 20.4 months with total hemoglobin of 8.3 g/dL, of which 6.6 g/dL was HbA^{T87Q}
- All three patients with TDT and β^0/β^E genotype have discontinued iron chelation and transitioned to therapeutic phlebotomy.

- The safety profile continues to be consistent with autologous transplantation. No drug-product related adverse events (AEs) have been observed, and there is no evidence of clonal dominance.

SCD:

- Patient 1204 was 13 years old at enrollment. At last follow-up (31.7 months), this patient was producing 50% HbA^{T87Q} – well above the approximately 30% anti-sickling hemoglobin level predicted to have potential clinical impact on the disease.
    - Approximately 30 months post-treatment, Patient 1204 suffered an episode of acute gastroenteritis with vomiting and 2 days of fever up to 40°C (104°F), which was followed by a vaso-occlusive crisis (VOC) and subsequent hospitalization. His HbA^{T87Q} and peripheral blood VCN levels have remained stable (HbA^{T87Q}: 6.1 g/dL, VCN: 2.3 copies/diploid genome at 30 months), suggesting continued durability of the gene therapy.
- Patient 1207 was 16 years old at enrollment. At last follow-up (6.1 months), this patient was producing 20% HbA^{T87Q}. This patient had a pre-treatment history of frequent episodes of VOC and acute chest syndrome (ACS) despite hydroxyurea prior to beginning regular transfusions and had one episode of ACS and a hospitalization at 6 months post-treatment.
- Patient 1208 was 21 years old at enrollment. At last follow-up (3.4 months), this patient was producing 15% HbA^{T87Q}.
- The safety profile continues to be consistent with autologous transplantation. No gene therapy related AEs have been observed, and there is no evidence of clonal dominance.

Webcast Information

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About TDT

Transfusion-dependent β-thalassemia (TDT), also called β-thalassemia major or Cooley's anemia, is an inherited blood disease that can be fatal within the first few years of life if not treated.

Despite advances in the supportive conventional management of the disease, which consists of frequent and lifelong blood transfusions and iron chelation therapy, there is still a significant unmet medical need, including the risk for significant morbidity and early mortality. Currently, the only advanced treatment option for TDT is allogeneic hematopoietic stem cell transplant (HSCT). Complications of allogeneic HSCT include a

significant risk of treatment-related mortality, graft failure, graft vs. host disease and opportunistic infections, particularly in patients who undergo non-sibling-matched allogeneic HSCT.

About SCD

Sickle cell disease (SCD) is an inherited disease caused by a mutation in the beta-globin gene that results in sickle-shaped red blood cells. Common complications include anemia, vaso-occlusive crisis, infections, stroke, overall poor quality of life and sometimes, early death.

Where adequate medical care is available, common treatments for patients with SCD largely revolve around prevention of infection and management and prevention of acute sickling episodes. Chronic management may include hydroxyurea and, in certain cases, chronic transfusions. Given the limitations of these treatments, there is no effective long-term treatment. The only advanced treatment for SCD is allogeneic HSCT. Complications of allogeneic HSCT include a significant risk of treatment-related mortality, graft failure, GvHD and opportunistic infections, particularly in patients who undergo non-sibling-matched allogeneic HSCT.

About the HGB-205 Study

HGB-205 is an ongoing, open-label Phase 1/2 study designed to evaluate the safety and efficacy of LentiGlobin drug product in the treatment of subjects with TDT and SCD. The study enrolled seven subjects who will be followed to evaluate safety and transfusion requirements post-transplant. Among patients with sickle cell disease only, efficacy will also be measured based on the number of vaso-occlusive crises or acute chest syndrome events. For more information on the HGB-205 study, please visit clinicaltrials.gov using identifier NCT02151526.

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