

**STATEMENT OF CHANGES IN BENEFICIAL OWNERSHIP**

Check this box if no longer subject to Section 16. Form 4 or Form 5 obligations may continue. See Instruction 1(b).

Filed pursuant to Section 16(a) of the Securities Exchange Act of 1934 or Section 30(h) of the Investment Company Act of 1940

| OMB APPROVAL                                 |           |
|--|-----------|
| OMB Number:                                  | 3235-0287 |
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|   |   |  |
|---|---|--|
| 1. Name and Address of Reporting Person*<br><u>THIRD ROCK VENTURES LP</u><br><br>(Last) (First) (Middle)<br><u>29 NEWBURY STREET, 3RD FLOOR</u><br><br>(Street)<br><u>BOSTON MA 02116</u><br><br>(City) (State) (Zip) | 2. Issuer Name and Ticker or Trading Symbol<br><u>bluebird bio, Inc. [ BLUE ]</u> | 5. Relationship of Reporting Person(s) to Issuer<br>(Check all applicable)<br><br>Director <input checked="" type="checkbox"/> 10% Owner<br><br>Officer (give title below) Other (specify below)                   |
|   | 3. Date of Earliest Transaction (Month/Day/Year)<br><u>01/21/2014</u>             |  |
|   |   | 6. Individual or Joint/Group Filing (Check Applicable Line)<br><br><input checked="" type="checkbox"/> Form filed by One Reporting Person<br><input type="checkbox"/> Form filed by More than One Reporting Person |

**Table I - Non-Derivative Securities Acquired, Disposed of, or Beneficially Owned**

| 1. Title of Security (Instr. 3) | 2. Transaction Date (Month/Day/Year) | 2A. Deemed Execution Date, if any (Month/Day/Year) | 3. Transaction Code (Instr. 8) |   | 4. Securities Acquired (A) or Disposed Of (D) (Instr. 3, 4 and 5) |            |                        | 5. Amount of Securities Beneficially Owned Following Reported Transaction(s) (Instr. 3 and 4) | 6. Ownership Form: Direct (D) or Indirect (I) (Instr. 4) | 7. Nature of Indirect Beneficial Ownership (Instr. 4) |
|---------------------------------|--------------------------------------|--|--------------------------------|---|---|------------|------------------------|---|--|---|
|                                 |                                      |  | Code                           | V | Amount  | (A) or (D) | Price                  |   |  |   |
| Common Stock                    | 01/21/2014                           |  | S                              |   | 250,000   | D          | \$23.91 <sup>(1)</sup> | 2,416,974   | D <sup>(2)</sup>   |   |

**Table II - Derivative Securities Acquired, Disposed of, or Beneficially Owned (e.g., puts, calls, warrants, options, convertible securities)**

| 1. Title of Derivative Security (Instr. 3) | 2. Conversion or Exercise Price of Derivative Security | 3. Transaction Date (Month/Day/Year) | 3A. Deemed Execution Date, if any (Month/Day/Year) | 4. Transaction Code (Instr. 8) |   | 5. Number of Derivative Securities Acquired (A) or Disposed of (D) (Instr. 3, 4 and 5) |     | 6. Date Exercisable and Expiration Date (Month/Day/Year) |                 | 7. Title and Amount of Securities Underlying Derivative Security (Instr. 3 and 4) | 8. Price of Derivative Security (Instr. 5) | 9. Number of derivative Securities Beneficially Owned Following Reported Transaction(s) (Instr. 4) | 10. Ownership Form: Direct (D) or Indirect (I) (Instr. 4) | 11. Nature of Indirect Beneficial Ownership (Instr. 4) |
|--|--|--------------------------------------|--|--------------------------------|---|--|-----|--|-----------------|---|--|--|---|--|
|  |  |                                      |  | Code                           | V | (A)  | (D) | Date Exercisable   | Expiration Date |   |  |  |   |  |

1. Name and Address of Reporting Person\*  
THIRD ROCK VENTURES LP  
 (Last) (First) (Middle)  
29 NEWBURY STREET, 3RD FLOOR  
 (Street)  
BOSTON MA 02116  
 (City) (State) (Zip)

1. Name and Address of Reporting Person\*  
Third Rock Ventures GP, L.P.  
 (Last) (First) (Middle)  
29 NEWBURY STREET, 3RD FLOOR  
 (Street)  
BOSTON MA 02116  
 (City) (State) (Zip)

1. Name and Address of Reporting Person\*  
TRV GP, LLC  
 (Last) (First) (Middle)  
29 NEWBURY STREET, 3RD FLOOR  
 (Street)  
BOSTON MA 02116  
 (City) (State) (Zip)

(City)

(State)

(Zip)

**Explanation of Responses:**

1. The price reported in Column 4 is a weighted average price. These shares were sold in multiple transactions at prices ranging from \$23.75 to \$24.35, inclusive. Each Reporting Person undertakes to provide to bluebird bio Inc., any security holder of bluebird bio Inc., or the staff of the Securities and Exchange Commission, upon request, full information regarding the number of shares sold at each separate price within the range set forth in this footnote.

2. The shares are directly held by TRV. The general partner of TRV is Third Rock Ventures GP, L.P. ("TRV GP"). The general partner of TRV GP is TRV GP, LLC ("TRV GP LLC") and, as such, each of TRV GP and TRV GP LLC exercises shared voting and investment power over the shares held of record by TRV. Each of the filing persons disclaims beneficial ownership of the shares except to the extent of their pecuniary interest therein, if any.

**Remarks:**

/s/ Kevin Gillis, Chief  
Financial Officer of TRV GP,  
LLC, general partner of Third 01/23/2014  
Rock Ventures GP, L.P.,  
general partner of Third Rock  
Ventures, L.P.

/s/ Kevin Gillis, Chief  
Financial Officer of TRV GP, 01/23/2014  
LLC, general partner of Third  
Rock Ventures GP, L.P.

/s/ Kevin Gillis, Chief  
Financial Officer of TRV GP, 01/23/2014  
LLC

\*\* Signature of Reporting Person      Date

Reminder: Report on a separate line for each class of securities beneficially owned directly or indirectly.

\* If the form is filed by more than one reporting person, see Instruction 4 (b)(v).

\*\* Intentional misstatements or omissions of facts constitute Federal Criminal Violations See 18 U.S.C. 1001 and 15 U.S.C. 78ff(a).

Note: File three copies of this Form, one of which must be manually signed. If space is insufficient, see Instruction 6 for procedure.

**Persons who respond to the collection of information contained in this form are not required to respond unless the form displays a currently valid OMB Number.**