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

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**SCHEDULE 13G**

**UNDER THE SECURITIES EXCHANGE ACT OF 1934**  
**(Amendment No. )\***

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**Rhythm Pharmaceuticals, Inc.**  
(Name of Issuer)

**COMMON STOCK, \$0.001 PAR VALUE PER SHARE**  
(Title of Class of Securities)

**76243J105**  
(CUSIP Number)

**December 31, 2017**  
(Date of Event Which Requires Filing of this Statement)

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Check the appropriate box to designate the rule pursuant to which this Schedule is filed:

- Rule 13d-1(b)  
 Rule 13d-1(c)  
 Rule 13d-1(d)

\* The remainder of this cover page shall be filled out for a reporting person's initial filing on this form with respect to the subject class of securities, and for any subsequent amendment containing information which would alter the disclosures provided in a prior cover page.

The information required in the remainder of this cover page shall not be deemed to be "filed" for the purpose of Section 18 of the Securities Exchange Act of 1934 ("Act") or otherwise subject to the liabilities of that section of the Act but shall be subject to all other provisions of the Act (however, see the Notes).

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1.	NAMES OF REPORTING PERSONS <b>Third Rock Ventures, L.P.</b>	
2.	CHECK THE APPROPRIATE BOX IF A MEMBER OF A GROUP (a) <input type="checkbox"/> (b) <input checked="" type="checkbox"/>	
3.	SEC USE ONLY	
4.	CITIZENSHIP OR PLACE OF ORGANIZATION  Delaware	
NUMBER OF SHARES BENEFICIALLY OWNED BY EACH REPORTING PERSON WITH	5.	SOLE VOTING POWER  0
	6.	SHARED VOTING POWER  3,981,437
	7.	SOLE DISPOSITIVE POWER  0
	8.	SHARED DISPOSITIVE POWER  3,981,437
9.	AGGREGATE AMOUNT BENEFICIALLY OWNED BY EACH REPORTING PERSON  3,981,437	
10.	CHECK BOX IF THE AGGREGATE AMOUNT IN ROW (9) EXCLUDES CERTAIN SHARES  <input type="checkbox"/>	
11.	PERCENT OF CLASS REPRESENTED BY AMOUNT IN ROW 9  14.6% (1)	
12.	TYPE OF REPORTING PERSON  PN	

- (1) The percent of class was calculated based on 27,284,140 shares of common stock issued and outstanding as of November 10, 2017, as disclosed in the Issuer's Quarterly Report on Form 10-Q filed with the Securities and Exchange Commission on November 14, 2017.

1.	NAMES OF REPORTING PERSONS <b>Third Rock Ventures GP, L.P.</b>	
2.	CHECK THE APPROPRIATE BOX IF A MEMBER OF A GROUP (a) <input type="checkbox"/> (b) <input checked="" type="checkbox"/>	
3.	SEC USE ONLY	
4.	CITIZENSHIP OR PLACE OF ORGANIZATION  Delaware	
NUMBER OF SHARES BENEFICIALLY OWNED BY EACH REPORTING PERSON WITH	5.	SOLE VOTING POWER  0
	6.	SHARED VOTING POWER  3,981,437
	7.	SOLE DISPOSITIVE POWER  0
	8.	SHARED DISPOSITIVE POWER  3,981,437
9.	AGGREGATE AMOUNT BENEFICIALLY OWNED BY EACH REPORTING PERSON  3,981,437	
10.	CHECK BOX IF THE AGGREGATE AMOUNT IN ROW (9) EXCLUDES CERTAIN SHARES  <input type="checkbox"/>	
11.	PERCENT OF CLASS REPRESENTED BY AMOUNT IN ROW 9  14.6% (1)	
12.	TYPE OF REPORTING PERSON  PN	

1.	NAMES OF REPORTING PERSONS <b>TRV GP, LLC</b>	
2.	CHECK THE APPROPRIATE BOX IF A MEMBER OF A GROUP (a) <input type="checkbox"/> (b) <input checked="" type="checkbox"/>	
3.	SEC USE ONLY	
4.	CITIZENSHIP OR PLACE OF ORGANIZATION  Delaware	
NUMBER OF SHARES BENEFICIALLY OWNED BY EACH REPORTING PERSON WITH	5.	SOLE VOTING POWER  0
	6.	SHARED VOTING POWER  3,981,437
	7.	SOLE DISPOSITIVE POWER  0
	8.	SHARED DISPOSITIVE POWER  3,981,437
9.	AGGREGATE AMOUNT BENEFICIALLY OWNED BY EACH REPORTING PERSON  3,981,437	
10.	CHECK BOX IF THE AGGREGATE AMOUNT IN ROW (9) EXCLUDES CERTAIN SHARES  <input type="checkbox"/>	
11.	PERCENT OF CLASS REPRESENTED BY AMOUNT IN ROW 9  14.6% (1)	
12.	TYPE OF REPORTING PERSON  OO	

1.	NAMES OF REPORTING PERSONS  <b>Mark Levin</b>	
2.	CHECK THE APPROPRIATE BOX IF A MEMBER OF A GROUP (a) <input type="checkbox"/> (b) <input checked="" type="checkbox"/>	
3.	SEC USE ONLY	
4.	CITIZENSHIP OR PLACE OF ORGANIZATION  United States	
NUMBER OF SHARES BENEFICIALLY OWNED BY EACH REPORTING PERSON WITH	5.	SOLE VOTING POWER  0
	6.	SHARED VOTING POWER  3,981,437
	7.	SOLE DISPOSITIVE POWER  0
	8.	SHARED DISPOSITIVE POWER  3,981,437
9.	AGGREGATE AMOUNT BENEFICIALLY OWNED BY EACH REPORTING PERSON  0	
10.	CHECK BOX IF THE AGGREGATE AMOUNT IN ROW (9) EXCLUDES CERTAIN SHARES  <input type="checkbox"/>	
11.	PERCENT OF CLASS REPRESENTED BY AMOUNT IN ROW 9  14.6% (1)	
12.	TYPE OF REPORTING PERSON  IN	

1.	NAMES OF REPORTING PERSONS <b>Kevin Starr</b>	
2.	CHECK THE APPROPRIATE BOX IF A MEMBER OF A GROUP (a) <input type="checkbox"/> (b) <input checked="" type="checkbox"/>	
3.	SEC USE ONLY	
4.	CITIZENSHIP OR PLACE OF ORGANIZATION  United States	
NUMBER OF SHARES BENEFICIALLY OWNED BY EACH REPORTING PERSON WITH	5.	SOLE VOTING POWER  0
	6.	SHARED VOTING POWER  3,981,437
	7.	SOLE DISPOSITIVE POWER  0
	8.	SHARED DISPOSITIVE POWER  3,981,437
9.	AGGREGATE AMOUNT BENEFICIALLY OWNED BY EACH REPORTING PERSON  0	
10.	CHECK BOX IF THE AGGREGATE AMOUNT IN ROW (9) EXCLUDES CERTAIN SHARES  <input type="checkbox"/>	
11.	PERCENT OF CLASS REPRESENTED BY AMOUNT IN ROW 9  14.6% (1)	
12.	TYPE OF REPORTING PERSON  IN	

1.	NAMES OF REPORTING PERSONS <b>Robert I. Tepper</b>	
2.	CHECK THE APPROPRIATE BOX IF A MEMBER OF A GROUP (a) <input type="checkbox"/> (b) <input checked="" type="checkbox"/>	
3.	SEC USE ONLY	
4.	CITIZENSHIP OR PLACE OF ORGANIZATION  United States	
NUMBER OF SHARES BENEFICIALLY OWNED BY EACH REPORTING PERSON WITH	5.	SOLE VOTING POWER  0
	6.	SHARED VOTING POWER  3,981,437
	7.	SOLE DISPOSITIVE POWER  0
	8.	SHARED DISPOSITIVE POWER  3,981,437
9.	AGGREGATE AMOUNT BENEFICIALLY OWNED BY EACH REPORTING PERSON  0	
10.	CHECK BOX IF THE AGGREGATE AMOUNT IN ROW (9) EXCLUDES CERTAIN SHARES  <input type="checkbox"/>	
11.	PERCENT OF CLASS REPRESENTED BY AMOUNT IN ROW 9  14.6% (1)	
12.	TYPE OF REPORTING PERSON  IN	

**Item 1. Issuer**

- (a) Name of Issuer:  
Rhythm Pharmaceuticals, Inc. (the “**Issuer**”)
- (b) Address of Issuer’s Principal Executive Offices:  
500 Boylston Street  
11th Floor  
Boston, MA 02116

**Item 2. Filing Person**

- (a) – (c) Name of Persons Filing; Address; Citizenship:
- (i) Third Rock Ventures, L.P. (“**TRV**”);
  - (ii) Third Rock Ventures GP, L.P. (“**TRV GP**”), which is the sole general partner of TRV;
  - (iii) TRV GP, LLC (“**TRV GP LLC**”), which is the sole general partner of TRV GP;
  - (iv) Mark Levin (“**Levin**”), a managing member of TRV GP LLC;
  - (v) Kevin P. Starr (“**Starr**”), a managing member of TRV GP LLC; and
  - (vi) Robert I. Tepper (“**Tepper**,” and collectively with TRV, TRV GP, TRV GP LLC, Levin and Starr, the “**Reporting Persons**”), a managing member of TRV GP LLC.

The address of the principal business office of each of the Reporting Persons is Third Rock Ventures, LLC, 29 Newbury Street, 3rd Floor, Boston, MA 02116.

Each of TRV and TRV GP is a Delaware limited partnership. TRV GP LLC is a Delaware limited liability company. Levin, Tepper and Starr are United States citizens.

- (d) Title of Class of Securities:  
Common stock, \$0.001 par value per share, (the “**Common Stock**”)
- (e) CUSIP Number:  
76243J105

**Item 3. If this statement is filed pursuant to Rules 13d-1(b), or 13d-2(b) or (c), check whether the person filing is a:**

- (a)  Broker or dealer registered under Section 15 of the Act;
- (b)  Bank as defined in Section 3(a)(6) of the Act;
- (c)  Insurance company as defined in Section 3(a)(19) of the Act;
- (d)  Investment company registered under Section 8 of the Investment Company Act of 1940;
- (e)  An investment adviser in accordance with Rule 13d-1(b)(1)(ii)(E);
- (f)  An employee benefit plan or endowment fund in accordance with Rule 13d-1(b)(1)(ii)(F);
- (g)  A parent holding company or control person in accordance with Rule 13d-1(b)(1)(ii)(G);
- (h)  A savings associations as defined in Section 3(b) of the Federal Deposit Insurance Act (12 U.S.C. 1813);
- (i)  A church plan that is excluded from the definition of an investment company under section 3(c)(14) of the Investment Company Act of 1940;

- (j)  A non-U.S. institution in accordance with Rule 240.13d-1(b)(1)(ii)(J);
- (k)  Group, in accordance with Rule 240.13d-1(b)(1)(ii)(K). If filing as a non-U.S. institution in accordance with Rule 240.13d-1(b)(1)(ii)(J), please specify the type of institution:

If filing as a non-U.S. institution in accordance with §240.13d-1(b)(1)(ii)(J), please specify the type of institution:

**Item 4. Ownership.**

(a) and (b) Amount beneficially owned:

- (i) TRV directly owns 3,981,437 shares of Common Stock (the “Shares”), which represents approximately 14.6% of the outstanding shares of Common Stock.
- (ii) TRV GP is the general partner of TRV and may be deemed to beneficially own the Shares.
- (iii) TRV GP LLC is the general partner of TRV GP and may be deemed to beneficially own the Shares.
- (iv) As a managing member of TRV GP LLC, Levin may be deemed to beneficially own the Shares.
- (v) As a managing member of TRV GP LLC, Tepper may be deemed to beneficially own the Shares.
- (vi) As a managing member of TRV GP LLC, Starr may be deemed to beneficially own the Shares.

(c) Number of shares as to which such person has:

Reporting Person	Number of Shares of Common Stock			
	(i)	(ii)	(iii)	(iv)
TRV	0	3,981,437	0	3,981,437
TRV GP	0	3,981,437	0	3,981,437
TRV GP LLC	0	3,981,437	0	3,981,437
Levin	0	3,981,437	0	3,981,437
Starr	0	3,981,437	0	3,981,437
Tepper	0	3,981,437	0	3,981,437

- (i) Sole power to vote or direct the vote
- (ii) Shared power to vote or to direct the vote
- (iii) Sole power to dispose or to direct the disposition of
- (iv) Shared power to dispose or to direct the disposition of

The percent of class was calculated based on 27,284,140 shares of common stock issued and outstanding as of November 10, 2017, as disclosed in the Issuer’s Quarterly Report on Form 10-Q filed with the Securities and Exchange Commission on November 14, 2017.

**Item 5. Ownership of Five Percent or Less of a Class.**

Not applicable.

**Item 6. Ownership of More than Five Percent on Behalf of Another Person.**

Not applicable.

**Item 7. Identification and Classification of the Subsidiary Which Acquired the Security Being Reported on by the Parent Holding Company or Control Person.**

Not applicable.

**Item 8. Identification and Classification of Members of the Group.**

Not applicable.

**Item 9. Notice of Dissolution of Group.**

Not applicable.

**Item 10. Certification.**

Not applicable.

**SIGNATURE**

After reasonable inquiry and to the best of my knowledge and belief, I certify that the information set forth in this statement is true, complete and correct.

Date: February 13, 2018

**THIRD ROCK VENTURES, L.P.**

By: THIRD ROCK VENTURES GP, L.P.,  
General Partner

By: TRV GP, LLC,  
General Partner

By: /s/ Kevin Gillis  
Kevin Gillis  
Chief Financial Officer

**THIRD ROCK VENTURES GP, L.P.**

By: TRV GP, LLC,  
General Partner

By: /s/ Kevin Gillis  
Kevin Gillis  
Chief Financial Officer

**TRV GP, LLC**

By: /s/ Kevin Gillis  
Kevin Gillis  
Chief Financial Officer

**MARK LEVIN**

/s/ Kevin Gillis, As attorney-in-fact  
Mark Levin

**KEVIN P. STARR**

/s/ Kevin Gillis, As attorney-in-fact  
Kevin P. Starr

**ROBERT I. TEPPER**

/s/ Kevin Gillis, As attorney-in-fact  
Robert I. Tepper

**POWER OF ATTORNEY**

KNOW ALL MEN BY THESE PRESENTS, that the undersigned hereby constitutes and appoints Kevin Gillis his true and lawful attorney-in-fact, with full power of substitution, to sign any and all instruments, certificates and documents that may be necessary, desirable or appropriate to be executed on behalf of himself as an individual or in his capacity as a direct or indirect general partner, director, officer, member or manager of any partnership, corporation or limited liability company, pursuant to section 13 or 16 of the Securities Exchange Act of 1934, as amended (the "Exchange Act"), and any and all regulations promulgated thereunder, and to file the same, with all exhibits thereto, and any other documents in connection therewith, with the Securities and Exchange Commission, and with any other entity when and if such is mandated by the Exchange Act or by the Financial Industry Regulatory Authority, granting unto said attorney-in-fact full power and authority to do and perform each and every act and thing necessary, desirable or appropriate, fully to all intents and purposes as he might or could do in person, thereby ratifying and confirming all that said attorney-in-fact, or his substitutes, may lawfully do or cause to be done by virtue hereof. Each of the undersigned may execute this power of attorney in separate counterparts, and each counterpart shall be deemed to be an original instrument. This agreement shall be effective as to each of the undersigned as of the date signed by that signatory.

IN WITNESS WHEREOF, this Power of Attorney has been signed as of the 16th day of January, 2014.

/s/ Mark Levin

Mark Levin

/s/ Kevin P. Starr

Kevin P. Starr

/s/ Robert I. Tepper

Robert I. Tepper

**Joint Filing Agreement**

The undersigned acknowledge and agree that the foregoing statement on Schedule 13G is filed on behalf of each of the undersigned and that all subsequent amendments to this statement on Schedule 13G shall be filed on behalf of each of the undersigned without the necessity of filing additional joint filing statements. The undersigned acknowledge that each shall be responsible for the timely filing of such amendments, and for the completeness and accuracy of the information concerning him, her or it contained herein, but shall not be responsible for the completeness and accuracy of the information concerning the other entities or persons, except to the extent that he, she or it knows or has reason to believe that such information is inaccurate.

Dated: February 13, 2018

**THIRD ROCK VENTURES, L.P.**

By: THIRD ROCK VENTURES GP, L.P.,  
General Partner

By: TRV GP, LLC,  
General Partner

By: /s/ Kevin Gillis  
Kevin Gillis  
Chief Financial Officer

**THIRD ROCK VENTURES GP, L.P.**

By: TRV GP, LLC,  
General Partner

By: /s/ Kevin Gillis  
Kevin Gillis  
Chief Financial Officer

**TRV GP, LLC**

By: /s/ Kevin Gillis  
Kevin Gillis  
Chief Financial Officer

**MARK LEVIN**

/s/ Kevin Gillis, As attorney-in-fact  
Mark Levin

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**KEVIN P. STARR**

/s/ Kevin Gillis, As attorney-in-fact  
Kevin P. Starr

**ROBERT I. TEPPER**

/s/ Kevin Gillis, As attorney-in-fact  
Robert I. Tepper