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

DIVISION OF
CORPORATION FINANCE

Mail Stop 4546

June 20, 2017

Keith M. Gottesdiener, M.D.
Chief Executive Officer
Rhythm Pharmaceuticals, Inc.
500 Boylston Street
11th Floor
Boston, MA 02116

Re: Rhythm Pharmaceuticals, Inc.
Amendment No. 3 to
Draft Registration Statement on Form S-1
Submitted May 24, 2017
CIK No. 0001649904

Dear Dr. Gottesdiener:

We have reviewed your amended draft registration statement and have the following comments. In some of our comments, we may ask you to provide us with information so we may better understand your disclosure.

Please respond to this letter by providing the requested information and either submitting an amended draft registration statement or publicly filing your registration statement on EDGAR. If you do not believe our comments apply to your facts and circumstances or do not believe an amendment is appropriate, please tell us why in your response.

After reviewing the information you provide in response to these comments and your amended draft registration statement or filed registration statement, we may have additional comments.

Prospectus Summary
Setmelanotide: A First-in-Class MC4 Agonist, page 2

1. Please revise to clarify whether the results noted in the last sentence on page 2 were statistically significant.

Clinical Development in Rare Genetic Disorders. . . , page 3

2. Given your disclosure in the Summary and in the Business section on page 107 that your focus is on developing product candidates that will address MC4 upstream indications, it is not appropriate to include the downstream indications and their potential number of

patients in the chart on page 3. Please revise so that this prominent graphic is limited to the indications you are focused on addressing.

Use of Proceeds, page 70

3. It appears from your disclosure that the proceeds from the offering will not be sufficient to fund development of setmelanotide through regulatory approval and commercialization for each indication noted in the bullet points in this section. Please disclose the sources of additional funds needed to reach regulatory approval and commercialization of your drug candidates if offering proceeds would not be sufficient. Refer to Instruction 3 to Item 504 of Regulation S-K.

Clinical Development in Rare Genetic Disorders of Obesity Caused by MC4 Pathway Deficiencies, page 108

4. Please remove the statement in the third paragraph of this section that initial clinical trials in patients with general obesity established the safety and efficacy of the drug as these determinations are the province of the U.S. Food and Drug Administration and other comparable regulatory agencies.

Please contact Christine Westbrook at (202) 551-5019 or Mary Beth Breslin at (202) 551-3625 with any questions.

Sincerely,

/s/ Mary Beth Breslin for

Suzanne Hayes
Assistant Director
Office of Healthcare and Insurance

cc: Julio E. Vega
Morgan, Lewis & Bockius LLP