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

DIVISION OF
CORPORATION FINANCE

Mail Stop 4546

September 15, 2016

Via E-mail
Douglas A. Treco, Ph.D.
President and Chief Executive Officer
Ra Pharmaceuticals, Inc.
87 Cambridge Park Drive
Cambridge, MA 02140

Re: Ra Pharmaceuticals, Inc.
Draft Registration Statement on Form S-1
Submitted August 17, 2016
CIK No. 0001481512

Dear Dr. Treco:

We have reviewed your 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
Overview, page 1

1. Please briefly define the term "macrocyclic peptides" and "macrocycle chemistry" where you introduce it.

Our Pipeline, page 2

2. The table displaying your pipeline product candidates should clearly reflect the actual, and not the anticipated, status of your pipeline candidates as of the latest practicable date unless the next developmental milestone is imminent. Based on your other disclosure, we believe you should change the descriptions and status for RA101495 and the rMG and LN indications to reflect the clinical studies that have been completed to date, and not those you intend to initiate in the future. Please make similar changes to the corresponding table on page 92.

3. The status description of the Merck collaboration is unclear. Please revise the status to clarify whether any preclinical or clinical trials have been completed. Similarly, revise page 92.

Our Team, page 4

4. Please clarify that the founder is Dr. Jack Szostak and clarify his ongoing relationship to the company. Additionally, clarify the nature of your rights to the Extreme Diversity platform technology he pioneered. If the rights are the subject of any agreements, please file the agreements. Alternatively, provide an analysis supporting your determination that you are not required to file them.

Use of Proceeds, page 66

5. Please amend your first bullet point to indicate the amount of offering proceeds you intend to allocate to each clinical trial for the different indications.

6. Please amend your second bullet point to indicate, to the extent practicable, the amount of offering proceeds you intend to allocate toward each of the preclinical programs and how far you expect to advance these programs with the proceeds from the offering.

Critical Accounting Policies and Significant Judgments and Estimates
Stock-Based Compensation, page 80

7. Once you have an estimated offering price or range, please explain to us the reasons for any differences between the recent valuations of your common stock leading up to the IPO and the estimated offering price. This information will help facilitate our review of your accounting for equity issuances including stock compensation and beneficial conversion features.

Business
Our Approach, page 95

8. On page 75 and elsewhere, you suggest that the technology underpinning the Extreme Diversity platform was acquired and not developed by you internally. Please discuss how

you acquired the rights to the technology, including the material provisions of any applicable agreements and any remaining material obligations.

RA101495 for Paroxysmal Nocturnal Hemoglobinuria, page 96

9. In your description of the Phase 1 clinical trial, please briefly define the terms "pharmacokinetics" and "pharmacodynamics."

Our Merck Collaboration and License Agreement, page 108

10. Please amend this discussion to state the "certain circumstances specified in the agreement" that allow you to terminate it. Please be advised that termination provisions are considered material and subject to disclosure.

Intellectual Property, page 109

11. Please identify the country of origin of the C5 inhibitor patent families.

12. Please disclose the material terms of the two license agreements you mention on page 110 and file these agreements as exhibits to your registration statement. If you believe these agreements are not required to be further described or filed, please explain the basis for your position in your response.

Manufacturing, page 113

13. Please tell us whether you have agreements in place with the manufacturers of RA101495 or whether you obtain your supplies solely on a purchase order basis.

Executive Compensation
Employment Agreements and Severance Agreements with our Named Executive Officer, page 137

14. Please describe the intended terms of the new employment agreements. Confirm that you will file them as exhibits before you request acceleration of your registration statement.

Other Comments

15. Please supplementally provide us with copies of all written communications, as defined in Rule 405 under the Securities Act, that you, or anyone authorized to do so on your behalf, present to potential investors in reliance on Section 5(d) of the Securities Act, whether or not they retain copies of the communications.

16. Please provide us with copies of any graphics, maps, photographs, and related captions or other artwork including logos that you intend to use in the prospectus. Such graphics and

pictorial representations should not be included in any preliminary prospectus distributed to prospective investors prior to our review.

You may contact Sasha Parikh at (202) 551-3627 or Lisa Vanjoske at (202) 551-3614 if you have questions regarding comments on the financial statements and related matters. Please contact Scot Foley at (202) 551-3383 or me at (202) 551-3675 with any other questions.

Sincerely,

/s/ Suzanne Hayes

Suzanne Hayes
Assistant Director

cc: Kingsley L. Taft, Esq.
Goodwin Procter LLP