



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

DIVISION OF
CORPORATION FINANCE

Mail Stop 4720

March 29, 2016

David G. Lowe, Ph.D.
Chief Executive Officer
Aeglea BioTherapeutics, Inc.
901 S. MoPac Expressway
Barton Oaks Plaza One
Suite 250
Austin, TX 78746

**Re: Aeglea BioTherapeutics, Inc.
Amendment No. 4 to Registration Statement on
Form S-1
Filed March 28, 2016
File No. 333-205001**

Dear Dr. Lowe:

We have reviewed your amended registration statement and have the following comment.

Please respond to this letter by amending your registration statement and providing the requested information. If you do not believe our comment applies to your facts and circumstances or do not believe an amendment is appropriate, please tell us why in your response.

After reviewing any amendment to your registration statement and the information you provide in response to this comment, we may have additional comments.

Notes to Consolidated Financial Statements

6. Convertible Preferred Shares/Stock

Conversion, page F-18

1. Throughout your prospectus, you assume the automatic conversion of all outstanding shares of your convertible preferred stock into shares of common stock immediately prior to the completion of this offering. Since your offering does not appear to fulfill the conditions of the automatic conversion herein, please tell us your basis for assuming the automatic conversion.

We urge all persons who are responsible for the accuracy and adequacy of the disclosure in the filing to be certain that the filing includes the information the Securities Act of 1933 and all applicable Securities Act rules require. Since the company and its management are in

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possession of all facts relating to a company's disclosure, they are responsible for the accuracy and adequacy of the disclosures they have made.

Notwithstanding our comments, in the event you request acceleration of the effective date of the pending registration statement, please provide a written statement from the company acknowledging that:

- should the Commission or the staff, acting pursuant to delegated authority, declare the filing effective, it does not foreclose the Commission from taking any action with respect to the filing;
- the action of the Commission or the staff, acting pursuant to delegated authority, in declaring the filing effective, does not relieve the company from its full responsibility for the adequacy and accuracy of the disclosure in the filing; and
- the company may not assert staff comments and the declaration of effectiveness as a defense in any proceeding initiated by the Commission or any person under the federal securities laws of the United States.

Please refer to Rules 460 and 461 regarding requests for acceleration. We will consider a written request for acceleration of the effective date of the registration statement as confirmation of the fact that those requesting acceleration are aware of their respective responsibilities under the Securities Act of 1933 and the Securities Exchange Act of 1934 as they relate to the proposed public offering of the securities specified in the above registration statement. Please allow adequate time for us to review any amendment prior to the requested effective date of the registration statement.

You may contact Keira Nakada at (202) 551-3659 or Joel Parker at 202-551-3651 if you have questions regarding comments on the financial statements and related matters. Please contact Christina Thomas at (202) 551-3577, Mary Beth Breslin at (202) 551-3625 or me at (202) 551-3675 with any other questions.

Sincerely,

/s/ Mary Beth Breslin for

Suzanne Hayes
Assistant Director
Office of Healthcare and Insurance

cc: Robert A. Freedman
Fenwick & West LLP