

March 29, 2016

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VIA EDGAR AND OVERNIGHT DELIVERY

U.S. Securities and Exchange Commission
Division of Corporation Finance
100 F Street, NE
Washington, DC 20549

Attention: Suzanne Hayes, Assistant Director
Mary Beth Breslin
Christina Thomas
Keira Nakada
Joel Parker

**Re: Aeglea BioTherapeutics, Inc.
Registration Statement on Form S-1
File No. 333-205001**

Ladies and Gentlemen:

On behalf of Aeglea BioTherapeutics, Inc. (the "**Company**"), we are transmitting this letter in response to the comments received from the staff of the Securities and Exchange Commission ("**Staff**") contained in the Staff's letter dated March 29, 2016, relating to the above referenced Registration Statement on Form S-1 (the "**Registration Statement**"). The numbered paragraphs below correspond to the numbered comments in that letter and the Staff's comment is presented in bold italics. For the convenience of the Staff, we are also sending, by overnight courier, copies of this letter addressing the comments in the Staff's letter.

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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.***

The Company respectfully advises the Staff that as disclosed in “Note 16 to the Consolidated Financial Statements – Subsequent Events” on page F-32 of the Registration Statement, the Company filed a restated certificate of incorporation with the Secretary of State of Delaware on March 28, 2016 to effect a 10.5-to-1 reverse stock split. This restated certificate also amended the provision with respect to the automatic conversion of the Company’s preferred stock to provide that all of the outstanding convertible preferred stock will automatically convert into common stock in connection with the completion of an offering pursuant to this Registration Statement, irrespective of the conditions of automatic conversion that were required as of the date of the Company’s consolidated financial statements included in the Registration Statement.

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Should the Staff have additional questions or comments regarding the foregoing, please do not hesitate to contact me at (650) 335-7292 or, in my absence, Niki Fang at (650) 335-7252.

Sincerely,

/s/ Robert A. Freedman

Robert A. Freedman

cc: Via E-mail
David G. Lowe
Aeglea BioTherapeutics, Inc.

Effie Toshav, Esq.
Niki Fang, Esq.
Melissa V. Frayer, Esq.
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