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

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**FORM S-8  
REGISTRATION STATEMENT UNDER THE SECURITIES ACT OF 1933**

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**AEGLEA BIOTHERAPEUTICS, INC.**

(Exact Name of Registrant as Specified in Its Charter)

**Delaware**  
(State or Other Jurisdiction of  
Incorporation or Organization)

**46-4312787**  
(I.R.S. Employer  
Identification No.)

**805 Las Cimas Parkway  
Suite 100  
Austin, TX 78746  
(512) 942-2935**  
(Address of Principal Executive Offices) (Zip Code)

**2016 Equity Incentive Plan  
2016 Employee Stock Purchase Plan**

(Full Title of the Plans)

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**Anthony Quinn, M.B. Ch.B, Ph.D.  
President and Chief Executive Officer  
Aeglea BioTherapeutics, Inc.  
805 Las Cimas Parkway  
Suite 100  
Austin, TX 78746**

(Name and Address of Agent for Service)

**(512) 942-2935**  
(Telephone Number, including area code, of agent for service)

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*Copies to:*

**Robert A. Freedman, Esq.  
Fenwick & West LLP  
555 California Street  
San Francisco, CA 94104  
(415) 875-2300**

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Indicate by check mark whether the Registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, or a smaller reporting company, or an emerging growth company. See definitions of "large accelerated filer," "accelerated filer," "smaller reporting company" and "emerging growth company" in Rule 12b-2 of the Exchange Act. (Check one):

Large accelerated filer   
Non-accelerated filer

Accelerated filer   
Smaller reporting company   
Emerging growth company

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If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 7(a)(2)(B) of the Securities Act.

**CALCULATION OF REGISTRATION FEE**

<b>Title of Securities To Be Registered</b>	<b>Amount To Be Registered (1)</b>	<b>Proposed Maximum Offering Price Per Share</b>	<b>Proposed Maximum Aggregate Offering Price</b>	<b>Amount of Registration Fee</b>
Common Stock, \$0.0001 par value per share				
—2016 Equity Incentive Plan, as amended	1,163,377 (2)	\$8.14 (3)	\$9,469,889	\$1,230
—2016 Employee Stock Purchase Plan, as amended	290,844 (4)	\$6.92 (5)	\$2,012,641	\$261
<b>TOTAL</b>	1,454,221	N/A	\$11,482,530	\$1,491

- (1) Pursuant to Rule 416(a) under the Securities Act of 1933, as amended (the "Securities Act"), this Registration Statement shall also cover any additional shares of the Registrant's Common Stock that become issuable under the Registrant's 2016 Equity Incentive Plan, as amended (the "2016 EIP") and 2016 Employee Stock Purchase Plan, as amended ("2016 ESPP") by reason of any stock dividend, stock split, recapitalization or other similar transaction effected without the Registrant's receipt of consideration that increases the number of the outstanding shares of the Registrant's Common Stock.
- (2) Represents 1,163,377 shares to be registered and available for grant under the 2016 EIP resulting from the annual 4% increase in the number of authorized shares available for issuance under the 2016 EIP.
- (3) Estimated in accordance with Rules 457(c) and 457(h) solely for the purpose of calculating the registration fee. The proposed maximum offering price per share of \$8.14 was computed by averaging the high and low prices of a share of Registrant's common stock as reported on The Nasdaq Global Market on February 20, 2020.
- (4) Represents 290,844 shares to be registered and available for grant under the 2016 ESPP resulting from the annual 1% increase in the number of authorized shares available for issuance under the 2016 ESPP.
- (5) Estimated in accordance with Rules 457(c) and 457(h) solely for the purpose of calculating the registration fee. The proposed maximum offering price per share of \$6.92 was computed by averaging the high and low prices of a share of Registrant's common stock as reported on The Nasdaq Global Market on February 20, 2020, multiplied by 85%, which is the percentage of the trading price per share applicable to purchasers under the 2016 ESPP.

## EXPLANATORY NOTE

Aeglea BioTherapeutics, Inc. (the “**Registrant**”) is filing this Registration Statement with the Securities and Exchange Commission (the “**Commission**”) to register (a) 1,163,377 additional shares of Common Stock available for issuance under the Registrant’s 2016 Equity Incentive Plan, as amended (the “**2016 EIP**”), pursuant to the provision of the 2016 EIP providing for an annual 4% increase in the number of shares reserved for issuance, and (b) 290,844 additional shares of Common Stock available for issuance under the Registrant’s 2016 Employee Stock Purchase Plan (the “**2016 ESPP**”), pursuant to the provision of the 2016 ESPP providing for an annual 1% increase in the number of shares reserved for issuance.

In accordance with General Instruction E of Form S-8, and only with respect to the Common Stock issuable under the 2016 EIP and 2016 ESPP, this Registration Statement hereby incorporates by reference the contents of the Registrant’s Registration Statements on Form S-8 filed with the Commission on April 7, 2016 (Registration No. 333-210633), March 23, 2017 (Registration No. 333-216903), March 13, 2018 (Registration No. 333-223614) and March 7, 2019 (Registration No. 333-230137), to the extent not superseded hereby.

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PART I

INFORMATION REQUIRED IN THE SECTION 10(a) PROSPECTUS

The documents containing the information required by Part I of Form S-8 (plan information and registrant information and employee plan annual information) will be sent or given to employees as specified by Rule 428(b)(1) of the Securities Act of 1933 (the “*Securities Act*”). Such documents need not be filed with the Commission either as part of this Registration Statement or as prospectuses or prospectus supplements pursuant to Rule 424 of the Securities Act. These documents and the documents incorporated by reference in this Registration Statement pursuant to Item 3 of Part II, taken together, constitute a prospectus that meets the requirements of Section 10(a) of the Securities Act.

PART II

Information Required in the Registration Statement

Item 3. Incorporation of Documents by Reference.

The following documents filed by the Registrant with the Commission pursuant to the Securities Act and the Securities Exchange Act of 1934, as amended (the “*Exchange Act*”) are incorporated herein by reference:

(a) the Registrant’s Annual Report on Form 10-K for the year ended December 31, 2019 filed with the Commission on February 24, 2020 pursuant to Section 13 of the Exchange Act;

(b) all other reports filed pursuant to Section 13(a) or 15(d) of the Exchange Act since the end of the fiscal year covered by the Registrant’s Annual Report on Form 10-K referred to in (a) above; and

(c) the description of the Registrant’s common stock contained in the Registrant’s registration statement on Form 8-A (File No. 001- 37722) filed on March 28, 2016 under Section 12(b) of the Exchange Act, including any amendment or report filed for the purpose of updating such description.

All documents filed by the Registrant pursuant to Section 13(a), 13(c), 14 or 15(d) of the Exchange Act subsequent to the filing of this Registration Statement and prior to the filing of a post-effective amendment which indicates that all securities offered hereby have been sold or which deregisters all securities then remaining unsold, shall be deemed to be incorporated by reference into this Registration Statement and to be a part hereof from the date of filing such documents, except as to specific sections of such documents as set forth therein. Any statement contained in a document incorporated or deemed to be incorporated by reference herein shall be deemed to be modified or superseded for purposes of this Registration Statement to the extent that a statement contained in any subsequently filed document which also is deemed to be incorporated by reference herein modifies or supersedes such statement.

Item 8. Exhibits.

Exhibit Number	Exhibit Description	Incorporated by Reference			Filed Herewith	
		Form	File No.	Exhibit		
4.1	<a href="#">Restated Certificate of Incorporation</a>	S-1/A	333-205001	3.2	9/14/2015	
4.2	<a href="#">Restated Bylaws</a>	S-1/A	333-205001	3.4	9/14/2015	
4.3	<a href="#">Form of Common Stock Certificate</a>	S-1/A	333-205001	4.1	9/14/2015	
5.1	<a href="#">Opinion and Consent of Fenwick &amp; West LLP.</a>					X
23.1	<a href="#">Consent of PricewaterhouseCoopers LLP, independent registered public accounting firm.</a>					X
23.2	<a href="#">Consent of Fenwick &amp; West LLP (contained in Exhibit 5.1).</a>					X
24.1	<a href="#">Power of Attorney (incorporated by reference to Page II-3 of this Registration Statement).</a>					X
99.1	<a href="#">2016 Equity Incentive Plan, as amended</a>	10-Q	001-37722	10.2	11/8/2018	
99.2	<a href="#">2016 Employee Stock Purchase Plan, as amended</a>	10-K	001-37722	10.4	3/7/2019	

## SIGNATURES

Pursuant to the requirements of the Securities Act, the Registrant certifies that it has reasonable grounds to believe that it meets all of the requirements for filing on Form S-8 and has duly caused this Registration Statement to be signed on its behalf by the undersigned, thereunto duly authorized, in Austin, Texas, on this 24th day of February, 2020.

### AEGLEA BIOTHERAPEUTICS, INC.

By: /s/ Anthony Quinn, M.B. Ch.B, Ph.D.  
Anthony Quinn, M.B. Ch.B, Ph.D.  
President, Chief Executive Officer and Director

## POWER OF ATTORNEY

**KNOW ALL PERSONS BY THESE PRESENTS**, that each person whose signature appears below hereby constitutes and appoints Anthony Quinn and Charles N. York II, and each of them, as his or her true and lawful attorney-in-fact and agent with full power of substitution, for him or her in any and all capacities, to sign any and all amendments (including post-effective amendments) to this Registration Statement on Form S-8, and to file the same, with all exhibits thereto and other documents in connection therewith, with the Securities and Exchange Commission, granting unto said attorney-in-fact and agent full power and authority to do and perform each and every act and thing requisite and necessary to be done in connection therewith, as fully for all intents and purposes as he might or could do in person, hereby ratifying and confirming all that said attorney-in-fact and agent, or his or her substitute, may lawfully do or cause to be done by virtue hereof.

Pursuant to the requirements of the Securities Act, this Registration Statement has been signed by the following persons in the capacities and on the date indicated.

<b>Signature</b>	<b>Title</b>	<b>Date</b>
<u>/s/ Anthony Quinn, M.B. Ch.B, Ph.D.</u> Anthony Quinn, M.B. Ch.B, Ph.D.	President, Chief Executive Officer and Director (Principal Executive Officer)	February 24, 2020
<u>/s/ Charles N. York II</u> Charles N. York II	Chief Financial Officer and Vice President (Principal Accounting Officer and Principal Financial Officer)	February 24, 2020
<u>/s/ Suzanne Bruhn, Ph.D.</u> Suzanne Bruhn, Ph.D.	Director	February 24, 2020
<u>/s/ Russell J. Cox</u> Russell J. Cox	Director	February 24, 2020
<u>/s/ Sandesh Mahatme, LLM</u> Sandesh Mahatme, LLM	Director	February 24, 2020
<u>/s/ Armen Shanafelt, Ph.D.</u> Armen Shanafelt, Ph.D.	Director	February 24, 2020
<u>/s/ Ivana Magovcevic-Liebisch, Ph.D., J.D.</u> Ivana Magovcevic-Liebisch, Ph.D., J.D.	Director	February 24, 2020
<u>/s/ V. Bryan Lawlis, Ph.D.</u> V. Bryan Lawlis, Ph.D.	Director	February 24, 2020



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555 CALIFORNIA STREET, 12TH FLOOR SAN FRANCISCO, CA 94104  
TEL 415.875.2300 FAX 415.281.1350 WWW.FENWICK.COM

February 24, 2020

Aeglea BioTherapeutics, Inc.  
901 S. MoPac Expressway  
Barton Oaks Plaza One  
Suite 250  
Austin, TX 78746

Ladies and Gentlemen:

At your request, as your counsel, we have examined the Registration Statement on Form S-8 (the "**Registration Statement**") to be filed by Aeglea BioTherapeutics, Inc., a Delaware corporation (the "**Company**") with the Securities and Exchange Commission (the "**Commission**") on or about February 24, 2020 in connection with the registration under the Securities Act of 1933, as amended (the "**Securities Act**"), of an aggregate of 1,454,221 shares (the "**Shares**") of the Company's Common Stock, \$0.0001 par value per share (the "**Common Stock**"), consisting of (a) 1,163,377 Shares that are subject to issuance by the Company upon the exercise or settlement of awards (including awards of stock options, restricted stock, stock bonuses, stock appreciation rights, restricted stock units and/or performance shares) granted or to be granted under the 2016 Equity Incentive Plan, as amended to date (the "**EIP**") and (b) 290,844 Shares that are subject to issuance by the Company pursuant to purchase rights granted or to be granted under the 2016 Employee Stock Purchase Plan (the "**ESPP**"). The EIP and the ESPP are each individually referred to herein as a "**Plan**" and collectively referred to in this letter as the "**Plans**". At your request we are providing this letter to express our opinion on the matters set forth below in this letter ("**our opinion**").

In connection with our opinion, we have examined such matters of fact as we have deemed necessary, which included examination of originals or copies of: the Company's current Certificate of Incorporation and Bylaws, as amended (collectively, the "**Charter Documents**"), the Plans, the Registration Statement and the exhibits thereto; certain corporate proceedings of the Company's Board of Directors (the "**Board**") and the Company's stockholders relating to adoption or approval of the Company Charter Documents, the Plans, the reservation of the Shares for sale and issuance, the filing of the Registration Statement and the registration of the Shares under the Securities Act and documents regarding the Company's outstanding and reserved capital stock and other securities and such other documents as we have deemed advisable, and we have examined such questions of law as we have considered necessary.

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In our examination of documents for purposes of this opinion, we have assumed, and express no opinion as to, the authenticity and completeness of all documents submitted to us as originals, the genuineness of signatures on documents reviewed by us, the conformity to originals and the completeness of all documents submitted to us as copies, the legal capacity of all parties executing any documents (other than the Company), the lack of any undisclosed termination or modification or waiver of any document, the absence of any extrinsic agreements or documents that might change or affect the interpretation or terms of documents, and the due authorization, execution and delivery of all documents by each party thereto other than the Company. We have also assumed that any certificates or instruments representing the Shares, when issued, will be executed by the Company by officers of the Company duly authorized to do so. In rendering our opinion, we have also relied upon a Certificate of Good Standing dated February 24, 2020 issued by the Delaware Secretary of State with respect to the Company and representations and certifications made to us by the Company, including without limitation representations in a Management Certificate addressed to us of even date herewith that the Company has available a sufficient number of authorized shares of Common Stock that are not currently outstanding or reserved for issuance under other outstanding securities or plans of the Company, to enable the Company to issue and deliver all of the Shares as of the date of this letter.

We render this opinion only with respect to, and we express no opinion herein concerning the application or effect of the laws of any jurisdiction other than, the existing Delaware General Corporation Law now in effect. We express no opinion with respect to the securities or “blue sky” laws of any state.

Based upon, and subject to, the foregoing, it is our opinion that when the 1,454,221 Shares of Common Stock that may be issued and sold by the Company upon the exercise or settlement of awards (including awards of stock options, restricted stock, stock bonuses, stock appreciation rights, restricted stock units and/or performance shares) granted or to be granted under the EIP and upon the exercise or settlement of purchase rights granted or to be granted under the ESPP, have been issued and sold by the Company against the Company’s receipt of payment therefor (in an amount and type of consideration not less than the par value per Share) in accordance with the terms (including without limitation payment and authorization provisions) of the applicable Plan, and have been duly registered on the books of the transfer agent and registrar for the Shares in the name or on behalf of the holders thereof, such Shares will be validly issued, fully paid and non-assessable.

We consent to the use of this opinion as an exhibit to the Registration Statement and further consent to all references to us, if any, in the Registration Statement, the prospectus constituting a part thereof and any amendments thereto. We do not thereby admit that we are within the category of persons whose consent is required under Section 7 of the Securities Act or the rules and regulations of the Commission thereunder. This opinion is intended solely for use in connection with issuance and sale of the Shares subject to the Registration Statement and is not to be relied upon for any other purpose. In providing this letter, we are opining only as to the specific legal issues expressly set forth above, and no opinion shall be inferred as to any other matter or matters. This opinion is rendered on, and speaks only as of, the date of this letter first written above, and does not address any potential change in facts or law that may occur after the date of this opinion letter. We assume no obligation to advise you of any fact, circumstance, event or

change in the law or the facts that may hereafter be brought to our attention, whether or not such occurrence would affect or modify any of the opinions expressed herein.

Very truly yours,

**/s/ Fenwick & West LLP**

**Fenwick & West LLP**

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We hereby consent to the incorporation by reference in this Registration Statement on Form S-8 of Aeglea BioTherapeutics, Inc. of our report dated February 24, 2020 relating to the financial statements, which appears in Aeglea BioTherapeutics, Inc.'s Annual report on Form 10-K for the year ended December 31, 2019.

/s/ PricewaterhouseCoopers LLP

Austin, Texas  
February 24, 2020