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

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

**ATYR PHARMA, INC.**

(Exact name of registrant as specified in its charter)

**Delaware**  
(State or other jurisdiction of  
incorporation or organization)

**20-3435077**  
(I.R.S. Employer  
Identification No.)

**3545 John Hopkins Court, Suite #250  
San Diego, CA 92121**  
(Address of Principal Executive Offices)

**ATYR PHARMA, INC. 2015 STOCK OPTION AND INCENTIVE PLAN, AS AMENDED**  
(Full title of the plans)

**Sanjay S. Shukla, M.D., M.S.**  
**President, Chief Executive Officer and Director**  
**3545 John Hopkins Court, Suite #250**  
**San Diego, CA 92121**  
(Name and address of agent for service)

**(858) 731-8389**  
(Telephone number, including area code, of agent for service)

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

Large accelerated filer

Accelerated filer

Non-accelerated filer

Smaller reporting company

Emerging growth company

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.

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**CALCULATION OF REGISTRATION FEE**

Title of securities to be registered	Amount to be registered(1)	Proposed maximum offering price per share(2)	Proposed maximum aggregate offering price(2)	Amount of registration fee
Common stock, \$0.001 par value per share	750,000 shares(3)	\$3.70	\$2,775,000	\$303

- (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 (“Common Stock”) that become issuable under the aTyr Pharma, Inc. 2015 Stock Option and Incentive Plan, as amended (the “2015 Plan”) by reason of any stock dividend, stock split, recapitalization or other similar transaction.
- (2) This estimate is made pursuant to Rule 457(h)(1) and Rule 457(c) of the Securities Act solely for purposes of calculating the registration fee. The price per share and aggregate offering price are based upon the average of the high and low prices of the Common Stock on May 11, 2021, as reported on the Nasdaq Capital Market.
- (3) Represents 750,000 additional shares of Common Stock reserved and available for issuance under the 2015 Plan, as approved by the Company’s stockholders at its annual meeting on April 28, 2021 (the “2021 Annual Meeting”). At the 2021 Annual Meeting, the Company’s stockholders approved an amendment to the 2015 Plan to increase the aggregate number of shares of Common Stock authorized for issuance under the 2015 Plan by 750,000 shares to 1,706,439 shares of Common Stock.

## INCORPORATION OF DOCUMENTS BY REFERENCE

This Registration Statement is being filed for the purpose of increasing the number of securities of the same class as other securities for which a Registration Statement of the Registrant on Form S-8 relating to the same employee benefit plan is effective.

The Registrant previously registered shares of its Common Stock for issuance under the 2015 Plan under Registration Statements on Form S-8 filed with the Securities and Exchange Commission on [May 7, 2015 \(File No. 333-203955\)](#), [April 1, 2016 \(File No. 333-210543\)](#), [March 22, 2017 \(File No. 333-216880\)](#), [March 23, 2018 \(333-223865\)](#), [May 20, 2019 \(File No. 333-231594\)](#) and [August 18, 2020 \(File No. 333-248090\)](#). Pursuant to General Instruction E to Form S-8, this Registration Statement hereby incorporates by reference the contents of the Registration Statements referenced above.

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**Item 8. Exhibits**

Exhibit Number	Exhibit Title	Incorporated by Reference			Filing Date
		Form	File No.	Exhibit	
3.1	<a href="#">Restated Certificate of Incorporation of the Registrant</a>	S-1/A	333-203272	3.2	May 1, 2015
3.2	<a href="#">Certificate of Amendment to Restated Certificate of Incorporation of the Registrant</a>	8-K	001-37378	3.1	June 28, 2019
3.3	<a href="#">Certificate of Amendment to Restated Certificate of Incorporation of the Registrant</a>	10-Q	001-37378	3.3	May 12, 2020
3.4	<a href="#">Certificate of Amendment to Restated Certificate of Incorporation of the Registrant</a>	8-K	001-37378	3.1	May 4, 2021
3.5	<a href="#">Amended and Restated Bylaws of the Registrant</a>	S-1/A	333-203272	3.4	April 27, 2015
3.6	<a href="#">Certificate of Designation of Preferences, Rights and Limitations of Class X Convertible Preferred Stock</a>	8-K	001-37378	3.1	August 31, 2017
4.1	<a href="#">Specimen Common Stock Certificate</a>	S-1/A	333-203272	4.1	April 27, 2015
4.2	<a href="#">Warrant to Purchase Stock issued to Silicon Valley Bank on July 24, 2013</a>	S-1	333-203272	4.4	April 6, 2015
4.3	<a href="#">Warrant to Purchase Stock issued to Silicon Valley Bank on November 18, 2016</a>	10-K	001-37378	4.5	March 16, 2017
4.4	<a href="#">Warrant to Purchase Stock issued to Solar Capital Ltd on November 18, 2016</a>	10-K	001-37378	4.6	March 16, 2017
4.5	<a href="#">Warrant to Purchase Stock issued to Silicon Valley Bank on June 30, 2017</a>	10-Q	001-37378	4.7	August 14, 2017
4.6	<a href="#">Warrant to Purchase Stock issued to Solar Capital Ltd on June 30, 2017</a>	10-Q	001-37378	4.8	August 14, 2017
4.7	<a href="#">Warrant to Purchase Stock issued to Silicon Valley Bank on December 22, 2017</a>	10-K	001-37378	4.8	March 20, 2018
4.8	<a href="#">Warrant to Purchase Stock issued to Solar Capital Ltd on December 22, 2017</a>	10-K	001-37378	4.9	March 20, 2018
5.1	<a href="#">Opinion of Cooley LLP</a>	—	—	—	Filed herewith
23.1	<a href="#">Consent of Cooley LLP (included in Exhibit 5.1)</a>	—	—	—	Filed herewith
23.2	<a href="#">Consent of Independent Registered Public Accounting Firm</a>	—	—	—	Filed herewith
24.1	<a href="#">Power of Attorney (included on the signature page hereto)</a>	—	—	—	Filed herewith
99.1	<a href="#">aTyr Pharma Inc. 2015 Stock Option and Incentive Plan, as amended</a>	8-K	001-37378	10.1	May 4, 2021
99.2	<a href="#">Forms of agreement under 2015 Stock Option and Incentive Plan</a>	S-1/A	333-203272	10.2	April 27, 2015

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## SIGNATURES

Pursuant to the requirements of the Securities Act of 1933, 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 the City of San Diego, State of California, this 14<sup>th</sup> day of May, 2021.

### ATYR PHARMA, INC.

By: /s/ Sanjay S. Shukla  
Sanjay S. Shukla, M.D., M.S.  
*President and Chief Executive Officer*

### POWER OF ATTORNEY AND SIGNATURES

We, the undersigned officers and directors of aTyr Pharma, Inc., hereby severally constitute and appoint Sanjay S. Shukla, M.D., M.S. and Jill M. Broadfoot, and each of them singly (with full power to each of them to act alone), our true and lawful attorneys-in-fact and agents, with full power of substitution and resubstitution in each of them for him and in his name, place and stead, and in any and all capacities, to sign for us and in our names in the capacities indicated below 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 attorneys-in-fact and agents, and each of them, full power and authority to do and perform each and every act and thing requisite or necessary to be done in and about the premises, as full to all intents and purposes as he might or could do in person, hereby ratifying and confirming all that said attorneys-in-fact and agents or any of them, or their or his substitute or substitutes, may lawfully do or cause to be done by virtue hereof.

Pursuant to the requirements of the Securities Act of 1933, this registration statement has been signed by the following persons in the capacities and on the date indicated below.

<u>Signature</u>	<u>Title</u>	<u>Date</u>
<u>/s/ Sanjay S. Shukla</u> Sanjay S. Shukla, M.D., M.S.	President, Chief Executive Officer and Director <i>(Principal Executive Officer)</i>	May 14, 2021
<u>/s/ Jill M. Broadfoot</u> Jill M. Broadfoot	Chief Financial Officer <i>(Principal Financial and Accounting Officer)</i>	May 14, 2021
<u>/s/ John K. Clarke</u> John K. Clarke	Chairman of the Board and Director	May 14, 2021
<u>/s/ Jane A. Gross</u> Jane A. Gross, Ph.D.	Director	May 14, 2021
<u>/s/ Timothy P. Coughlin</u> Timothy P. Coughlin	Director	May 14, 2021
<u>/s/ Svetlana Lucas</u> Svetlana Lucas, Ph.D.	Director	May 14, 2021
<u>/s/ Paul Schimmel</u> Paul Schimmel, Ph.D.	Director	May 14, 2021



Sean M. Clayton  
+1 858 550 6034  
sclayton@cooley.com

May 14, 2021

aTyr Pharma, Inc.  
3545 John Hopkins Court, Suite #250  
San Diego, California 92121

Ladies and Gentlemen:

You have requested our opinion, as counsel to aTyr Pharma, Inc., a Delaware corporation (the "**Company**"), in connection with the filing by the Company of a Registration Statement on Form S-8 (the "**Registration Statement**") with the Securities and Exchange Commission covering the offering of up to 750,000 shares (the "**Shares**") of the Company's Common Stock, par value \$0.001 per share, issuable pursuant to the Company's 2015 Stock Option and Incentive Plan (the "**Plan**").

In connection with this opinion, we have examined and relied upon the Registration Statement and related prospectus, the Plan, the Company's Certificate of Incorporation and Bylaws, each as currently in effect, and originals or copies certified to our satisfaction of such records, documents, certificates, memoranda and other instruments as in our judgment are necessary or appropriate to enable us to render the opinion expressed below. We have assumed the genuineness of all signatures, the authenticity of all documents submitted to us as originals, the conformity to originals of all documents submitted to us as copies, the accuracy, completeness and authenticity of certificates of public officials, and the due authorization, execution and delivery of all documents by all persons other than the Company where authorization, execution and delivery are prerequisites to the effectiveness of such documents. As to certain factual matters, we have relied upon a certificate of an officer of the Company and have not independently verified such matters.

Our opinion is expressed only with respect to the General Corporation Law of the State of Delaware. We express no opinion to the extent that any other laws are applicable to the subject matter hereof and express no opinion and provide no assurance as to compliance with any federal or state securities law, rule or regulation.

On the basis of the foregoing, and in reliance thereon, we are of the opinion that the Shares, when sold and issued in accordance with the Plan, the Registration Statement and related prospectus, will be validly issued, fully paid and nonassessable (except as to Shares issued pursuant to certain deferred payment arrangements, which will be fully paid and nonassessable when such deferred payments are made in full).

We consent to the filing of this opinion as an exhibit to the Registration Statement.

Sincerely,

Cooley LLP

By: Sean M. Clayton  
Sean M. Clayton

**Consent of Independent Registered Public Accounting Firm**

We consent to the incorporation by reference in the Registration Statement (Form S-8) pertaining to the ATYR PHARMA, INC. 2015 STOCK OPTION AND INCENTIVE PLAN, AS AMENDED of our report dated March 23, 2021, with respect to the consolidated financial statements of aTyr Pharma, Inc. included in its Annual Report (Form 10-K) for the year ended December 31, 2020, filed with the Securities and Exchange Commission.

/s/ Ernst & Young LLP

San Diego, California  
May 14, 2021