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

**FORM S-3
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 Number)

**3545 John Hopkins Court, Suite #250
San Diego, CA 92121
(858) 731-8389**

(Address, including zip code, and telephone number, including area code, of principal executive offices)

**John D. Mendlein, Ph.D.
Chief Executive Officer
aTyr Pharma, Inc.**

**3545 John Hopkins Court, Suite 250
San Diego, CA 92121
(858) 731-8389**

(Name, address, including zip code, and telephone number, including area code, of agent for service)

With copies to:

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Approximate date of commencement of proposed sale to the public: From time to time after this Registration Statement becomes effective.

If the only securities being registered on this form are being offered pursuant to dividend or interest reinvestment plans, please check the following box.

If any of the securities being registered on this Form are to be offered on a delayed or continuous basis pursuant to Rule 415 under the Securities Act of 1933, as amended, other than securities offered only in connection with dividend or interest reinvestment plans, check the following box:

If this form is filed to register additional securities for an offering pursuant to Rule 462(b) under the Securities Act, please check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering.

If this form is a post-effective amendment filed pursuant to Rule 462(c) under the Securities Act, check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering.

If this Form is a registration statement pursuant to General Instruction I.D. or a post-effective amendment thereto that shall become effective upon filing with the Commission pursuant to Rule 462(e) under the Securities Act, check the following box.

If this Form is a post-effective amendment to a registration statement filed pursuant to General Instruction I.D. filed to register additional securities or additional classes of securities pursuant to Rule 413(b) under the Securities Act, check the following box.

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 (Do not check if a smaller reporting company) 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.

CALCULATION OF REGISTRATION FEE

Title of Each Class of Securities to be Registered	Amount to be Registered	Proposed Maximum Offering Price Per Share (4)	Proposed Maximum Aggregate Offering Price (4)	Amount of Registration Fee
Common Stock, par value \$0.001 per share	5,740,048(1)	\$3.05	\$17,507,146.40	\$2,029.08
Common Stock, par value \$0.001 per share	11,429,760(2)	\$3.05	\$34,860,768.00	\$4,040.37
Common Stock, par value \$0.001 per share	6,438,678(3)	\$3.05	\$19,637,967.90	\$2,276.05

(1) This amount represents shares to be offered by the selling stockholders from time to time after the effective date of this Registration Statement at prevailing market prices at the time of sale. In accordance with Rule 416(a), the registrant is also registering for resale hereunder an indeterminate number of shares that may be issued with respect to the shares being registered hereunder as a result of stock splits, stock dividends or similar transactions. Consists of shares of common stock sold pursuant to a Securities Purchase Agreement dated August 27, 2017 by and among the registrant and the purchasers named therein.

(2) This amount represents shares to be offered by the selling stockholders from time to time after the effective date of this Registration Statement at prevailing market prices at the time of sale. In accordance with Rule 416(a), the registrant is also registering for resale hereunder an indeterminate number of shares that may be issued with respect to the shares being registered hereunder as a result of stock splits, stock dividends or similar transactions. Consists of shares of common stock issuable upon the conversion of an aggregate of 2,285,952 shares of Class X Convertible Preferred Stock.

(3) This amount represents shares to be offered by the selling stockholders from time to time after the effective date of this Registration Statement at prevailing market prices at the time of sale. In accordance with Rule 416(a), the registrant is also registering for resale hereunder an indeterminate number of shares that may be issued with respect to the shares being registered hereunder as a result of stock splits, stock dividends or similar transactions. Consists of shares of common stock issuable upon the exercise of the Company's existing warrants issued pursuant to the terms of the Securities Purchase Agreement dated August 27, 2017 by and among the registrant and the purchasers named therein (the "Warrants").

(4) Estimated solely for purposes of calculating the amount of the registration fee pursuant to Rule 457(c) of the Securities Act of 1933, as amended (the "Securities Act"), based upon the average of the high and low sales prices of the registrant's common stock as reported on The NASDAQ Global Select Market on September 12, 2017.

THE REGISTRANT HEREBY AMENDS THIS REGISTRATION STATEMENT ON SUCH DATE OR DATES AS MAY BE NECESSARY TO DELAY ITS EFFECTIVE DATE UNTIL THE REGISTRANT SHALL FILE A FURTHER AMENDMENT WHICH SPECIFICALLY STATES THAT THIS REGISTRATION STATEMENT SHALL THEREAFTER BECOME EFFECTIVE IN ACCORDANCE WITH SECTION 8(a) OF THE SECURITIES ACT OF 1933, AS AMENDED, OR UNTIL THE REGISTRATION STATEMENT SHALL BECOME EFFECTIVE ON SUCH DATE AS THE COMMISSION ACTING PURSUANT TO SAID SECTION 8(a), MAY DETERMINE.

**SUBJECT TO COMPLETION,
DATED September 14, 2017.**

The information in this preliminary prospectus is not complete and may be changed. These securities may not be sold until the registration statement filed with the Securities and Exchange Commission is effective. This preliminary prospectus is not an offer to sell nor does it seek an offer to buy these securities in any jurisdiction where the offer or sale is not permitted.

PROSPECTUS



23,608,486 Shares of Common Stock

This prospectus relates to the resale from time to time of up to 23,608,486 shares of our common stock by the selling stockholders named in this prospectus. Of these shares, 5,740,048 are outstanding shares of common stock held by the selling stockholders identified in this prospectus, 11,429,760 shares are shares of common stock issuable upon conversion of the Class X Preferred Stock held by the selling stockholders identified in this prospectus and 6,438,678 shares are shares of common stock issuable upon exercise of warrants held by the selling stockholders identified in this prospectus. We are not selling any securities under this prospectus and we will not receive any of the proceeds from the sale of our common stock by the selling stockholders. We will, however, receive the net proceeds of any warrants exercised for cash.

The shares of common stock registered hereunder were issued to the selling stockholders pursuant to a Securities Purchase Agreement, dated as of August 27, 2017, by and between us and the selling stockholders or are issuable on exercise of warrants or conversion of preferred stock sold to the selling stockholders under that Securities Purchase Agreement. The selling stockholders may resell or dispose of the shares of our common stock, or interests therein, at fixed prices, at prevailing market prices at the time of sale or at prices negotiated with purchasers, to or through underwriters, broker-dealers, agents, or through any other means described in this prospectus under "Plan of Distribution." The selling stockholders will bear all selling commissions and underwriting discounts, if any, attributable to the sale or disposition of the shares, or interests therein. We will bear all costs, expenses and fees in connection with the registration of the shares.

You should read this document and any prospectus supplement or amendment carefully before you invest in our securities.

Our common stock is listed on The NASDAQ Global Select Market under the symbol "LIFE." On September 13, 2017, the closing price for our common stock, as reported on The NASDAQ Global Market, was \$3.25 per share. Our principal executive offices are located at 3545 John Hopkins Court, Suite 250, San Diego, CA 92121.

Investing in our securities involves a high degree of risk. You should review carefully the risks and uncertainties described under the heading "Risk Factors" contained in this prospectus beginning on page 2 and any applicable prospectus supplement, and under similar headings in the other documents that are incorporated by reference into this prospectus.

Neither the Securities and Exchange Commission nor any state securities commission has approved or disapproved of these securities or determined if this prospectus is truthful or complete. Any representation to the contrary is a criminal offense.

The date of this Prospectus is September __, 2017.

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ABOUT THIS PROSPECTUS

This prospectus is part of a registration statement that we filed with the Securities and Exchange Commission (“SEC”). The selling stockholders may from time to time sell up to 23,608,486 shares of common stock, as described in this prospectus, in one or more offerings. We have agreed to pay the expenses incurred in registering these shares, including legal and accounting fees.

This prospectus provides you with a general description of the securities the selling stockholders may offer. You should read this prospectus and the additional information described under the heading “Where You Can Find More Information” beginning on page 19 of this prospectus.

You should rely only on the information contained in or incorporated by reference in this prospectus. Neither we nor any selling stockholder have authorized anyone to provide you with different information. The selling stockholders are offering to sell, and seeking offers to buy, shares of our common stock only in jurisdictions where it is lawful to do so. The selling stockholders are not making an offer of these shares in any jurisdiction where the offer is not permitted.

You should assume that the information appearing in this prospectus is accurate only as of the date of this prospectus, regardless of the time of delivery of this prospectus or any sale of our common stock.

Unless the context otherwise indicates, references in this prospectus to “aTyr Pharma”, “we”, “our”, “us” and “the Company” refer, collectively, to aTyr Pharma, Inc., a Delaware corporation.

RISK FACTORS

Investing in our securities involves a high degree of risk. In addition to the other information included in, or incorporated by reference into, this prospectus, you should carefully consider the risk factors incorporated by reference from our Annual Report on Form 10-K for the year ended December 31, 2016, and our Quarterly Reports on Form 10-Q for the quarters ended March 31, 2017 and June 30, 2017, which are on file with the SEC and are incorporated by reference into this prospectus, as the same may be updated from time to time by our future filings under the Securities Exchange Act of 1934, as amended (the “Exchange Act”), when determining whether or not to purchase the securities offered under this prospectus, in addition to the following:

Our executive officers, directors, principal stockholders and their affiliates own a significant percentage of our stock and will be able to exert significant control over matters submitted to stockholders for approval.

As of August 31, 2017, based on the latest information available to us, our executive officers, directors, principal stockholders and their affiliates beneficially own approximately 76.87% of our voting stock, including 14.29% held by entities affiliated with EcoR1 Capital and 9.50% held by Viking Global Opportunities Illiquid Investments Sub-Master LP (“VGO Fund”, together with its affiliates, “Viking”). The percentage of our common stock beneficially owned by Viking would increase substantially if Viking waived the Viking Percentage Limitation and would further increase substantially if the Company obtained the Requisite Approval (up to 39.40% assuming no other shares of common stock were issued upon exercise of the warrants purchased by all other selling stockholders). See “Selling Stockholders”. VGO Fund can waive or change the Viking Percentage Limitation on 61 days notice. Assuming all of the shares included in and offered by this prospectus are sold, our executive officers, directors, principal stockholders and their affiliates would beneficially own approximately 25.33% of our voting stock. Therefore, our executive officers, directors, principal stockholders and their affiliates will have the ability to influence us through their ownership positions and may be able to determine all matters requiring stockholder approval. For example, these stockholders, acting together, may be able to control elections of directors, amendments of our organizational documents, or approval of any merger, sale of assets, or other major corporate transaction. This may prevent or discourage unsolicited acquisition proposals or offers for our common stock that you may believe are in your best interest as one of our stockholders.

Future sales of our common stock by the selling stockholders could cause our stock price to decline.

Sales of a substantial number of shares of our common stock by the selling stockholders in the public market or the perception that these sales might occur, could depress the market price of our common stock and could impair our ability to raise capital through the sale of additional equity securities, even if there is no relationship between such sales and the performance of our business.

CAUTIONARY STATEMENT REGARDING FORWARD-LOOKING STATEMENTS

This prospectus, including the documents that we incorporate by reference, contains “forward-looking statements” that involve risks and uncertainties, as well as assumptions that even if they never materialize or prove incorrect, could cause our results to differ materially from those expressed or implied by such forward-looking statements. We make such forward-looking statements pursuant to the safe harbor provisions of the Private Securities Litigation Reform Act of 1995 and other federal securities laws. All statements other than statements of historical facts contained in this prospectus, including the documents that we incorporate by reference, are forward-looking statements. In some cases, you can identify forward-looking statements by terms such as “may,” “will,” “expect,” “anticipate,” “estimate,” “intend,” “predict,” “potential,” “believe,” “should” and similar expressions. Forward-looking statements in this prospectus, including the documents that we incorporate by reference, include, but are not limited to, statements about:

- the success, cost and timing of clinical trials of Resolaris, iMod.Fc and any other product candidates, including potential product candidates from ORCA, and whether the results of our trials will be sufficient to support domestic or foreign regulatory approvals;
- the likelihood and timing of regulatory approvals for Resolaris, iMod.Fc and any of our other product candidates, including potential product candidates from ORCA;
- our ability to identify and discover additional product candidates;
- whether our existing capital resources will be sufficient to enable us to complete any particular portion of our planned clinical development of Resolaris, iMod.Fc and any other product candidates, including potential product candidates from ORCA;
- our ability to obtain, maintain, defend and enforce intellectual property rights protecting our product candidates;
- our estimates of our expenses, ongoing losses, future revenue, capital requirements and our needs for, or ability to obtain, additional financing;
- the performance of third-party service providers and independent contractors upon whom we rely to conduct our clinical trials and to manufacture our product candidates or certain components of our product candidates;
- our ability to develop sales and marketing capabilities or to enter into strategic partnerships to develop and commercialize Resolaris, iMod.Fc or any of our other product candidates, including potential product candidates from ORCA;
- the timing and success of the commercialization of Resolaris, iMod.Fc or any of our other product candidates, including potential product candidates from ORCA;
- the rate and degree of market acceptance of our product candidates;
- the size and growth of the potential markets for our product candidates and our ability to serve those markets;
- regulatory developments in the United States and foreign countries;
- the success of competing therapies that are or may become available;
- our ability to attract and retain key scientific, medical or management personnel; and
- other risks and uncertainties, including those described under the caption “Risk Factors” in this prospectus, any documents incorporated by reference into this prospectus and any prospectus supplement that we may file.

The cautionary statements made in this prospectus are intended to be applicable to all related forward-looking statements wherever they may appear in this prospectus. The forward looking statements made in documents incorporated by reference in this prospectus are made only as of the date of such documents. We urge you not to place undue reliance on these forward-looking statements, which speak only as of the date of this prospectus. Except as required by law, we assume no obligation to update our forward-looking statements, even if new information becomes available in the future.

THE COMPANY

We engage in the discovery and clinical development of innovative medicines for patients suffering from severe, rare diseases using our knowledge of Physiocrine biology, a newly discovered set of immunological and physiological pathways. Through our research efforts, we believe that Physiocrines evolved over billions of years to promote homeostasis in complex organisms. We have evidence to support that some of these proteins evolved to govern and orchestrate the mammalian immune system. We believe immune imbalance is underappreciated in many disease types and may ultimately be responsible for much of the pathophysiology associated with a number of important genetic and immunology based diseases.

By focusing on immune pathways in disease, we believe our therapeutic candidates have the potential to restore patients to a healthier state, achieve homeostatic balance and ultimately lead to improved clinical outcomes. To date, our discovery efforts have generated three immunology-based programs, Resolaris, iMod.Fc and ORCA, in three different therapeutic areas, including rare myopathies, rare pulmonary diseases and various cancers. Each program utilizes a different modality related to the Resokine pathway, including a natural protein therapy, an engineered Fc-fusion protein therapeutic and a Resokine antibody.

Resolaris

We internally discovered and developed Resolaris, our first Physiocrine-based therapeutic candidate, based on a protein naturally secreted from muscle that acts on T-cells at the tissue level to promote healthier muscle. We believe this may translate into an innovative therapeutic for rare genetic myopathies with an immune component (e.g. T-cells in the patients' muscle), including limb-girdle muscular dystrophy, facioscapulohumeral muscular dystrophy, and Duchenne muscular dystrophy. Resolaris also represents an example of our first therapeutic modality – natural protein therapy – adding back a pathway that is insufficiently produced by the human body to counteract disease.

We have completed a robust Phase 1b/2 program with Resolaris. Across all of our studies, 44 patients have received Resolaris for a total drug exposure of 204 patient months. We believe the results from our Phase 1b/2 program are supportive of the advancement of Resolaris as a treatment for various rare myopathies with an immune component. For future clinical development, initiation of a randomized placebo-controlled trial with Resolaris is contingent upon the identification of a PD assay and execution of a partnership related to one or more of our programs.

iMod.Fc

Our scientists successfully engineered the first fusion protein with a Physiocrine, iMod.Fc, to provide designed properties to enhance the immunomodulatory aspects of a Physiocrine *in vivo*. We plan to develop iMod.Fc as a potential therapeutic for patients with rare pulmonary diseases with an immune component, including interstitial lung disease (“ILD”). This fusion protein, which utilizes the Fc region of an antibody, also potentially represents a novel Fc-Physiocrine platform for future Physiocrine-based therapies. We plan to commence Phase 1/2a clinical development for the iMod.Fc program by the end of 2017. This program will investigate the safety, tolerability, immunogenicity, pharmacokinetics and pharmacodynamics of intravenous iMod.Fc in healthy volunteers and patients with ILD.

ORCA

Our third program represents a third therapeutic modality distinct from Resolaris or iMod.Fc. ORCA is a preclinical research program that targets a novel, proprietary immuno-oncology pathway using antibodies to change levels of Resokine in tumor settings. We believe tumors, across multiple tumor types, utilize Resokine to evade immune system responses. ORCA represents a novel and proprietary target that we believe is active in 100% of the tumor types tested and the target appears to be upregulated and active in 95% or more of patients with a specific tumor type (> 10 types tested across over 300 patients). We have evaluated the therapeutic potential of targeting this novel pathway in multiple in-vitro and in-vivo tumor models, in comparison to and in combination with incumbent check-point modulators. Based on the tumor model data, we believe that targeting this pathway can reduce or, in some cases, reverse tumor growth either as a monotherapy or in combination therapy.

Our expansive Physiocrine patent estate provides us with potential product protection as we pioneer this new and important area of human biology. To protect our industry unique pipeline based on our proprietary new biology, we have built an intellectual property estate comprising over 220 issued patents or allowed patent applications that are owned or exclusively licensed by us, including over 300 potential Physiocrine-based protein compositions. We believe it is in the best interest of our stakeholders, including patients, caregivers, and our stockholders, to advance one or more of our three current programs based on Physiocrine biology with the expertise of or funding from appropriate strategic partners.

We own various U.S. federal trademark applications and unregistered trademarks, including our company name and Resolaris™.

We qualify as an “emerging growth company” as defined in the Jumpstart Our Business Startups Act of 2012, as amended (the “JOBS Act”). As an emerging growth company, we may take advantage of specified reduced disclosure and other requirements that are otherwise applicable generally to public companies. We would cease to be an emerging growth company on the date that is the earliest of: (i) the last day of the fiscal year in which we have total annual gross revenues of \$1 billion or more; (ii) December 31, 2020; (iii) the date on which we have issued more than \$1 billion in nonconvertible debt during the previous three years; or (iv) the date on which we are deemed to be a large accelerated filer under the rules of the SEC.

We were incorporated under the laws of the State of Delaware in September 2005. Our principal executive offices are located at 3545 John Hopkins Court, Suite 250, San Diego, CA 92121 and our telephone number is (858) 731-8389. Our website address is www.atyrpharma.com. The information on, or that can be accessed through, our website does not constitute part of this prospectus, and you should not rely on any such information in making the decision whether to purchase our common stock. Our common stock trades on The NASDAQ Global Select Market under the symbol “LIFE”.

USE OF PROCEEDS

The selling stockholders are offering all of the shares of our common stock being offered pursuant to this prospectus. Accordingly, we will not receive any proceeds from the sale of shares of our common stock by any selling stockholder. We have agreed to pay all costs, expenses and fees relating to registering the shares of our common stock referenced in this prospectus. The selling stockholders will pay any brokerage commissions and/or similar charges incurred in connection with the sale or other disposition by them of the shares covered hereby.

DESCRIPTION OF CAPITAL STOCK

The following description of our common stock and preferred stock, together with the additional information we include in any applicable prospectus supplements, summarizes the material terms and provisions of our capital stock. The following description of our capital stock does not purport to be complete and is subject to, and qualified in its entirety by, our certificate of incorporation and bylaws, which are exhibits to the registration statement of which this prospectus forms a part, and by applicable law. The terms of our common stock and preferred stock may also be affected by Delaware law.

Authorized Capital Stock

Our authorized capital stock consists of 150,000,000 shares of common stock, par value \$0.001 per share, and 7,285,456 shares of preferred stock, par value \$0.001 per share, of which 72,000 shares are designated Series B redeemable convertible preferred stock, 15,957 shares are designated Series C redeemable convertible preferred stock, 2,197,499 shares are designated Series D redeemable convertible preferred stock, 2,285,952 shares are designated Class X Convertible Preferred Stock and 2,714,048 shares are undesignated preferred stock. The designated preferred stock is not available for future issuance. As of August 31, 2017, we had 29,711,783 shares of common stock outstanding and 2,285,952 shares of preferred stock outstanding.

Common Stock

The holders of our common stock are entitled to one vote for each share held on all matters submitted to a vote of the stockholders. The holders of our common stock do not have any cumulative voting rights. Holders of our common stock are entitled to receive ratably any dividends declared by our board of directors out of funds legally available for that purpose, subject to any preferential dividend rights of any outstanding preferred stock. Our common stock has no preemptive rights, conversion rights or other subscription rights or redemption or sinking fund provisions.

In the event of our liquidation, dissolution or winding up, holders of our common stock will be entitled to share ratably in all assets remaining after payment of all debts and other liabilities and any liquidation preference of any outstanding preferred stock. All outstanding shares, including the shares of common stock offered under this prospectus are fully paid and nonassessable.

Exchange Listing

Our common stock is listed on The NASDAQ Global Select Market under the symbol "LIFE." On September 13, 2017, the closing price for our common stock, as reported on The NASDAQ Global Select Market, was \$3.25 per share.

Transfer Agent and Registrar

The transfer agent and registrar for our common stock is American Stock Transfer & Trust Company, LLC. The transfer agent and registrar's address is 6201 15th Avenue, Brooklyn, NY 11219.

Preferred Stock

Our board of directors is authorized to issue up to 5,000,000 shares of undesignated preferred stock in one or more series without stockholder approval. As a result of the designation and issuance of 2,285,952 shares of Class X Convertible Preferred Stock described below, our board of directors is authorized to designate and issue up to 2,714,048 remaining shares of preferred stock. Our board of directors may determine the rights, preferences, privileges and restrictions, including voting rights, dividend rights, conversion rights, redemption privileges and liquidation preferences, of each series of preferred stock, any or all of which may be more favorable than the rights of our common stock. The issuance of our preferred stock could adversely affect the voting power of holders of common stock and the likelihood that such holders will receive dividend payments and payments upon our liquidation. In addition, the issuance of preferred stock could have the effect of delaying, deferring or preventing a change in control of our company or other corporate action.

We filed a Certificate of Designation of Preferences, Rights and Limitations of Class X Convertible Preferred Stock with the Secretary of State of Delaware on August 28, 2017 (the “Certificate of Designation”), pursuant to which we designated 2,285,952 shares of authorized and unissued preferred stock as Class X Convertible Preferred Stock (the “Preferred Shares”). Each Preferred Share is convertible into five shares of common stock (subject to adjustment for stock dividends, stock splits, combinations and the like). VGO Fund will not be able to convert the Preferred Shares into shares of common stock if, as a result of such conversion, VGO Fund, together with any other persons whose beneficial ownership of our common stock would be aggregated with VGO Fund’s for purposes of Section 13(d) and Section 16 of the Exchange Act and the applicable regulations of the SEC, including any group of which VGO Fund is a member, would beneficially own more than 9.50% of the shares of our common stock then issued and outstanding (the “Viking Percentage Limitation”), which percentage may change at VGO Fund’s election upon 61 days’ notice to us to (i) any other number less than or equal to 19.99% or (ii) subject to approval of our stockholders to the extent required in accordance with the NASDAQ Global Market rules (the “Requisite Approval”), any number in excess of 19.99%. Additionally, in the event of certain fundamental transactions, including (i) any merger or consolidation of the Company with or into another individual or corporation, partnership, trust, incorporated or unincorporated association, joint venture, limited liability company, joint stock company, government (or an agency or subdivision thereof) or other entity of any kind, in which the Company is not the survivor or the stockholders of the Company immediately prior to such merger or consolidation do not own, directly or indirectly, at least 50% of the voting securities of the surviving entity, (ii) any sale of all or substantially all of its assets or a majority of its common stock is acquired by a third party, in each case, in one or a series of related transactions, (iii) any tender offer or exchange offer (whether by the Company or another person) is completed pursuant to which all or substantially all of the holders of common stock are permitted to tender or exchange their shares for other securities, cash or property, or (iv) any reclassification of the common stock or any compulsory share exchange pursuant to which the common stock is effectively converted into or exchanged for other securities, cash or property (other than as a result of certain subdivisions or combinations of shares of common stock) (X) if the Requisite Approval has previously been obtained, each share of Class X Convertible Preferred Stock outstanding immediately prior to such fundamental transaction will automatically convert into shares of common stock at the applicable conversion ratio, and (Y) if the Requisite Approval has not previously been obtained, then each outstanding share of Class X Convertible Preferred Stock will be canceled and automatically exchanged for the same kind and amount of securities, cash and other property receivable upon the effectiveness of such fundamental transaction by a holder of the corresponding number of shares of common stock otherwise issuable upon conversion of the Class X Convertible Preferred Stock at the then-effective conversion ratio.

In the event of our liquidation, dissolution or winding up, holders of Preferred Shares will participate *pari passu* with the holders of our common stock in any distribution of proceeds, pro rata based on the number of shares held by each such holder on an as-converted basis. The Preferred Shares have no voting rights. Holders of the Preferred Shares are entitled to receive, on an as-converted-to-common-stock basis, dividends that are equal to dividends actually paid on shares of common stock, when, as and if such dividends are paid on shares of the common stock.

Provisions of our Certificate of Incorporation and Bylaws and Delaware Anti-Takeover Law

Certain provisions of the Delaware General Corporation Law (“DGCL”) and of our certificate of incorporation and bylaws could have the effect of delaying, deferring or discouraging another party from acquiring control of us. These provisions, which are summarized below, are expected to discourage certain types of coercive takeover practices and inadequate takeover bids and, as a consequence, they might also inhibit temporary fluctuations in the market price of our common stock that often result from actual or rumored hostile takeover attempts. These provisions are also designed in part to encourage anyone seeking to acquire control of us to first negotiate with our board of directors. These provisions might also have the effect of preventing changes in our management. It is possible that these provisions could make it more difficult to accomplish transactions that stockholders might otherwise deem to be in their best interests. However, we believe that the advantages gained by protecting our ability to negotiate with any unsolicited and potentially unfriendly acquirer outweigh the disadvantages of discouraging such proposals, including those priced above the then-current market value of our common stock, because, among other reasons, the negotiation of such proposals could improve their terms.

Provisions of our Certificate of Incorporation and Bylaws

Our certificate of incorporation and bylaws include a number of provisions that may have the effect of delaying, deferring or discouraging another party from acquiring control of us and encouraging persons considering unsolicited tender offers or other unilateral takeover proposals to negotiate with our board of directors rather than pursue non-negotiated takeover attempts. These provisions include the items described below.

Board Composition and Filling Vacancies. Our certificate of incorporation provides for the division of our board of directors into three classes serving staggered three-year terms, with one class being elected each year. Our certificate of incorporation also provides that directors may be removed only for cause and then only by the affirmative vote of the holders of 75% or more of the shares then entitled to vote at an election of directors. Furthermore, any vacancy on our board of directors, however occurring, including a vacancy resulting from an increase in the size of our board, may only be filled by the affirmative vote of a majority of our directors then in office even if less than a quorum.

No Written Consent of Stockholders. Our certificate of incorporation provides that all stockholder actions are required to be taken by a vote of the stockholders at an annual or special meeting, and that stockholders may not take any action by written consent in lieu of a meeting.

Meetings of Stockholders. Our certificate of incorporation and bylaws provide that only a majority of the members of our board of directors then in office may call special meetings of stockholders and only those matters set forth in the notice of the special meeting may be considered or acted upon at a special meeting of stockholders. Our bylaws limit the business that may be conducted at an annual meeting of stockholders to those matters properly brought before the meeting.

Advance Notice Requirements. Our bylaws establish advance notice procedures with regard to stockholder proposals relating to the nomination of candidates for election as directors or new business to be brought before meetings of our stockholders. These procedures provide that notice of stockholder proposals must be timely given in writing to our corporate secretary prior to the meeting at which the action is to be taken. Generally, to be timely, notice must be received at our principal executive offices not less than 90 days nor more than 120 days prior to the first anniversary date of the annual meeting for the preceding year. Our bylaws specify the requirements as to form and content of all stockholders' notices.

Amendment to Certificate of Incorporation and Bylaws. As required by the DGCL, any amendment of our certificate of incorporation must first be approved by a majority of our board of directors, and if required by law or our certificate of incorporation, must thereafter be approved by a majority of the outstanding shares entitled to vote on the amendment and a majority of the outstanding shares of each class entitled to vote thereon as a class, except that the amendment of the provisions relating to stockholder action, board composition, limitation of liability and the amendment of our certificate of incorporation must be approved by not less than 75% of the outstanding shares entitled to vote on the amendment, and not less than 75% of the outstanding shares of each class entitled to vote thereon as a class. Our bylaws may be amended by the affirmative vote of a majority of the directors then in office, subject to any limitations set forth in the bylaws; and may also be amended by the affirmative vote of at least 75% of the outstanding shares entitled to vote on the amendment, or, if our board of directors recommends that the stockholders approve the amendment, by the affirmative vote of the majority of the outstanding shares entitled to vote on the amendment, in each case voting together as a single class.

Undesignated Preferred Stock. Our certificate of incorporation provides for 5,000,000 authorized shares of undesignated preferred stock, of which 2,285,952 shares have been designated as Class X Convertible Preferred Stock. Our other classes of designated preferred stock may not be issued. The existence of authorized but unissued shares of undesignated preferred stock may enable our board of directors to discourage an attempt to obtain control of us by means of a merger, tender offer, proxy contest or otherwise. For example, if in the due exercise of its fiduciary obligations, our board of directors were to determine that a takeover proposal is not in the best interests of our stockholders, our board of directors could cause shares of preferred stock to be issued without stockholder approval in one or more private offerings or other transactions that might dilute the voting or other rights of the proposed acquirer or insurgent stockholder or stockholder group. In this regard, our certificate of incorporation grants our board of directors broad power to establish the rights and preferences of authorized and unissued shares of preferred stock. The issuance of shares of undesignated preferred stock could decrease the amount of earnings and assets available for distribution to holders of shares of common stock. The issuance may also adversely affect the rights and powers, including voting rights, of these holders and may have the effect of delaying, deterring or preventing a change in control of us.

Delaware Anti-Takeover Law. We are subject to the provisions of Section 203 of the DGCL. In general, Section 203 prohibits a publicly held Delaware corporation from engaging in a “business combination” with an “interested stockholder” for a three-year period following the time that this stockholder becomes an interested stockholder, unless the business combination is approved in a prescribed manner. Under Section 203, a business combination between a corporation and an interested stockholder is prohibited unless it satisfies one of the following conditions:

- before the stockholder became interested, the board of directors approved either the business combination or the transaction which resulted in the stockholder becoming an interested stockholder;
- upon consummation of the transaction which resulted in the stockholder becoming an interested stockholder, the interested stockholder owned at least 85% of the voting stock of the corporation outstanding at the time the transaction commenced, excluding for purposes of determining the voting stock outstanding, shares owned by persons who are directors and also officers, and employee stock plans, in some instances; or
- at or after the time the stockholder became interested, the business combination was approved by the board of directors of the corporation and authorized at an annual or special meeting of the stockholders by the affirmative vote of at least two-thirds of the outstanding voting stock which is not owned by the interested stockholder.

Section 203 defines a business combination to include:

- any merger or consolidation involving the corporation and the interested stockholder;
- any sale, transfer, lease, pledge or other disposition involving the interested stockholder of 10% or more of the assets of the corporation;
- subject to exceptions, any transaction that results in the issuance or transfer by the corporation of any stock of the corporation to the interested stockholder;
- subject to exceptions, any transaction involving the corporation that has the effect of increasing the proportionate share of the stock of any class or series of the corporation beneficially owned by the interested stockholder; and
- the receipt by the interested stockholder of the benefit of any loans, advances, guarantees, pledges or other financial benefits provided by or through the corporation.

In general, Section 203 defines an interested stockholder as any entity or person beneficially owning or having owned in the past three years 15% or more of the outstanding voting stock of the corporation and any entity or person affiliated with or controlling or controlled by the entity or person.

Exclusive Jurisdiction of Certain Actions. Our bylaws provide that, unless we consent in writing to the selection of an alternative forum, the Court of Chancery of the State of Delaware shall be the sole and exclusive forum for (i) any derivative action or proceeding brought on our behalf, (ii) any action asserting a claim of breach of a fiduciary duty owed by any of our directors, officers or other employees to us or our stockholders, (iii) any action asserting a claim arising pursuant to any provision of the DGCL, our certificate of incorporation or our bylaws, or (iv) any action asserting a claim against us governed by the internal affairs doctrine. Although we believe this provision benefits us by providing increased consistency in the application of Delaware law in the types of lawsuits to which it applies, the provision may have the effect of discouraging lawsuits against our directors and officers. The enforceability of similar exclusive forum provisions in other companies’ certificates of incorporation or bylaws has been challenged in legal proceedings, and it is possible that a court could rule that this provision in our bylaws is inapplicable or unenforceable.

Registration Rights

In connection with the private placement described below in the section entitled “Selling Stockholders,” on August 27, 2017 we entered into the Registration Rights Agreement with the selling stockholders, pursuant to which we agreed to file a registration statement with the SEC within 30 days from August 31, 2017 (or the next business day if such 30th day falls on a weekend day or SEC holiday) in order to register for resale (i) the shares of common stock purchased by such selling stockholders in the private placement, (ii) the shares of common stock issuable to the selling stockholders upon conversion of the shares of Class X Preferred Stock purchased by such selling stockholders in such private placement and (iii) the shares of common stock issuable to the selling stockholders upon exercise of the warrants purchased by such selling stockholders in such private placement, and to use commercially reasonable efforts to have the registration statement declared effective within 90 days if there is no review by the SEC, and within 120 days in the event of such review. If the Company is notified by the SEC that the Registration Statement is not subject to review or the SEC has no further comments, the effectiveness deadline is five days from such notification.

We are required to use commercially reasonable efforts to cause such registration statement to become effective as soon as possible and to remain continuously effective for a period that will terminate upon the earlier of (i) such time as all of the registrable securities covered by such registration statement have been publicly sold by the holders or (ii) the date on which the holders cease to hold registrable securities.

SELLING STOCKHOLDERS

We have prepared this prospectus to allow the selling stockholders to sell or otherwise dispose of, from time to time, up to 23,608,486 shares of our common stock.

On August 27, 2017, we and VGO Fund, EcoR1 Capital (as defined below), Redmile Group (as defined below), Hudson Bay Master Fund Ltd. and other accredited investors, certain of whom are affiliated with our directors and officers, entered into a Securities Purchase Agreement (“the Purchase Agreement”), and a Registration Rights Agreement (“RRA”). Pursuant to the Purchase Agreement, we sold (i) an aggregate of 5,872,120 shares of our common stock at a price of \$2.65 per unit (“Initial Shares”) (each common stock unit consisting of one share of the Company’s common stock and a warrant to purchase 0.375 shares of the Company’s common stock), (ii) an aggregate of 2,285,952 Preferred Shares at a price of \$13.25 per unit (the shares of common stock issuable upon conversion of the Preferred Shares are referred to herein as the “Underlying Shares”) (each preferred stock unit consisting of one Preferred Share and a warrant to purchase 1.875 shares of the Company’s common stock) and (iii) warrants (“Warrants”) to purchase up to an aggregate of 6,488,205 shares of our common stock at an exercise price of \$4.64 per share (the shares of common stock issuable upon exercise of or otherwise pursuant to the Warrants collectively are referred to herein as the “Warrant Shares”, and together with the Initial Shares and the Underlying Shares, the “Shares”), in a private placement.

When we refer to “selling stockholders” in this prospectus, we mean the stockholders listed in the table below and their pledgees, donees, transferees or other successors in interest.

Pursuant to the RRA, we agreed to prepare and file a Registration Statement on Form S-3 within 30 days of the closing of the transaction to provide for the resale of the issued shares of the selling stockholders. This prospectus is a part of the Registration Statement filed pursuant to that obligation. We did not provide registration rights to John D. Mendlein, Ph.D., an officer and director of the Company, and an entity affiliated with Paul Schimmel, Ph.D., a director of the Company, each of whom was a party to the Purchase Agreement. As a result, we excluded (i) 37,736 shares of common stock and 14,151 Warrant Shares purchased by Dr. Mendlein, and (ii) 94,336 shares of common stock and 35,376 Warrant Shares purchased by an entity affiliated with Dr. Schimmel from the total number of shares of common stock offered for resale pursuant to this prospectus.

The table below lists the names of the selling stockholders and other information regarding the beneficial ownership of the shares of common stock held by each of the selling stockholders, including the nature of any position, office or other material relationship, if any, that the selling stockholder (or the individuals or entities who have control over such selling stockholders) has had within the past three years with us or with any of our predecessors or affiliates. The first column lists the number of shares of common stock beneficially owned by each selling stockholder, based on its ownership as of August 31, 2017, as such beneficial ownership is determined in accordance with the rules of the SEC. The second column lists the shares of common stock being offered by this prospectus by each selling stockholder. The third and fourth columns assume the sale of all of the shares offered by the selling stockholders pursuant to this prospectus.

Beneficial ownership is determined in accordance with rules promulgated by the SEC, and the information is not necessarily indicative of beneficial ownership for any other purpose. This table is based upon information supplied to us by the selling stockholders and information filed with the SEC.

Information about the selling stockholders may change over time. Any changed information will be set forth in supplements to this prospectus to the extent required.

Name and Address of Selling Stockholder	Number of Shares Beneficially Owned Prior to the Offering	Number of Shares Registered for Sale	Number of Shares Beneficially Owned After the Offering(1)	Percent of Class Beneficially Owned After the Offering(1)
Viking Global Opportunities Illiquid Investments Sub-Master LP c/o Viking Global Investors LP 55 Railroad Avenue Greenwich, CT 06830	2,932,229(2)	18,160,373(3)	0	*
Entities affiliated with EcoR1 Capital, LLC 409 Illinois Street San Francisco, CA 94158 San Francisco, California 94104	4,642,396(4)	2,594,339(5)	2,048,057	4.30%
Entities affiliated with Redmile Group, LLC c/o Redmile Group, LLC One Letterman Drive, Building D, Suite D3-300 San Francisco, CA 94129	2,594,339(6)	2,594,339(7)	0	*
Hudson Bay Master Fund Ltd. 777 Third Avenue, 30 th Floor New York, NY 10017	259,435(8)	259,435(9)	0	*

- (1) We do not know when or in what amounts the selling stockholders will offer shares for sale, if at all. The selling stockholders may sell any or all of the shares included in and offered by this prospectus. Because the selling stockholders may offer all or some of the shares pursuant to this offering, we cannot estimate the number of shares that will be held by the selling stockholders after completion of the offering. However, for purposes of this table, we have assumed that after completion of the offering, none of the shares included in and covered by this prospectus will be held by the selling stockholders. The percent of beneficial ownership for the selling stockholders after the offering is based on 47,629,748 shares, which is the total of 29,711,783 shares of our common stock outstanding as of August 31, 2017, 11,429,760 Underlying Shares issuable upon conversion of all 2,285,952 Preferred Shares outstanding on such date and 6,488,205 Warrant Shares.
- (2) Includes (i) 1,777,784 shares of common stock held by VGO Fund, and (ii) the shares of common stock described in footnote (3) below, subject to the beneficial ownership limitations described below as set forth in each of the warrant to purchase common stock held by the VGO Fund and the Certificate of Designation relating to the Class X Convertible Preferred Stock, such limitations resulting in beneficial ownership of an aggregate of 1,154,445 Warrant Shares and/or Underlying Shares. Pursuant to the terms of the warrant held by the VGO Fund and the Certificate of Designation, the VGO Fund will not be able to exercise or convert, respectively, if that would cause such holder to hold in excess of the Viking Percentage Limitation. Each of Viking Global Opportunities Portfolio GP LLC (the "Subsidiary General Partner"), the general partner of the VGO Fund, Viking Global Opportunities GP LLC (the "General Partner"), the sole owner of the Subsidiary General Partner, Viking Global Investors LP (the "Management Company"), which provides managerial services to the VGO Fund, and O. Andreas Halvorsen, David C. Ott and Rose Shabet, the executive committee members of the General Partner and Viking Global Partners LLC, the general partner of the Management Company, may be deemed to have voting and investment power over the shares held of record by the VGO Fund.

- (3) Includes (i) 1,777,784 shares of common stock, (ii) 4,952,829 Warrant Shares and (iii) 11,429,760 Underlying Shares.
- (4) Includes (A)(i) 1,662,221 shares of common stock held by EcoR1 Capital Fund Qualified, LP and (ii) 385,836 shares of common stock held by EcoR1 Capital Fund, LP.; and (B)(i) the shares of common stock described in footnote (5) below, subject to the beneficial ownership limitations set forth in the warrant to purchase common stock held by EcoR1 Capital Fund Qualified, LP (such limitations prohibiting any exercise that would cause such holder to hold in excess of 19.99% of our then issued and outstanding shares of common stock) and (ii) the shares of common stock described in footnote (5) below, subject to the beneficial ownership limitations set forth in the warrant to purchase common stock held by EcoR1 Capital Fund, LP (such limitations prohibiting any exercise that would cause such holder to hold in excess of 19.99% of our then issued and outstanding shares of common stock). Oleg Nodelman, founder and managing director of EcoR1 Capital Fund, LP, may be deemed to beneficially own the 2,594,339 shares of common stock held by EcoR1 Capital Fund, LP and EcoR1 Capital Fund Qualified, LP.
- (5) Includes (A)(i) 1,531,320 shares of common stock held by EcoR1 Capital Fund Qualified, LP and (ii) 355,472 shares of common stock held by EcoR1 Capital Fund, LP.; and (B)(i) 574,245 Warrant Shares by EcoR1 Capital Fund Qualified, LP and (ii) 133,302 Warrant Shares held by EcoR1 Capital Fund, LP.
- (6) Includes (A)(i) 118,840 shares of common stock held by P Redmile, Ltd. (ii) 81,200 shares of common stock held by Redmile Capital Offshore Fund (ERISA), Ltd., (iii) 949,120 shares of common stock held by Redmile Capital Offshore Fund, Ltd., (iv) 543,560 shares of common stock held by Redmile Capital Fund, LP and (v) 194,072 shares of common stock held by Redmile Capital Offshore Fund II, Ltd.; and (B)(i) the shares of common stock described in footnote (7) below, subject to the beneficial ownership limitations set forth in the warrant to purchase common stock held by P Redmile, Ltd. (such limitations prohibiting any exercise that would cause such holder to hold in excess of 9.99% of our then issued and outstanding shares of common stock), (ii) the shares of common stock described in footnote (7) below, subject to the beneficial ownership limitations set forth in the warrant to purchase common stock held by Redmile Capital Offshore Fund (ERISA), Ltd. (such limitations prohibiting any exercise that would cause such holder to hold in excess of 9.99% of our then issued and outstanding shares of common stock), (iii) the shares of common stock described in footnote (7) below, subject to the beneficial ownership limitations set forth in the warrant to purchase common stock held by Redmile Capital Offshore Fund, Ltd. (such limitations prohibiting any exercise that would cause such holder to hold in excess of 9.99% of our then issued and outstanding shares of common stock), (iv) the shares of common stock described in footnote (7) below, subject to the beneficial ownership limitations set forth in the warrant to purchase common stock held by Redmile Capital Fund, LP (such limitations prohibiting any exercise that would cause such holder to hold in excess of 9.99% of our then issued and outstanding shares of common stock) and (v) the shares of common stock described in footnote (7) below, subject to the beneficial ownership limitations set forth in the warrant to purchase common stock held by Redmile Capital Offshore Fund II, Ltd. (such limitations prohibiting any exercise that would cause such holder to hold in excess of 9.99% of our then issued and outstanding shares of common stock). Each of the private investment vehicles and separately managed accounts listed in this footnote (6), is affiliated with Redmile Group, LLC (“Redmile Group”). Accordingly, the shares of common stock referred to in this footnote (6) may be deemed beneficially owned by Redmile Group as investment manager of the private investment vehicles and separately managed accounts. Such shares of common stock may also be deemed beneficially owned by Jeremy Green as the principal of Redmile Group. Each of Redmile Group and Mr. Green disclaims beneficial ownership of such shares of common stock except to the extent of its pecuniary interest therein. Each of the private investment vehicles and separately managed accounts listed in this footnote (6) purchased shares of common stock in the ordinary course of business and at the time of the purchase of the Company’s shares of common stock to be resold under this registration statement, had no agreements or understandings, directly or indirectly, with any person to distribute the shares of common stock.

- (7) Includes (A)(i) 118,840 shares of common stock held by P Redmile, Ltd. (ii) 81,200 shares of common stock held by Redmile Capital Offshore Fund (ERISA), Ltd., (iii) 949,120 shares of common stock held by Redmile Capital Offshore Fund, Ltd., (iv) 543,560 shares of common stock held by Redmile Capital Fund, LP and (v) 194,072 shares of common stock held by Redmile Capital Offshore Fund II, Ltd.; and (B)(i) 44,565 Warrant Shares held by P Redmile, Ltd., (ii) 30,450 Warrant Shares held by Redmile Capital Offshore Fund (ERISA), Ltd., (iii) 355,920 Warrant Shares held by Redmile Capital Offshore Fund, Ltd., (iv) 203,835 Warrant Shares held by Redmile Capital Fund, LP and (v) 72,777 Warrant Shares held by Redmile Capital Offshore Fund II, Ltd.
- (8) Includes (i) 188,680 shares of common stock held by Hudson Bay Master Fund Ltd. and (ii) the shares of common stock described in footnote (9) below, subject to the beneficial ownership limitations set forth in the warrant to purchase common stock held by Hudson Bay Master Fund Ltd. (such limitations prohibiting any exercise that would cause such holder to hold in excess of 9.99% of our then issued and outstanding shares of common stock). Hudson Bay Capital Management LP, the investment manager of Hudson Bay Master Fund Ltd., has voting and investment power over these securities. Sander Gerber is the managing member of Hudson Bay Capital GP LLC, which is the general partner of Hudson Bay Capital Management LP. Each of Hudson Bay Master Fund Ltd. and Sander Gerber disclaims beneficial ownership over these securities.
- (9) Includes (i) 188,680 shares of common stock held by Hudson Bay Master Fund Ltd. and (ii) 70,755 Warrant Shares held by Hudson Bay Master Fund Ltd.

* Less than 1%

Relationship with the Selling Stockholders

Registration Rights Agreement

The selling stockholders are a party to the RRA. For more information, see description in section titled “Description of Capital Stock—Registration Rights” above.

PLAN OF DISTRIBUTION

We are registering the shares of common stock issued to the selling stockholders and issuable upon exercise of the warrants and conversion of the Class X Preferred Stock issued to the selling stockholders to permit the resale of these shares of common stock by the holders of the shares of common stock, warrants and Class X Preferred Stock from time to time after the date of this prospectus. We will not receive any of the proceeds from the sale by the selling stockholders of the shares of common stock. We will bear all fees and expenses incident to our obligation to register the shares of common stock.

The selling stockholders may sell all or a portion of the shares of common stock beneficially owned by them and offered hereby from time to time directly or through one or more underwriters, broker-dealers or agents. If the shares of common stock are sold through underwriters or broker-dealers, the selling stockholders will be responsible for underwriting discounts or selling commissions. The shares of common stock may be sold on any national securities exchange or quotation service on which the securities may be listed or quoted at the time of sale, in the over-the-counter market or in transactions otherwise than on these exchanges or systems or in the over-the-counter market and in one or more transactions at fixed prices, at prevailing market prices at the time of the sale, at varying prices determined at the time of sale, or at negotiated prices. These sales may be effected in transactions, which may involve crosses or block transactions. The selling stockholders may use any one or more of the following methods when selling shares:

- an underwritten offering;
- ordinary brokerage transactions and transactions in which the broker-dealer solicits purchasers;
- block trades in which the broker-dealer will attempt to sell the shares as agent but may position and resell a portion of the block as principal to facilitate the transaction;
- purchases by a broker-dealer as principal and resale by the broker-dealer for its account;
- an exchange distribution in accordance with the rules of the applicable exchange;
- privately negotiated transactions;
- settlement of short sales entered into after the effective date of the registration statement of which this prospectus is a part;
- broker-dealers may agree with the selling stockholders to sell a specified number of such shares at a stipulated price per share;
- through the writing or settlement of options or other hedging transactions, whether such options are listed on an options exchange or otherwise;
- a combination of any such methods of sale; and
- any other method permitted pursuant to applicable law.

The selling stockholders also may resell all or a portion of the shares in open market transactions in reliance upon Rule 144 under the Securities Act of 1934, as amended (the “Securities Act”), as permitted by that rule, or Section 4(a)(1) under the Securities Act, if available, rather than under this prospectus, provided that they meet the criteria and conform to the requirements of those provisions.

Broker-dealers engaged by the selling stockholders may arrange for other broker-dealers to participate in sales. If the selling stockholders effect such transactions by selling shares of common stock to or through underwriters, broker-dealers or agents, such underwriters, broker-dealers or agents may receive commissions in the form of discounts, concessions or commissions from the selling stockholders or commissions from purchasers of the shares of common stock for whom they may act as agent or to whom they may sell as principal. Such commissions will be in amounts to be negotiated, but, except as set forth in a supplement to this Prospectus, in the case of an agency transaction will not be in excess of a customary brokerage commission in compliance with FINRA Rule 2121; and in the case of a principal transaction a markup or markdown in compliance with FINRA Rule 2121.01.

In connection with sales of the shares of common stock or otherwise, the selling stockholders may enter into hedging transactions with broker-dealers or other financial institutions, which may in turn engage in short sales of the shares of common stock in the course of hedging in positions they assume. The selling stockholders may also sell shares of common stock short and if such short sale shall take place after the date that this Registration Statement is declared effective by the Commission, the selling stockholders may deliver shares of common stock covered by this prospectus to close out short positions and to return borrowed shares in connection with such short sales. The selling stockholders may also loan or pledge shares of common stock to broker-dealers that in turn may sell such shares, to the extent permitted by applicable law. The selling stockholders may also enter into option or other transactions with broker-dealers or other financial institutions or the creation of one or more derivative securities which require the delivery to such broker-dealer or other financial institution of shares offered by this prospectus, which shares such broker-dealer or other financial institution may resell pursuant to this prospectus (as supplemented or amended to reflect such transaction). Notwithstanding the foregoing, the selling stockholders have been advised that they may not use shares registered on this registration statement to cover short sales of our common stock made prior to the date the registration statement, of which this prospectus forms a part, has been declared effective by the SEC.

The selling stockholders may, from time to time, pledge or grant a security interest in some or all of the warrants or the shares of common stock or Class X Preferred Stock owned by them and, if they default in the performance of their secured obligations, the pledgees or secured parties may offer and sell the shares of common stock from time to time pursuant to this prospectus or any amendment to this prospectus under Rule 424(b)(3) or other applicable provision of the Securities Act of 1933, as amended, amending, if necessary, the list of selling stockholders to include the pledgee, transferee or other successors in interest as selling stockholders under this prospectus. The selling stockholders also may transfer and donate the shares of common stock in other circumstances in which case the transferees, donees, pledgees or other successors in interest will be the selling beneficial owners for purposes of this prospectus.

Each selling stockholder has informed the Company that it is not a registered broker-dealer and does not have any written or oral agreement or understanding, directly or indirectly, with any person to distribute the common stock. Upon the Company being notified in writing by a selling stockholder that any material arrangement has been entered into with a broker-dealer for the sale of common stock through a block trade, special offering, exchange distribution or secondary distribution or a purchase by a broker or dealer, a supplement to this prospectus will be filed, if required, pursuant to Rule 424(b) under the Securities Act, disclosing (i) the name of each such selling stockholder and of the participating broker-dealer(s), (ii) the number of shares involved, (iii) the price at which such the shares of common stock were sold, (iv) the commissions paid or discounts or concessions allowed to such broker-dealer(s), where applicable, (v) that such broker-dealer(s) did not conduct any investigation to verify the information set out or incorporated by reference in this prospectus, and (vi) other facts material to the transaction. In no event shall any broker-dealer receive fees, commissions and markups, which, in the aggregate, would exceed eight percent (8.0%).

Under the securities laws of some states, the shares of common stock may be sold in such states only through registered or licensed brokers or dealers. In addition, in some states the shares of common stock may not be sold unless such shares have been registered or qualified for sale in such state or an exemption from registration or qualification is available and is complied with.

There can be no assurance that any selling stockholder will sell any or all of the shares of common stock registered pursuant to the shelf registration statement, of which this prospectus forms a part.

Each selling stockholder and any other person participating in such distribution will be subject to applicable provisions of the Exchange Act and the rules and regulations thereunder, including, without limitation, to the extent applicable, Regulation M of the Exchange Act, which may limit the timing of purchases and sales of any of the shares of common stock by the selling stockholder and any other participating person. To the extent applicable, Regulation M may also restrict the ability of any person engaged in the distribution of the shares of common stock to engage in market-making activities with respect to the shares of common stock. All of the foregoing may affect the marketability of the shares of common stock and the ability of any person or entity to engage in market-making activities with respect to the shares of common stock.

We will pay all expenses of the registration of the shares of common stock pursuant to the Registration Rights Agreement, including, without limitation, SEC filing fees and expenses of compliance with state securities or “blue sky” laws; *provided, however*, that each selling stockholder will pay all underwriting discounts and selling commissions, if any and any related legal expenses incurred by it. We will indemnify the selling stockholders against certain liabilities, including some liabilities under the Securities Act, in accordance with the RRA, or the selling stockholders will be entitled to contribution. We may be indemnified by the selling stockholders against certain liabilities, including some liabilities under the Securities Act, that may arise from any written information furnished to us by the selling stockholders specifically for use in this prospectus, in accordance with the related RRA, or we may be entitled to contribution.

LEGAL MATTERS

Certain legal matters in connection with this offering will be passed upon for us by Goodwin Procter LLP, San Francisco, California.

EXPERTS

The consolidated financial statements of aTyr Pharma, Inc. appearing in our Annual Report (Form 10-K) for the year ended December 31, 2016 have been audited by Ernst & Young LLP, independent registered public accounting firm, as set forth in their report thereon, included therein, and incorporated herein by reference. Such consolidated financial statements are incorporated herein by reference in reliance upon such report given on the authority of such firm as experts in accounting and auditing.

WHERE YOU CAN FIND MORE INFORMATION

We are subject to the information requirements of the Exchange Act and, in accordance therewith, file annual, quarterly and special reports, proxy statements and other information with the SEC. You may read and copy any document we file at the SEC's Public Reference Room at 100 F Street, N.E., Washington, D.C. 20549. You may call the SEC at 1-800-SEC-0330 for further information on the operation of the Public Reference Room. These documents also may be accessed through the SEC's electronic data gathering, analysis and retrieval system, or EDGAR, via electronic means, including the SEC's home page on the Internet (www.sec.gov).

We have the authority to designate and issue more than one class or series of stock having various preferences, conversion and other rights, voting powers, restrictions, limitations as to dividends, qualifications, and terms and conditions of redemption. See "Description of Capital Stock." We will furnish a full statement of the relative rights and preferences of each class or series of our stock which has been so designated and any restrictions on the ownership or transfer of our stock to any stockholder upon written or oral request and without charge. Written requests for such copies should be directed to aTyr Pharma, Inc., 3545 John Hopkins Court, Suite 250, San Diego, CA 92121, Attention: Secretary, or by telephone request to (858) 731-8389. Our website is located at www.atyrpharma.com. Information contained on our website is not incorporated by reference into this prospectus and, therefore, is not part of this prospectus or any accompanying prospectus supplement.

INCORPORATION BY REFERENCE

The SEC allows us to incorporate by reference the information and reports we file with it, which means that we can disclose important information to you by referring you to these documents. The information incorporated by reference is an important part of this prospectus, and information that we file later with the SEC will automatically update and supersede the information already incorporated by reference. We are incorporating by reference the documents listed below, which we have already filed with the SEC, and any future filings we make with the SEC under Sections 13(a), 13(c), 14 or 15(d) of the Exchange Act, including all filings made after the date of the filing of this registration statement and prior to the effectiveness of this registration statement, except as to any portion of any future report or document that is not deemed filed under such provisions, until we sell all of the securities:

- Annual Report on Form 10-K for the year ended December 31, 2016;
- The information specifically incorporated by reference into our Annual Report on Form 10-K for the year ended December 31, 2016 from our definitive proxy statement on Schedule 14A (other than information furnished rather than filed), which was filed with the SEC on March 16, 2017;
- Quarterly Reports on Form 10-Q filed with the SEC for the quarters ended March 31, 2017 and June 30, 2017;
- Current Reports on Form 8-K filed with the SEC on April 3, 2017, April 10, 2017, April 24, 2017 (only with respect to Item 8.01), April 24, 2017 (only with respect to Item 8.01), May 11, 2017 (only with respect to Items 5.02, 5.07), July 5, 2017, August 28, 2017 (only with respect to Items 1.01, 3.02 and 5.03) and August 31, 2017; and

- The description of our common stock contained in our registration statement on Form 8-A (Registration No. 001-37378) filed with the SEC on May 6, 2015 under Section 12(b) of the Exchange Act, including any amendments or reports filed for the purpose of updating such description.

Upon request, we will provide, without charge, to each person, including any beneficial owner, to whom a copy of this prospectus is delivered, a copy of the documents incorporated by reference into this prospectus but not delivered with the prospectus. You may request a copy of these filings, and any exhibits we have specifically incorporated by reference as an exhibit in this prospectus, at no cost by writing or telephoning us at the following address:

aTyr Pharma, Inc., 3545 John Hopkins Court, Suite 250, San Diego, CA 92121, Attention: Secretary, or by telephone request to (858) 731-8389.

This prospectus is part of a registration statement we filed with the SEC. We have incorporated exhibits into this registration statement. You should read the exhibits carefully for provisions that may be important to you.

You should rely only on the information incorporated by reference or provided in this prospectus or any prospectus supplement. We have not authorized anyone to provide you with different information. We are not making an offer of these securities in any state where the offer is not permitted. You should not assume that the information in this prospectus or in the documents incorporated by reference is accurate as of any date other than the date on the front of this prospectus or those documents.



23,608,486 Shares of Common Stock

PROSPECTUS

September __, 2017

Part II—INFORMATION NOT REQUIRED IN PROSPECTUS

Item 14. Other Expenses of Issuance and Distribution

The following table sets forth the various expenses to be incurred in connection with the issuance and distribution of the securities being registered, all of which will be borne by aTyr Pharma, Inc., or the Company or the registrant. Each item listed is estimated, except for the Securities and Exchange Commission, or the SEC, registration fee.

Securities and Exchange Commission registration fee	\$	8,345.50
Legal fees and expenses	\$	465,000.00
Accounting fees and expenses		*
Printing fees and Miscellaneous Fees		*
Total	\$	473,345.50

* Estimated expenses not presently known

Item 15. Indemnification of Directors and Officers

Section 145 of the Delaware General Corporation Law, or the DGCL, authorizes a corporation to indemnify its directors and officers against liabilities arising out of actions, suits and proceedings to which they are made or threatened to be made a party by reason of the fact that they have served or are currently serving as a director or officer to a corporation. The indemnity may cover expenses (including attorneys' fees), judgments, fines and amounts paid in settlement actually and reasonably incurred by the director or officer in connection with any such action, suit or proceeding. Section 145 permits corporations to pay expenses (including attorneys' fees) incurred by directors and officers in advance of the final disposition of such action, suit or proceeding. In addition, Section 145 provides that a corporation has the power to purchase and maintain insurance on behalf of its directors and officers against any liability asserted against them and incurred by them in their capacity as a director or officer, or arising out of their status as such, whether or not the corporation would have the power to indemnify the director or officer against such liability under Section 145.

We have adopted provisions in our restated certificate of incorporation and amended and restated bylaws that limit or eliminate the personal liability of our directors to the fullest extent permitted by the DGCL, as it now exists or may in the future be amended. Consequently, a director will not be personally liable to us or our stockholders for monetary damages or breach of fiduciary duty as a director, except for liability for:

- any breach of the director's duty of loyalty to us or our stockholders;
- any act or omission not in good faith or that involves intentional misconduct or a knowing violation of law;
- any unlawful payments related to dividends or unlawful stock purchases, redemptions or other distributions; or
- any transaction from which the director derived an improper personal benefit.

These limitations of liability do not alter director liability under the federal securities laws and do not affect the availability of equitable remedies such as an injunction or rescission.

In addition, our bylaws provide that:

- we will indemnify our directors, officers and, in the discretion of our board of directors, certain employees to the fullest extent permitted by the DGCL, as it now exists or may in the future be amended; and

- we will advance reasonable expenses, including attorneys' fees, to our directors and, in the discretion of our board of directors, to our officers and certain employees, in connection with legal proceedings relating to their service for or on behalf of us, subject to limited exceptions.

We have entered into indemnification agreements with each of our directors and certain of our executive officers. These agreements provide that we will indemnify each of our directors, certain of our executive officers and, at times, their affiliates to the fullest extent permitted by Delaware law. We will advance expenses, including attorneys' fees (but excluding judgments, fines and settlement amounts), to each indemnified director, executive officer or affiliate in connection with any proceeding in which indemnification is available and we will indemnify our directors and officers for any action or proceeding arising out of that person's services as a director or officer brought on behalf of the Company or in furtherance of our rights. Additionally, certain of our directors may have certain rights to indemnification, advancement of expenses or insurance provided by their affiliates, which indemnification relates to and might apply to the same proceedings arising out of such director's services as a director referenced herein. Nonetheless, we have agreed in the indemnification agreements that the Company's obligations to those same directors are primary and any obligation of the affiliates of those directors to advance expenses or to provide indemnification for the expenses or liabilities incurred by those directors are secondary. We also maintain a general liability insurance policy which covers certain liabilities of directors and officers of our Company arising out of claims based on acts or omissions in their capacities as directors or officers, including liabilities under the Securities Act of 1933, as amended.

Item 16. Exhibits

A list of exhibits filed with this registration statement on Form S-3 is set forth on the Exhibit Index and is incorporated herein by reference.

Item 17. Undertakings

The undersigned registrant hereby undertakes:

(a)(1) To file, during any period in which offers or sales are being made, a post-effective amendment to this registration statement:

(i) To include any prospectus required by Section 10(a)(3) of the Securities Act of 1933;

(ii) To reflect in the prospectus any facts or events arising after the effective date of the registration statement (or the most recent post-effective amendment thereof) which, individually or in the aggregate, represent a fundamental change in the information set forth in the registration statement. Notwithstanding the foregoing, any increase or decrease in volume of securities offered (if the total dollar value of securities offered would not exceed that which was registered) and any deviation from the low or high end of the estimated maximum offering range may be reflected in the form of prospectus filed with the Securities and Exchange Commission pursuant to Rule 424(b) if, in the aggregate, the changes in volume and price represent no more than a 20 percent change in the maximum aggregate offering price set forth in the "Calculation of Registration Fee" table in the effective registration statement; and

(iii) To include any material information with respect to the plan of distribution not previously disclosed in the registration statement or any material change to such information in the registration statement;

provided, however, that paragraphs (a)(1)(i), (a)(1)(ii) and (a)(1)(iii) of this section do not apply if the information required to be included in a post-effective amendment by those paragraphs is contained in reports filed with or furnished to the Securities and Exchange Commission by the registrant pursuant to Section 13 or Section 15(d) of the Securities Exchange Act of 1934 that are incorporated by reference in the registration statement, or is contained in a form of prospectus filed pursuant to Rule 424(b) that is part of the registration statement.

(2) That, for the purpose of determining any liability under the Securities Act of 1933, each such post-effective amendment shall be deemed to be a new registration statement relating to the securities offered therein, and the offering of such securities at that time shall be deemed to be the initial *bona fide* offering thereof.

(3) To remove from registration by means of a post-effective amendment any of the securities being registered which remain unsold at the termination of the offering.

(4) That, for the purpose of determining liability under the Securities Act of 1933 to any purchaser:

(i) If the registrant is subject to Rule 430B, each prospectus filed by the registrant pursuant to Rule 424(b)(3) shall be deemed to be part of the registration statement as of the date the filed prospectus was deemed part of and included in the registration statement; and

(ii) Each prospectus required to be filed pursuant to Rule 424(b)(2), (b)(5), or (b)(7) as part of a registration statement in reliance on Rule 430B relating to an offering made pursuant to Rule 415(a)(1)(i), (vii), or (x) for the purpose of providing the information required by Section 10(a) of the Securities Act of 1933 shall be deemed to be part of and included in the registration statement as of the earlier of the date such form of prospectus is first used after effectiveness or the date of the first contract of sale of securities in the offering described in the prospectus. As provided in Rule 430B, for liability purposes of the issuer and any person that is at that date an underwriter, such date shall be deemed to be a new effective date of the registration statement relating to the securities in the registration statement to which that prospectus relates, and the offering of such securities at that time shall be deemed to be the initial *bona fide* offering thereof; *provided, however*, that no statement made in a registration statement or prospectus that is part of the registration statement or made in a document incorporated or deemed incorporated by reference into the registration statement or prospectus that is part of the registration statement will, as to a purchaser with a time of contract of sale prior to such effective date, supersede or modify any statement that was made in the registration statement or prospectus that was part of the registration statement or made in any such document immediately prior to such effective date.

(5) That, for the purpose of determining liability of the registrant under the Securities Act of 1933 to any purchaser in the initial distribution of the securities, the undersigned registrant undertakes that in a primary offering of securities of the undersigned registrant pursuant to this registration statement, regardless of the underwriting method used to sell the securities to the purchaser, if the securities are offered or sold to such purchaser by means of any of the following communications, the undersigned registrant will be a seller to the purchaser and will be considered to offer or sell such securities to such purchaser:

(i) Any preliminary prospectus or prospectus of the undersigned registrant relating to the offering required to be filed pursuant to Rule 424;

(ii) Any free writing prospectus relating to the offering prepared by or on behalf of the undersigned registrant or used or referred to by the undersigned registrant;

(iii) The portion of any other free writing prospectus relating to the offering containing material information about the undersigned registrant or its securities provided by or on behalf of the undersigned registrant; and

(iv) Any other communication that is an offer in the offering made by the undersigned registrant to the purchaser.

(6) That, for purposes of determining any liability under the Securities Act of 1933, each filing of the registrant's annual report pursuant to Section 13(a) or Section 15(d) of the Securities Exchange Act of 1934 (and, where applicable, each filing of an employee benefit plan's annual report pursuant to Section 15(d) of the Securities Exchange Act of 1934) that is incorporated by reference in the registration statement shall be deemed to be a new registration statement relating to the securities offered therein, and the offering of such securities at that time shall be deemed to be the initial *bona fide* offering thereof.

(7) Insofar as indemnification for liabilities arising under the Securities Act of 1933 may be permitted to directors, officers and controlling persons of the registrant pursuant to the foregoing provisions, or otherwise, the registrant has been advised that in the opinion of the Securities and Exchange Commission such indemnification is against public policy as expressed in the Securities Act of 1933 and is, therefore, unenforceable. In the event that a claim for indemnification against such liabilities (other than the payment by the registrant of expenses incurred or paid by a director, officer or controlling person of the registrant in the successful defense of any action, suit or proceeding) is asserted by such director, officer or controlling person in connection with the securities being registered, the registrant will, unless in the opinion of its counsel the matter has been settled by controlling precedent, submit to a court of appropriate jurisdiction the question whether such indemnification by it is against public policy as expressed in the Securities Act of 1933 and will be governed by the final adjudication of such issue.

SIGNATURES

Pursuant to the requirements of the Securities Act of 1933, as amended, the registrant certifies that it has reasonable grounds to believe that it meets all of the requirements for filing on Form S-3 and has duly caused this registration statement to be signed on its behalf by the undersigned, thereunto duly authorized, in City of San Diego, State of California, on September 14, 2017.

ATYR PHARMA, INC.

By: /s/ John D. Mendlein
John D. Mendlein, Ph.D.
Chief Executive Officer

KNOW ALL BY THESE PRESENTS, that each person whose signature appears below hereby severally constitutes and appoints each of John D. Mendlein, Ph.D. and John T. Blake, and each of them singly, as such person's true and lawful attorneys-in-fact and agents, with full power of substitution and resubstitution, for such person and in such person's name, place and stead, in any and all capacities, to sign any or all amendments (including, without limitation, post-effective amendments) to this registration statement (or any registration statement for the same offering that is to be effective upon filing pursuant to Rule 462(b) under the Securities Act of 1933), and to file the same, with all exhibits thereto, and all documents in connection therewith, with the Securities and Exchange Commission, granting unto each 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 and about the premises, as fully to all intents and purposes as such person might or could do in person, hereby ratifying and confirming all that any said attorney-in-fact and agent, or any substitute or substitutes of any of them, 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 dates indicated.

<u>Signature</u>	<u>Title</u>	<u>Date</u>
<u>/s/ John D. Mendlein</u> John D. Mendlein, Ph.D.	Chief Executive Officer and Director (Principal Executive Officer)	September 14, 2017
<u>/s/ John T. Blake</u> John T. Blake	Senior Vice President, Finance (Principal Financial and Accounting Officer)	September 14, 2017
<u>/s/ John K. Clarke</u> John K. Clarke	Chairman of the Board and Director	September 14, 2017
<u>/s/ Srinivas Akkaraju</u> Srinivas Akkaraju, M.D., Ph.D.	Director	September 14, 2017
<u>/s/ James C. Blair</u> James C. Blair, Ph.D.	Director	September 14, 2017
<u>/s/ Timothy P. Coughlin</u> Timothy P. Coughlin	Director	September 14, 2017
<u>/s/ Mark Goldberg</u> Mark Goldberg, M.D.	Director	September 14, 2017
<u>/s/ Jeffrey S. Hatfield</u> Jeffrey S. Hatfield	Director	September 14, 2017
<u>/s/ Amir H. Nashat</u> Amir H. Nashat, Sc.D.	Director	September 14, 2017
<u>/s/ Paul Schimmel</u> Paul Schimmel, Ph.D.	Director	September 14, 2017

EXHIBIT INDEX

Exhibit No.	Description
3.1	<u>Restated Certificate of Incorporation (filed as Exhibit 3.2 to the registrant's Registration Statement on Form S-1/A (File No. 333-203272) filed with the SEC on May 1, 2015 and incorporated herein by reference)</u>
3.2	<u>Certificate of Designation of Preferences, Rights and Limitations of Class X Convertible Preferred Stock (filed as Exhibit 3.1 to the registrant's Current Report on Form 8-K dated August 28, 2017 and filed on August 31, 2017 and incorporated herein by reference)</u>
3.3	<u>Amended and Restated Bylaws (filed as Exhibit 3.4 to the registrant's Registration Statement on Form S-1/A (File No. 333-203272) filed with the SEC on April 27, 2015 and incorporated herein by reference)</u>
4.1	<u>Specimen Common Stock Certificate (filed as Exhibit 4.1 to the registrant's Registration Statement on Form S-1/A (File No. 333-203272) filed with the SEC on April 27, 2015 and incorporated herein by reference)</u>
4.2	<u>Securities Purchase Agreement, dated August 27, 2017, by and among the Company and the Purchasers party thereto (filed as Exhibit 10.1 to the registrant's Current Report on Form 8-K dated August 27, 2017 and filed on August 28, 2017 and incorporated herein by reference)</u>
4.3	<u>Registration Rights Agreement, dated August 27, 2017, by and among the Company and the Purchasers party thereto (filed as Exhibit 10.2 to the registrant's Current Report on Form 8-K dated August 27, 2017 and filed on August 28, 2017 and incorporated herein by reference)</u>
4.4	<u>Form of Warrant to Purchase Common Stock, dated August 27, 2017, issued by the registrant (filed as Exhibit 10.3 to the registrant's Current Report on Form 8-K dated August 27, 2017 and filed on August 28, 2017 and incorporated herein by reference)</u>
5.1	<u>Opinion of Goodwin Procter LLP</u>
23.1	<u>Consent of Independent Registered Public Accounting Firm</u>
23.2	<u>Consent of Goodwin Procter LLP (included in Exhibit 5.1 hereto)</u>
24.1	<u>Power of Attorney (included on the signature pages to this registration statement)</u>

September 14, 2017

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

Re: Securities Registered under Registration Statement on Form S-3

Ladies and Gentlemen:

We have acted as counsel to you in connection with your filing of a Registration Statement on Form S-3 (as amended or supplemented, the "Registration Statement") filed on September 14, 2017 with the Securities and Exchange Commission (the "Commission") pursuant to the Securities Act of 1933, as amended (the "Securities Act"), relating to the registration of the offering by aTyr Pharma, Inc., a Delaware corporation (the "Company") of up to 23,608,486 shares (the "Shares") of the Company's common stock, par value \$0.001 per share ("Common Stock"), to be sold from time to time by the selling stockholders listed in the Registration Statement under the caption "Selling Stockholders" (the "Selling Stockholders").

We have reviewed such documents and made such examination of law as we have deemed appropriate to give the opinions set forth below. We have relied, without independent verification, on certificates of public officials and, as to matters of fact material to the opinions set forth below, on certificates of officers of the Company.

The opinion set forth below is limited to the Delaware General Corporation Law.

Based on the foregoing, we are of the opinion that the Shares have been duly authorized and validly issued and are fully paid and nonassessable.

We hereby consent to the inclusion of this opinion as Exhibit 5.1 to the Registration Statement and to the references to our firm under the caption "Legal Matters" in the Registration Statement. In giving our consent, we do not admit that we are in the category of persons whose consent is required under Section 7 of the Securities Act or the rules and regulations thereunder.

Very truly yours,

/s/ GOODWIN PROCTER LLP

GOODWIN PROCTER LLP

Consent of Independent Registered Public Accounting Firm

We consent to the reference to our firm under the caption “Experts” in this Registration Statement (Form S-3) and related Prospectus of aTyr Pharma, Inc. for the registration of 23,608,486 shares of its common stock and to the incorporation by reference therein of our report dated March 16, 2017, 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, 2016, filed with the Securities and Exchange Commission.

/s/ Ernst & Young LLP

San Diego, California
September 13, 2017