



March 2023

To our stockholders,

Thank you for your continued support of aTyr Pharma, where we are working to develop a new class of medicines from our tRNA synthetase biology platform with a current focus on disease areas related to inflammation and fibrosis.

Our lead therapeutic candidate, efzofitimod, is a novel immunomodulator that downregulates immune responses in uncontrolled inflammatory diseases. We are developing efzofitimod as a potential transformative treatment for patients with interstitial lung disease (ILD), a group of rare immune-mediated fibrotic lung disorders, with the goal of resolving inflammation to prevent the progression of fibrosis in order to improve outcomes for patients.

2022 was an important year for aTyr as we advanced efzofitimod to the first global pivotal Phase 3 study in patients with pulmonary sarcoidosis, the most prevalent form of ILD, where there remains a dire need for safer and more effective treatments. This study, which is known as EFZO-FIT™, is currently enrolling at multiple centers in the U.S, Europe and Japan. We are conducting this study in collaboration with Kyorin Pharmaceutical, our partner for the development and commercialization of efzofitimod for ILD in Japan, and their initiation of the study in Japan in early 2023 triggered a \$10.0 million milestone payment to aTyr.

Our strategy for efzofitimod includes investigating the role it may play as a potential treatment for other, more inflammatory forms of ILD, such as connective tissue disease related ILD (CTD-ILD) and chronic hypersensitivity pneumonitis. We plan to initiate a Phase 2 proof-of-concept study in patients with systemic sclerosis (SSc, or scleroderma)-associated ILD (SSc-ILD) in 2023. SSc-ILD is a major type of CTD-ILD that, like sarcoidosis, has limited standard of care. Current treatments for this serious condition are not disease modifying and do nothing to improve the quality of life of these patients. Experts support our rationale for expanding the efzofitimod clinical program to SSc-ILD, not only based on the clinical proof-of-concept demonstrated for efzofitimod in pulmonary sarcoidosis patients, but also the robust preclinical work that we conducted showing efzofitimod's potential in this debilitating condition.

This program expansion increases the potential market opportunity for efzofitimod in these multiple forms of ILD, which we believe is an untapped \$2-3 billion dollar global market opportunity.

While our primary focus is our clinical program for efzofitimod, we continue to leverage our intellectual property estate covering fragments from all 20 human tRNA synthetases and utilize our platform as an engine to generate potential pipeline candidates and identify therapeutic targets. In 2022, we entered into a research collaboration with Dualsystems Biotech AG to leverage their advanced technology to increase productivity in our discovery engine and efficiently generate new therapeutics from our tRNA synthetase domain library.

We are very pleased with our accomplishments in 2022 and our start to 2023 as we work towards fulfilling our mission to harness the potential power of this advanced evolutionary biology and create novel breakthrough therapies.

Sincerely,

A handwritten signature in black ink, appearing to read "SSW".

Sanjay S. Shukla, M.D., M.S.
President and Chief Executive Officer

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

FORM 10-K

(Mark One)

☒ **ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the fiscal year ended December 31, 2022

or

☐ **TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the transition period from _____ to _____

Commission file number: 001-37378

ATYR PHARMA, INC.

(Exact name of registrant as specified in its charter)

Delaware
(State or other jurisdiction of
incorporation or organization)

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

10240 Sorrento Valley Road, Suite 300, San Diego, CA
(Address of principal executive offices)

92121
(Zip Code)

Registrant's telephone number, including area code: (858) 731-8389

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol	Name of each exchange on which registered
Common Stock, par value \$0.001 per share	LIFE	The Nasdaq Capital Market

Securities registered pursuant to Section 12(g) of the Act: None

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes ☐ No ☒

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. Yes ☐ No ☒

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or Section 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes ☒ No ☐

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files).

☒ Yes ☐ No

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

Large accelerated filer ☐ Accelerated filer ☐ Non-accelerated filer ☒ Smaller reporting company ☒ Emerging growth company ☐

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Indicate by check mark whether the registrant has filed a report on and attestation to its management's assessment of the effectiveness of its internal control over financial reporting under Section 404(b) of the Sarbanes-Oxley Act (15 U.S.C. 7262(b)) by the registered public accounting firm that prepared or issued its audit report. ☐

If securities are registered pursuant to Section 12(b) of the Act, indicate by check mark whether the financial statements of the registrant included in the filing reflect the correction of an error to previously issued financial statements. ☐

Indicate by check mark whether any of those error corrections are restatements that required a recovery analysis of incentive-based compensation received by any of the registrant's executive officers during the relevant recovery period pursuant to §240.10D-1(b). ☐

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Act). Yes ☐ No ☒

The aggregate market value of the registrant's voting and non-voting common equity held by non-affiliates of the registrant was approximately \$77,194,107 based on the closing price of the registrant's common stock on the Nasdaq Capital Market of \$2.83 per share on June 30, 2022, the last business day of the registrant's most recently completed second fiscal quarter. Shares of common stock held by each executive officer and director have been excluded from this calculation. This determination of affiliate status may not be conclusive for other purposes.

The number of outstanding shares of the registrant's common stock, par value \$0.001 per share, as of March 10, 2023 was 53,162,052.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant's definitive proxy statement to be filed with the Securities and Exchange Commission (SEC), pursuant to Regulation 14A in connection with the registrant's 2023 Annual Meeting of Stockholders, which will be filed subsequent to the date hereof, are incorporated by reference into Part III of this Annual Report on Form 10-K. Such proxy statement will be filed with the SEC not later than 120 days following the end of the registrant's fiscal year ended December 31, 2022.

ATYR PHARMA, INC.

ANNUAL REPORT ON FORM 10-K

For the Fiscal Year Ended December 31, 2022

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In this Annual Report on Form 10-K (Annual Report), unless the context requires otherwise, “aTyr Pharma,” “aTyr,” “Company,” “we,” “our,” and “us” means aTyr Pharma, Inc. and our subsidiary, Pangu BioPharma Limited.

The market data and certain other statistical information used in this Annual Report are based on independent industry publications, governmental publications, reports by market research firms or other independent sources. Some data are also based on our good faith estimates. Information that is based on estimates, forecasts, projections, market research or similar methodologies is inherently subject to uncertainties and actual events or circumstances may differ materially from events and circumstances reflected in this information.

We own various U.S. federal trademark applications and unregistered trademarks, including our company name. All other trademarks or trade names referred to in this Annual Report are the property of their respective owners. Solely for convenience, the trademarks and trade names in this Annual Report are referred to without the symbols ® and ™, but such references should not be construed as any indicator that their respective owners will not assert, to the fullest extent under applicable law, their rights thereto.

Forward-Looking Statements

In addition to historical information, this Annual Report and the information incorporated herein by reference contains forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended (Securities Act) and Section 21E of the Securities Exchange Act of 1934, as amended (Exchange Act) including statements regarding our business, our financial position, the research and development of biopharmaceutical products, the timing of clinical trial activities and other statements describing our goals, expectations, intentions or beliefs. These statements include but are not limited to statements under the captions “Business” and “Management’s Discussion and Analysis of Financial Condition and Results of Operations”, as well as other sections in this Annual Report. Such statements reflect our current views and assumptions and are subject to risks and uncertainties, particularly those inherent in the process of developing and commercializing biopharmaceutical products. Actual results could differ materially from those discussed in this Annual Report. Factors that could cause or contribute to such differences include, but are not limited to, those identified in Part I, Item 1A “Risk Factors” beginning on page 23 of this Annual Report, as well as those discussed in our other filings with the Securities and Exchange Commission (SEC). As a result, you are cautioned not to unduly rely on these forward-looking statements. We disclaim any duty to update any forward-looking statement to reflect events or circumstances that occur after the date on which such statement is made.

Risk Factors Summary

Below is a summary of the principal factors that make an investment in our securities speculative or risky. This summary does not address all of the risks that we face. Additional discussion of the risks summarized in this risk factors summary, and other risks that we face, can be found in Part I, Item 1A “Risk Factors” and should be carefully considered, together with other information in this Annual Report and our other filings with the SEC before making investment decisions regarding our securities.

Investing in our securities involves substantial risk. The risks described under Part I, Item 1A “Risk Factors” beginning on page 23 of this Annual Report may cause us to not realize the full benefits of our strengths or may cause us to be unable to successfully execute all or part of our strategy. Some of the more significant risks we face include the following:

- We may encounter substantial delays and other challenges in our planned clinical trials or we may fail to demonstrate safety and efficacy to the satisfaction of applicable regulatory authorities;
- If we are unable to successfully complete or otherwise advance clinical development, obtain regulatory or marketing approval for, or successfully commercialize our therapeutic product candidates, including efzofitmod, or experience significant delays in doing so, our business will be materially harmed;
- We will need to raise additional capital or enter into strategic partnering relationships to fund our operations;
- We are a pre-commercial biotherapeutics company and have incurred significant losses since our inception and anticipate that we will continue to incur significant losses for the foreseeable future;
- The U.S. Food and Drug Administration (FDA) has not approved any product candidate for the treatment of patients with pulmonary sarcoidosis, and as such, there is no established FDA regulatory pathway for approval of a drug in that indication. As a result, the EFZO-FIT study, even if successful, may not be sufficient to support FDA approval, which would materially and adversely harm our business;
- Our current product candidates and any other product candidates that we may develop from our discovery engine represent novel therapeutic approaches, which may cause significant delays or may not result in any commercially viable drugs;
- Our therapeutic product candidates may cause undesirable side effects or have other properties that could delay or prevent their regulatory approval, limit the commercial profile of an approved label, or result in significant negative consequences following marketing approval, if any;
- We depend on our existing collaborations and may depend on collaborations with additional third parties for the development and commercialization of certain of our product candidates. If our collaborations are not successful, we may not be able to capitalize on the market potential of these product candidates;
- If we are unable to obtain, maintain or protect intellectual property rights related to our product candidates, or if the scope of such intellectual property protection is not sufficiently broad, we may not be able to compete effectively in our markets;
- Our business could continue to be adversely affected by the effects of the COVID-19 pandemic; the ongoing Ukraine-Russian conflict and other geopolitical and macroeconomic conditions;
- Our future success depends on our ability to retain key employees, consultants and advisors and to attract, retain and motivate qualified personnel; and
- The market price of our common stock historically has been highly volatile and is likely to continue to be volatile, and you could lose all or part of your investment.

PART I

Item 1. Business.

We are a biotherapeutics company engaged in the discovery and development of first-in-class medicines from our proprietary tRNA synthetase platform. We have concentrated our research and development efforts on a newly discovered area of biology, the extracellular functionality and signaling pathways of tRNA synthetases. Built on more than a decade of foundational science on extracellular tRNA synthetase biology and its effect on immune responses, we have built a global intellectual property estate directed to a potential pipeline of protein compositions derived from 20 tRNA synthetase genes and their extracellular targets, such as neuropilin-2 (NRP2).

Efzofitimod

Our primary focus is efzofitimod, a clinical-stage product candidate which targets NRP2 to resolve chronic inflammation that can lead to fibrosis. Efzofitimod has a novel mechanism of action for potentially treating lung inflammation and fibrosis. We believe by targeting NRP2 on myeloid cells during active inflammation, efzofitimod works upstream of currently available immunomodulators to restore immune homeostasis, thereby resolving chronic inflammation and preventing the progression of fibrosis. We are developing efzofitimod as a potential disease-modifying therapy for patients with interstitial lung disease (ILD). ILDs are predominantly immune-mediated disorders that are characterized by chronic inflammation, which can lead to progressive fibrosis of the lung. There are limited treatment options for ILD and there remains a high unmet medical need. Sarcoidosis and systemic sclerosis (SSc, also known as scleroderma)-associated ILD (SSc-ILD) are two major forms of ILD. During 2022, the U.S. Food and Drug Administration (FDA) granted efzofitimod orphan drug designations for the treatment of sarcoidosis and for the treatment of SSc, and Fast Track designations for the treatment of pulmonary sarcoidosis and for the treatment of SSc-ILD. In January 2023, the European Commission granted efzofitimod an orphan drug designation for the treatment of sarcoidosis based on the opinion of the European Medicines Agency (EMA) Committee for Orphan Medicinal Products (COMP).

In September 2021, we announced positive results and clinical proof-of-concept from a double-blind, placebo-controlled Phase 1b/2a clinical trial in 37 patients with pulmonary sarcoidosis. The study was designed to evaluate the safety, tolerability, immunogenicity and preliminary efficacy of three doses of efzofitimod, 1.0, 3.0 and 5.0 mg/kg, in the context of a forced steroid taper. Efzofitimod was safe and well-tolerated at all doses administered with no serious drug-related adverse events or signal of immunogenicity. Additionally, the study demonstrated consistent dose response for efzofitimod on key efficacy endpoints and improvements compared to placebo, including measures of steroid reduction, lung function, pulmonary sarcoidosis symptom measures and inflammatory biomarkers. These data were subsequently presented at the American Thoracic Society (ATS) International Conference and published in the peer-reviewed journal *CHEST* during 2022.

In February 2022, we met with the FDA in an end-of-Phase 2 meeting to discuss our plans for subsequent clinical development and path to registration for efzofitimod for pulmonary sarcoidosis. Subsequently, we initiated a global pivotal Phase 3 randomized, double-blind, placebo-controlled clinical trial to evaluate the efficacy and safety of efzofitimod in patients with pulmonary sarcoidosis (the EFZO-FIT study). The EFZO-FIT study is a 52-week study consisting of three parallel cohorts randomized equally to either 3.0 mg/kg or 5.0 mg/kg of efzofitimod or placebo dosed intravenously once a month for a total of 12 doses. The study is currently enrolling and intends to enroll 264 subjects with pulmonary sarcoidosis at multiple centers in the United States, Europe and Japan. The trial design incorporates a forced steroid taper. The primary endpoint of the study is steroid reduction. Secondary endpoints include measures of lung function and sarcoidosis symptoms. In September 2022, we dosed the first patient in this study.

Based on the results of the Phase 1b/2a clinical trial, we believe efzofitimod has potential applications in the treatment of other ILDs, such as chronic hypersensitivity pneumonitis (CHP) and connective tissue disease related ILD (CTD-ILD), including SSc-ILD and rheumatoid arthritis-associated ILD. As such, we designed a focused Phase 2 proof-of-concept study of efzofitimod in patients with SSc-ILD and we have received FDA clearance for this study. In February 2023, we announced that we plan to initiate this Phase 2 study of efzofitimod in patients with SSc-ILD in 2023. This planned Phase 2 study is expected to be a randomized, double-blind placebo-controlled proof-of-concept study to evaluate the efficacy, safety and tolerability of efzofitimod in patients with SSc-ILD. This is expected to be a 28-week study with three parallel cohorts randomized 2:2:1 to either 270 mg or 450 mg of efzofitimod or placebo dosed intravenously monthly for a total of six doses. It is expected the study will enroll 25 patients at multiple centers in the United States. The primary objective of the study will be to evaluate the efficacy of multiple doses of intravenous (IV) efzofitimod on pulmonary, cutaneous and systemic manifestations in patients with SSc-ILD. Secondary objectives will include safety and tolerability.

In January 2020, we entered into a collaboration and license agreement (Kyorin Agreement) with Kyorin Pharmaceutical Co., Ltd. (Kyorin) for the development and commercialization of efzofitimod for the treatment of ILD in Japan. Under the Kyorin Agreement, Kyorin received an exclusive right to develop and commercialize efzofitimod in Japan for all forms of ILD, and is obligated to fund all research, development, regulatory, marketing and commercialization activities in Japan. In September 2020, Kyorin began dosing patients in a Phase 1 clinical trial of efzofitimod (known as KRP-R120 in Japan) and completed the last subject visit in December 2020.

The Phase 1 clinical trial, which was conducted and funded by Kyorin, was a placebo-controlled clinical trial to evaluate the safety, pharmacokinetics (PK) and immunogenicity of efzofitimid in 32 healthy Japanese male volunteers. Efzofitimid was observed to be generally well-tolerated with no drug-related serious adverse events, and PK findings were consistent with previous studies of efzofitimid. Kyorin is also participating in the EFZO-FIT study as the local sponsor in Japan. In February 2023, Kyorin dosed the first patient in Japan in the EFZO-FIT study which triggered a \$10.0 million milestone payment to us. To date, the Kyorin Agreement has generated \$20.0 million in upfront and milestone payments to us and we are eligible to receive up to an additional \$155.0 million in the aggregate upon achievement of certain development, regulatory and sales milestones, as well as tiered royalties on any net sales in Japan.

Discovery Pipeline

Extracellular tRNA synthetase biology represents a novel set of potential physiological modulators and therapeutic targets.

Using efzofitimid as a model, we have developed a process to advance novel tRNA synthetase domains from a concept to therapeutic candidate. This process leverages our early discovery work as well as current scientific understanding of tRNA synthetase evolution, protein structure, gene splicing and tissue-specific regulation to identify potentially active protein domains. Screening approaches are employed to identify target cells and extracellular receptors for these tRNA synthetase-derived proteins. These cellular systems can then be used in mechanism-of-action studies to elucidate the role these proteins play in cellular responses and their potential therapeutic utility. We are working to identify new tRNA synthetase based drug candidates through our internal discovery efforts and industry and academic collaborations, including our collaboration with Dualsystems Biotech AG (Dualsystems). Dualsystems has agreed to utilize their proprietary receptor screening technology and research expertise to attempt to identify and validate new target receptors for tRNA synthetases. Through our internal research efforts, the Dualsystems collaboration and other industry and academic collaborators, we intend to continue to advance our product development efforts within our tRNA synthetase biology platform.

We have also advanced our preclinical pipeline of NRP2 targeting antibody candidates through internal research efforts and academic collaborations. ATYR2810 is a product candidate from our NRP2 antibody program that we believe is ready to enter clinical trials. In the third quarter of 2022, we announced that we intend to focus our resources on the efzofitimid program. Therefore, we have made the strategic decision not to use internal resources to initiate a Phase 1 study of ATYR2810 at this time. We intend to pursue alternative avenues to advance this program.

Therapeutic Candidate Pipeline

PROGRAM	TARGET/MOA	INDICATION	RESEARCH	PRECLINICAL	PHASE 1	PHASE 2	PHASE 3
Efzofitimid	NRP2 agonist	Pulmonary Sarcoidosis ⁽¹⁾					
		SSc-ILD ⁽²⁾					
		Other ILD (CTD-ILD; CHP) ⁽³⁾					
ATYR2810	NRP2/VEGF antagonist	Solid Tumors					
AARS	FGFR4 modulator	Fibrosis					
DARS	LTBP1 modulator	Fibrosis					
NRP2 mAbs	NRP2/CCR7 antagonist	Inflammation					
	NRP2/SEMA3F antagonist	Inflammation					

(1) In partnership with Kyorin Pharmaceutical Co., Ltd. for the development and commercialization of efzofitimid for ILD in Japan

(2) SSc-ILD: Scleroderma-related ILD

(3) CTD-ILD: Connective Tissue Disease-ILD; CHP: Chronic Hypersensitivity Pneumonitis

Strategy

Key elements of our strategy include the following:

Advance efzofitimod toward regulatory approval in pulmonary sarcoidosis. Based on the positive results and clinical proof-of-concept from our efzofitimod Phase 1b/2a clinical trial in September 2021, we believe we can expedite development of efzofitimod for pulmonary sarcoidosis toward regulatory approval. Our strategy for the advancement of efzofitimod includes initiating and completing a pivotal Phase 3 study in patients with pulmonary sarcoidosis that we expect will serve as the basis for regulatory approval. During the third quarter of 2022, we initiated the EFZO-FIT study, a global pivotal Phase 3 randomized, double-blind, placebo-controlled clinical trial to evaluate the efficacy and safety of efzofitimod in patients with pulmonary sarcoidosis.

Develop efzofitimod to address unmet medical needs in other ILDs. In addition, we believe the positive results from our efzofitimod Phase 1b/2a trial, as well as data from numerous preclinical studies we have conducted to date, will give us the opportunity to potentially launch additional Phase 2 clinical trials of efzofitimod in other forms of ILD. As part of this strategy, in February 2023, we announced that we plan to initiate a Phase 2 study of efzofitimod in patients with SSc-ILD in 2023.

Build a diverse pipeline of biologics product candidates based on our understanding of extracellular tRNA synthetase biology. We have advanced two additional tRNA synthetase programs into preclinical development as well as antibodies targeting the NRP2 receptor. Additionally, entering into the collaboration with Dualsystems to identify and validate new target receptors for tRNA synthetases is part of our strategy to further expand and diversify our pipeline. Through our internal research efforts, the Dualsystems collaboration and other industry and academic collaborators, we intend to continue to advance our product development efforts within our tRNA synthetase biology platform.

Efzofitimod

Background and Mechanism of Action

Efzofitimod is a novel immunomodulatory Fc fusion protein in development for the treatment of ILD. Efzofitimod is a selective modulator of NRP2 that downregulates innate immune responses at a cellular level in uncontrolled inflammatory disease states to resolve chronic inflammation and prevent subsequent fibrosis.

Efzofitimod is a novel molecular entity comprised of a human 59 amino acid protein fused to the Fc region of human immunoglobulin 1 (IgG1). It acts as an extracellular immunomodulator. The amino acid sequence of the active moiety corresponds identically to the extracellularly active immunomodulatory domain of histidyl-tRNA synthetase (HARS) amino acids 2 to 60 (HARS 2-60).

The gene for HARS gives rise to a number of splice variants, and though most of these have lost their catalytic activity, they all retain the N-terminal domain (HARS amino acids 2-60). This N-terminal domain, non-essential for the enzyme's protein synthesis activity that is required in all living organisms, was appended to HARS during the evolutionary development of multicellular organisms and retained with high sequence identity across mammalian species, but is not found in lower organisms. One splice variant (SV9), which encodes only the N-terminal domain of the protein, is enriched in human lung tissue. Expression of this HARS splice variant is increased following inflammatory cytokine stimulation (IFN- γ and TNF- α , two key players in the initiation of lung inflammation and fibrosis) followed by subsequent secretion, indicating it is being regulated in response to local inflammation. Furthermore, HARS, specifically the N-terminal domain, is targeted by autoantibodies in a rare autoimmune disorder (known as anti-Jo-1 syndrome). Anti-Jo-1 syndrome is characterized by extensive activation and migration of immune cells into lung and muscle and is classically associated with the triad of ILD, myositis, and arthritis. It is hypothesized that the sequestration of HARS may play a causal role through disruption of its homeostatic immune-regulatory effects.

NRP2 was identified as the sole binding partner for efzofitimod through screening via a cell microarray system in which over 4,500 cell surface proteins are represented. This screening approach identified two NRP2 isoforms (Neuropilin 2A and 2B) as the only convincing and specific binding partners of efzofitimod. The binding site was confirmed to be within the "turn" of the helix-turn-helix structure of the HARS N-terminal domain comprised within efzofitimod. Binding of efzofitimod is specific to NRP2 with no observable cross-reactivity to NRP1, which is the most closely related cell surface receptor in both protein sequence and structure. A domain that is structurally similar (but divergent in protein sequence) to the HARS N-terminal domain (termed the WHEP domain) is found in other amino-acyl tRNA synthetases, yet these domains do not exhibit binding to NRP2, indicating this is a highly specific interaction. Interestingly, binding of efzofitimod occurs in a manner distinct from the more well-characterized ligands of NRP2 including VEGF and semaphorin 3F (SEMA3F), and does not interfere with NRP2 dimerization with their co-receptors. Thus, the HARS N-terminus appears to be a newly discovered ligand for NRP2, as opposed to an antagonist. The discovery of the HARS N-terminus/NRP2 signaling axis represents a previously unknown mechanism of biological regulation, in which this novel ligand of NRP2 may act as a homeostatic regulator of aberrant immune responses.

NRP2 is a cell surface receptor that is present on multiple immune cell types, including certain myeloid cells and subsets of T-cells. NRP2 expression is often upregulated upon inflammatory insult or stimulation. Growing evidence indicates that NRP2 predominantly influences myeloid cell biology such as activation and recruitment to inflammatory sites. For instance, NRP2 expression on alveolar macrophages regulates airway inflammatory responses to inhaled lipopolysaccharide. In sarcoidosis, NRP2 expression has been shown to be localized within the sarcoid granulomas, highly expressed in Langhans giant cells which are myeloid in nature.

Efzofitimid has been shown to significantly reduce lung inflammation and fibrosis, reduce immune cell trafficking to the lung and improve respiratory function parameters in multiple animal models of lung fibrosis. Furthermore, efzofitimid has demonstrated consistent downregulatory effects on inflammatory and pro-fibrotic cytokines and chemokines in both animal disease models and human clinical trials. Efzofitimid appears to primarily impact interleukin-6 (IL-6), TNF- α , IFN- γ , MCP-1 and IP-10, markers that have been implicated in the pathology of ILD.

Efzofitimid is a first-in-class immunomodulator that presents a novel mechanism of action to potentially therapeutically control chronic immune responses that can cause lung fibrosis.

Preclinical Development

Our preclinical estate of translational animal models was selected to help inform and de-risk clinical development of efzofitimid. We have evaluated the biological activity and safety of efzofitimid across a diverse set of experimental fibrotic lung disease models, representative of the four major forms of ILD (sarcoidosis, CHP, CTD-ILD and idiopathic pulmonary fibrosis (IPF)), as well as in normal animals, looking for signals of activity and potential biomarkers, while confirming tolerability and a favorable safety profile.

In these models, efzofitimid has significantly reduced histological lung fibrosis and inflammation, restored normal lung function, reduced lung protein levels of several inflammation and fibrosis-related cytokines and chemokines (e.g. IFN- γ , MCP-1/CCL2, IL-6) and reduced counts of immune cells in bronchoalveolar lavage (BAL) central to ILD pathology (e.g., neutrophils). These data have been presented in posters at key respiratory conferences over the past several years (e.g. the ATS International Congress) and are available for review on our website.

Efzofitimid and NRP2 receptor

NRP2 is known to be expressed on a number of different immune cell types that play a key role in regulating inflammatory responses. Efzofitimid is a fusion protein combining a novel immunomodulatory domain from HARS and a human IgG1 Fc. Efzofitimid inhibits cytokines and chemokines involved in the regulation of inflammatory and fibrotic responses and reduces inflammation and fibrosis in animal models of ILD. Efzofitimid has previously demonstrated potent immunomodulatory activity *in vitro* and *in vivo*. We sought to characterize the molecular basis for efzofitimid's immunomodulatory properties and demonstrated that efzofitimid specifically and selectively binds to NRP2 on the cell surface. These findings indicate that modulation of the NRP2 signaling pathway with efzofitimid could be a novel therapeutic approach to immune-mediated and fibrotic diseases such as pulmonary sarcoidosis.

Sarcoidosis is characterized by the formulation of granulomas, clumps of inflammatory cells found in one or more organs of the body and denoted by the presence of Langhans giant cells which are myeloid in nature. NRP2 was shown to be expressed in samples obtained from lung and skin of sarcoidosis patients with high NRP2 expression detected on key immune cells known to play an important role in inflammation and granuloma formation, including the Langhans giant cells. In work carried out in collaboration with Dr. Elliot Crouser's laboratory at The Ohio State University utilizing an established *ex vivo* assay of granuloma formation, it was demonstrated that an efzofitimid analog containing the identical immunomodulatory HARS domain exhibited statistically significant reduction of granuloma formation generated from sarcoid peripheral blood mononuclear cells (PBMCs). Given the importance of granulomas in the pathology and progression of pulmonary sarcoidosis and the known ability of efzofitimid to disrupt inflammatory responses, we hypothesize that efzofitimid may play a role in regulating sarcoid granuloma formation. These findings highlight the potential of efzofitimid to exert its effect on various immune cells directly related to the pathology of the target patient population. These data were presented in posters at the ATS International Virtual Meeting in 2020 and the European Society International Congress in 2021. As an extension of this work, a highly selective and sensitive antibody was developed for immunohistochemical detection of the target receptor for efzofitimid, NRP2, in patient tissue samples. Development and characterization of the antibody, as well as detection of NRP2 on key immune cells in granulomas of sarcoidosis patient lung and skin biopsy samples was highlighted in a poster presentation at the European Respiratory Society (ERS) International Congress 2022 in Barcelona, Spain.

SSc-ILD is an autoimmune disease characterized by chronic inflammation and fibrosis with common involvement of the skin and lungs. As in sarcoidosis, myeloid cells are centrally involved in driving this cycle of chronic inflammation and fibrosis in SSc-ILD. One aspect of this is the production by these cells of inflammatory cytokines, including IL-6.

Based on our translational biology program, which demonstrated activity across distinct experimental animal models either driven by direct lung injury or systemic pathology, along with our understanding of efzofitimod's mechanism of action, we decided to move the program forward into patient clinical trials in ILD.

ILD and the Role of Immunology

The current primary target population for efzofitimod is ILD, a group of predominantly immune-mediated disorders which can cause progressive fibrosis of the lung. There are over 200 different types of ILD, of which the four major forms are: pulmonary sarcoidosis, CHP, CTD-ILD, and IPF. These four types comprise roughly 80% of the total ILD population. We have focused our development efforts on progressive, immune-mediated forms of ILD, with limited therapeutic options, where we believe efzofitimod can have disease modifying effects. These lung conditions are recognized as having a measurable immune-mediated pathology, involving both innate and adaptive immune mechanisms that contribute to pathogenesis, and can result in progressive disease leading to fibrosis and death.

Pulmonary Sarcoidosis

Sarcoidosis is an inflammatory disease of unknown cause, characterized by the formation of granulomas, clumps of inflammatory cells in one or more organs in the body. Sarcoidosis affects people of all ages, with the incidence peaking at 20 to 39 years of age. The disorder usually begins in the lungs, skin or lymph nodes, but can affect almost any organ. Sarcoidosis in the lungs is called pulmonary sarcoidosis and occurs in over 90% of sarcoidosis patients. Approximately 200,000 Americans are currently living with pulmonary sarcoidosis. The prognosis for patients with pulmonary sarcoidosis ranges from benign and self-limiting to chronic, debilitating fibrotic disease and death.

The immunopathogenesis of sarcoidosis is not yet well understood, but a hallmark of the disease is the presence of granulomas, or clumps of immune cells. Granulomas consist of epithelioid cells, lymphocytes (both T and B cells) and myeloid cells, with macrophages and multinucleated giant cells (formed by fusion of macrophages), both of myeloid origin, playing a central role in their formation and persistence. A leading hypothesis is that granuloma formation involves the interplay between antigen, human leukocyte antigen class II molecules, and T-cell receptors: a presumptive sarcoid antigen is engulfed by circulating antigen-presenting cells (APCs; macrophages, dendritic cells) and the subsequent interplay between APCs and CD4+ T-cells initiates granuloma formation. This process is accompanied by the release of inflammatory cytokines such as interferon gamma (IFN- γ) and TNF alpha (TNF- α) from myeloid cells.

For patients with pulmonary sarcoidosis, the primary goal of treatment is to improve quality of life and avoid damage to organs. Efzofitimod may provide a therapeutic benefit in pulmonary sarcoidosis by resolving chronic inflammation, alleviating symptoms such as cough and shortness of breath and preventing disease progression towards fibrosis and permanent organ damage. Efzofitimod may also improve patient quality of life by allowing patients to reduce or completely avoid the need for oral corticosteroids, which are associated with debilitating side effects when used chronically. Efzofitimod targets the immune cells, primarily of myeloid lineage (monocytes, macrophages and dendritic cells), that drive the cellular pathology observed in pulmonary sarcoidosis. In preclinical studies, efzofitimod has been observed to inhibit cytokines involved in regulation of inflammatory and immune responses, modulating the reaction of myeloid cells at the sites of inflammation and attenuating T-cell activation. We have also discovered that efzofitimod's receptor target NRP2 is up-regulated during differentiation and activation of myeloid cells including macrophages, dendritic cells and neutrophils. Furthermore, efzofitimod has been observed to significantly reduce lung inflammation and fibrosis and improve respiratory function parameters in bleomycin-induced animal models of ILD. We believe that by inhibiting the chronic inflammatory response in these patients, efzofitimod may be able to restore immune balance and prevent progressive fibrosis, without toxicity associated with current treatment options, thereby providing a safer, potentially more effective alternative to oral corticosteroids (OCS) and other immunosuppressive therapies that currently comprise the standard of care for patients with symptomatic pulmonary sarcoidosis.

Systemic Sclerosis

Systemic sclerosis (SSc, or scleroderma) is a chronic, progressive, autoimmune disease characterized by inflammation and fibrosis of connective tissues throughout the body, including the skin and other internal organs. SSc that occurs in the lungs is called SSc-ILD. It is estimated that approximately 100,000 people in the U.S. are affected by SSc and up to 80% may develop ILD. SSc-ILD is caused by chronic inflammation in the lungs and, if left untreated, can result in scarring, or fibrosis, that causes permanent loss of lung function. ILD is the primary cause of death in patients with SSc. Current treatment options are limited. They mainly focus on slowing lung function decline, do not improve patient symptoms and are associated with significant toxicity. New treatments are needed that can stabilize or improve lung function and improve patient quality of life.

Efzofitimod has been shown to reduce lung and skin fibrosis in an animal model of SSc. Certain cytokines central to the immune pathology of SSc-ILD, including IL-6, were also downregulated in both animal models of ILD and in humans in an adjacent ILD, pulmonary sarcoidosis, in our Phase 1b/2a study. This data in both animal and human systems, along with our current understanding of the role of efzofitimod's target receptor NRP2 and the manner with which this novel ligand can modulate the immune response at the sites of inflammation, suggest it is a promising therapeutic candidate for SSc-ILD.

Efzofitimod Phase 3 Clinical Trial – Pulmonary Sarcoidosis

We are conducting the EFZO-FIT study, which is a Phase 3 clinical trial investigating the efficacy and safety of efzofitimod in patients with pulmonary sarcoidosis. The EFZO-FIT study is a global Phase 3, multicenter, randomized, double-blind, placebo-controlled study to evaluate the efficacy and safety of intravenous (IV) efzofitimod 3.0 mg/kg and 5.0 mg/kg versus placebo in patients with symptomatic pulmonary sarcoidosis. It is a 52-week study with patients receiving either efzofitimod or placebo once a month for a total of 12 doses. The study is currently enrolling and intends to enroll adults with histologically confirmed pulmonary sarcoidosis receiving stable treatment with oral corticosteroids, with or without immunosuppressant therapy. The study intends to enroll 264 patients at centers throughout North America, Europe and Japan. The study incorporates a forced steroid taper.

The objective of the study is to evaluate the efficacy and safety of efzofitimod in pulmonary sarcoidosis. The primary endpoint of the study is steroid reduction. Secondary endpoints include measures of lung function and sarcoidosis symptoms. In September 2022, we dosed the first patient in this study.

Efzofitimod Phase 2 Clinical Trial – SSc-ILD

We plan to initiate a Phase 2 study of efzofitimod in patients with SSc-ILD in 2023. This planned Phase 2 study is expected to be a randomized, double-blind placebo-controlled proof-of-concept study to evaluate the efficacy, safety and tolerability of efzofitimod in patients with SSc-ILD. This is expected to be a 28-week study with three parallel cohorts randomized 2:2:1 to either 270 mg or 450 mg of efzofitimod or placebo dosed IV monthly for a total of six doses. It is expected the study will enroll 25 patients at multiple centers in the United States. The primary objective of the study will be to evaluate the efficacy of multiple doses of IV efzofitimod on pulmonary, cutaneous and systemic manifestations in patients with SSc-ILD. Secondary objectives will include safety and tolerability.

Efzofitimod Phase 1b/2a Clinical Trial –Pulmonary Sarcoidosis

We initiated a proof-of-concept Phase 1b/2a clinical trial for efzofitimod at the end of 2018. The Phase 1b/2a clinical trial was a randomized, double-blind, placebo-controlled multiple-ascending dose, first-in-patient study with IV efzofitimod in 37 patients. The study was conducted in patients with pulmonary sarcoidosis undergoing an OCS tapering regimen, in three cohorts of 12 patients each, at dose levels of 1.0 mg/kg, 3.0 mg/kg and 5.0 mg/kg.

The primary objective of the study was to evaluate safety and tolerability of multiple ascending doses of efzofitimod. Secondary objectives included assessment of the potential steroid-sparing effects of efzofitimod. In addition, efzofitimod's PK and immunogenicity following multiple dose administration were evaluated. Additional endpoints of interest included the exploratory assessment of the efficacy of efzofitimod for the treatment of pulmonary sarcoidosis by evaluating changes over time in: lung function assessed by forced vital capacity (FVC) and diffusing capacity of the lungs for carbon monoxide (DLCO); health-related quality of life assessments and questionnaires; and serum biomarkers of interest.

This study consisted of three staggered dose cohorts. Each cohort consisted of three periods: a screening period, a 20-week placebo-controlled treatment period, and a four-week follow-up period ending with final study assessments at Week 24. Within each cohort, 12 patients were randomized 2:1 to efzofitimod (N=8) or placebo (N=4). Study drug was administered via IV infusion every four weeks for a total of six doses (20 weeks of treatment). The efzofitimod doses levels being evaluated were 1 mg/kg, 3 mg/kg and 5 mg/kg. Starting on Day 15 patients began a taper (reduction) in OCS according to specific guidelines from their starting dose of 10-25 mg/day of prednisone (or equivalent) to a target dose of 5.0 mg/day, to be completed on or before Day 50. The OCS dose was tapered through Week 24 and patients were followed for the remainder of the study to determine their ability to maintain on this 5 mg dose. Optionally, further reductions in the OCS dose to below 5.0 mg/day may be attempted after the Week 16 visit, if determined by the investigator to be feasible. Patients who required an increase in OCS dose at any time in the study were to continue to receive blinded study drug and be followed through to the end of the study.

In September 2021, we announced positive results and clinical proof-of-concept from the Phase 1b/2a clinical trial in 37 patients with pulmonary sarcoidosis. These data were subsequently presented at the ATS International Conference and published in the peer reviewed journal *CHEST* in 2022. Efzofitimod was safe and well-tolerated at all doses with no drug-related serious adverse events or signal of immunogenicity. Additionally, the study demonstrated consistent dose response for efzofitimod on key efficacy endpoints and improvements compared to placebo, including measures of steroid reduction, lung function, sarcoidosis symptom measures and inflammatory biomarkers. Key safety and clinical efficacy findings for efzofitimod from the study include:

- Safe and well-tolerated at all doses:
 - No dose-relationship with most common adverse events associated with underlying disease;
 - No drug-related serious adverse events; and

- No signal of immunogenicity.
- Dose response and consistent positive findings across key efficacy endpoints:
 - Steroid reduction of 58% overall from baseline and 22% relative reduction compared to placebo in steroid usage post taper in the 5.0 mg/kg treatment group;
 - Complete steroid taper to 0 mg achieved and maintained for 33% of patients in the 5.0 mg/kg treatment group compared to no patients in any other group;
 - Absolute improvement in forced vital capacity (FVC) as a measure of lung function at week 24 of 3.3% in the 5.0 mg/kg treatment group compared to placebo, with an improvement in FVC of > 2.5%, considered clinically meaningful;
 - Clinically meaningful improvement over placebo observed for dyspnea (shortness of breath), cough, fatigue and the King's Sarcoidosis Scores for Lung and General Health in 5.0 mg/kg treatment group;
 - Dose dependent trends of improvement in key inflammatory biomarkers compared to placebo including IL-6, MCP-1, IFN- γ , IP-10 and TNF- α as well as key sarcoidosis markers including ACE, IL-2Ra and SAA with tightest control in the 5.0 mg/kg treatment group; and
 - FDG-PET-CT was not evaluable due to incomplete data primarily caused by operational issues related to the COVID-19 pandemic.

Efzofitimod Phase 2 Clinical Trial – COVID-19 with Severe Respiratory Complications

In response to the COVID-19 pandemic, we conducted a Phase 2 clinical trial of efzofitimod in patients with COVID-19 related severe respiratory complications. The study was designed to evaluate the safety and preliminary efficacy of efzofitimod compared to placebo through the assessment of key clinical outcome measures. In early 2021, we reported positive data which showed that the trial met its primary endpoint of safety, demonstrating that a single, IV dose of efzofitimod was observed to be generally safe and well-tolerated in both the 1.0 and 3.0 mg/kg treatment groups. The study also showed a signal of activity in the 3.0 mg/kg cohort. In addition, patients treated with efzofitimod demonstrated a trend of overall improvement in key biomarkers analyzed compared to placebo. We plan on leveraging these data for our mechanistic understanding of efzofitimod and for its application in ILD.

Efzofitimod Phase 1 Clinical Trial – Healthy Volunteers

In June 2018, we announced results of our first-in-human Phase 1 clinical trial of efzofitimod conducted in Australia. This randomized, double-blind, placebo-controlled study evaluated the safety, tolerability, immunogenicity, and PK of IV efzofitimod in healthy volunteers. The Phase 1 clinical trial enrolled 36 healthy volunteers who were randomized to one of six sequential cohorts and received a single infusion of IV efzofitimod or placebo. Ascending efzofitimod doses by cohort ranged from 0.03 mg/kg to 5.0 mg/kg. The results indicate that the drug was observed to be generally well-tolerated at all dose levels tested, with no significant adverse events or induction of anti-drug antibodies observed following efzofitimod dosing or throughout the one-month follow-up period. The PK profile of efzofitimod following single-dose administration was linear across the evaluated dose range. Higher efzofitimod doses yielded sustained serum concentrations through the end of the one-month follow-up period that were above the predicted therapeutic threshold, supporting the potential for a once-monthly dosing regimen.

Kyorin Agreement

In January 2020, we entered into the Kyorin Agreement for the development and commercialization of efzofitimod for the treatment of ILD in Japan. Under the terms of the Kyorin Agreement, Kyorin received exclusive rights to develop and commercialize efzofitimod in Japan for all forms of ILD and is obligated to fund all research, development, regulatory, marketing and commercialization activities in Japan. We are responsible for supplying all drug product for Japan, as well as supporting development activities for efzofitimod. In September 2020, Kyorin began dosing of its Phase 1 clinical trial of efzofitimod (known as KRP-R120 in Japan) and completed the last subject visit in December 2020. The Phase 1 trial, which was conducted and funded by Kyorin, was a placebo-controlled study to evaluate the safety, PK and immunogenicity of efzofitimod in 32 healthy Japanese male volunteers. Efzofitimod was observed to be generally well-tolerated with no drug-related serious adverse events, and PK findings were consistent with previous studies of efzofitimod. Kyorin is also participating in the EFZO-FIT study as the local sponsor in Japan. In February 2023, Kyorin dosed the first patient in Japan in the EFZO-FIT study which triggered a \$10.0 million milestone payment to us. To date, the Kyorin Agreement has generated \$20.0 million in upfront and milestone payments to us and we are eligible to receive up to an additional \$155.0 million in the aggregate upon achievement of certain development, regulatory and sales milestones, as well as tiered royalties on any net sales in Japan.

Unless earlier terminated, the term of the Kyorin Agreement continues until the expiration of the royalty obligations. Either party may terminate the Kyorin Agreement in the event that the other party breaches the agreement and fails to cure the breach, becomes insolvent or challenges certain of the intellectual property rights licensed under the agreement.

Our Discovery Engines

tRNA Synthetase Biology

Extracellular tRNA synthetase biology represents a novel set of potential physiological modulators and therapeutic targets.

Using efzofitimod as a model, we have developed a process to advance novel tRNA synthetase domains from a concept to therapeutic candidate. This process leverages our early discovery work as well as current scientific understanding of tRNA synthetase evolution, protein structure, RNA splicing, proteolytic activation and tissue-specific regulation to identify potentially active protein domains. Screening approaches are employed to identify target cells and extracellular receptors for these tRNA synthetase-derived proteins. These cellular systems can then be used in mechanism-of-action studies to elucidate the role these proteins play in cellular responses and their potential therapeutic utility. We are working to identify new tRNA synthetase based drug candidates through our internal discovery efforts and industry and academic collaborations, including our collaboration with Dualsystems.

AARS/DARS

Utilizing our novel approach, we identified target receptors for fragments of AARS and DARS, gaining insights into their potential biological activity in immunology and fibrosis. We are also advancing our preclinical pipeline of tRNA synthetases and NRP2 targeting candidates through internal research efforts, industry and academic collaborations. In June 2022, we announced that the target receptor for AARS was identified as fibroblast growth factor receptor 4 (FGFR4), indicating that AARS may have therapeutic potential in fibrosis. In December 2022, we announced that the target for DARS was identified as latent transforming growth factor beta binding protein 1 (LTBP1). LTBP1 is an extracellular matrix protein and key regulator of transforming growth factor beta (TGF- β), a central player in the pathogenesis of fibrotic diseases. In 2023, we plan to further elucidate the therapeutic potential of these additional tRNA synthetase molecules through mechanistic investigations, including *in vitro* and *in vivo* preclinical studies.

NRP2 Biology

We have also advanced our preclinical pipeline of NRP2 targeting antibody candidates through internal research efforts and academic collaborations. ATYR2810 is a product candidate from our NRP2 antibody program that we believe is ready to enter clinical trials. In the third quarter of 2022, we announced that we intend to focus our resources on the efzofitimod program. Therefore, we have made the strategic decision not to use internal resources to initiate a Phase 1 study of ATYR2810 at this time. We intend to pursue alternative avenues to advance this program.

Impact of the COVID-19 Pandemic and Other Geopolitical and Macroeconomic Conditions

The impacts of the COVID-19 pandemic on our business have included the delay in enrollment of our now completed Phase 1b/2a clinical trial in patients with pulmonary sarcoidosis and the discontinuation of some patients in that trial, temporary closures of portions of our facilities and those of our licensees and collaborators, disruptions or restrictions on our employees' ability to travel and delays in certain research and development activities. Other potential impacts to our business include, but are not limited to, disruptions to or delays in other clinical trials, third-party manufacturing supply and other operations, the potential diversion of healthcare resources away from the conduct of clinical trials to focus on pandemic concerns, interruptions or delays in the operations of the FDA or other regulatory authorities, and our ability to raise capital and conduct business development activities.

In February 2022, the U.S. and global financial markets experienced volatility following the invasion of Ukraine by Russia, which has led to disruptions to trade, commerce, pricing stability, credit availability and supply chain continuity globally. In response to the invasion, the United States, United Kingdom and European Union (EU), along with others, imposed significant new sanctions and export controls against Russia, Russian banks and certain Russian individuals and may implement additional sanctions or take further punitive actions in the future. The full economic and social impact of the sanctions imposed on Russia (as well as possible future punitive measures that may be implemented), as well as the counter measures imposed by Russia, in addition to the ongoing Ukraine-Russia conflict, which could conceivably expand into the surrounding region, remains uncertain; however, both the conflict and related sanctions have resulted and could continue to result in disruptions to trade, commerce, pricing stability, credit availability and supply chain continuity in both Europe and globally, and has introduced significant uncertainty into global markets. As a result, our business and results of operations may be adversely affected by the ongoing Ukraine-Russia conflict, particularly to the extent it escalates to involve additional countries, further economic sanctions or wider military conflict.

In addition to the COVID-19 pandemic and the ongoing Ukraine-Russia conflict, global economic and business activities continue to face widespread macroeconomic uncertainties, including labor shortages, inflation and monetary supply shifts, and recession risks, which has resulted in further volatility in the U.S. and global financial markets and which has led to, and may continue to lead to,

additional disruptions to trade, commerce, pricing stability, credit availability and supply chain continuity globally. The ultimate long-term impact of the COVID-19 pandemic, the ongoing Ukraine-Russia conflict and other evolving geopolitical and macroeconomic conditions on our business is uncertain, although we continue to actively monitor the impact of these factors on our results of operations, financial condition and cash flows. The extent of the impact of these factors on our operational and financial performance, including our ability to execute our business strategies and initiatives in the expected timeframe, will depend on future developments, which are uncertain and cannot be predicted; however, any continued or renewed disruption resulting from these factors could negatively impact our business.

Competition

The biotechnology and pharmaceutical industries are intensely competitive. We will face competition with respect to our current product candidates and any other therapeutics we may develop or commercialize in the future, from pharmaceutical companies, biotechnology companies, universities and other research institutions. Our competitors may have substantially greater financial, technical and other resources, such as larger research and development staff and established marketing, sales and manufacturing organizations. Additional mergers and acquisitions in the biotechnology and pharmaceutical industries may result in even more resources being concentrated in our competitors. Competition may increase further as a result of advances in the commercial applicability of technologies and greater availability of capital for investment in these industries. Our competitors may succeed in developing, acquiring or licensing on an exclusive basis, drug products that are more effective, safer or less costly than any product candidate that we may develop.

Although we believe we are the only company engaged in the discovery and development of therapeutics based on novel functions of tRNA synthetases and NRP2 receptor biology, we are aware of other companies that could compete with our product candidates as described below.

Efzofitimod

Our lead indication for efzofitimod is pulmonary sarcoidosis. For patients with pulmonary sarcoidosis, the primary goal of treatment is to improve the patient's quality of life and avoid danger to organs, such as development of scarring or fibrosis caused by chronic inflammation. Currently, the only FDA-approved therapies for the treatment of sarcoidosis are glucocorticoids approved by FDA in the 1950s, prior to current regulatory standards. The consensus standard of care for pulmonary sarcoidosis is immunomodulatory therapy. First line treatment is typically with OCS that act mainly by suppressing inflammatory genes. OCS therapy has been shown to stabilize or improve disease symptoms in some patients, although relapse commonly occurs once OCS therapy is tapered or discontinued. Long-term OCS use is associated with significant side effects including substantial weight gain, development of insulin resistance, osteoporosis, and risk of infection. Alternatives, such as cytotoxic immunosuppressive agents (e.g., methotrexate) have been used as steroid-sparing agents, however, these therapies can also have significant side effects and toxicities, including serious infections and liver toxicity. Patients who have progressive disease despite OCS or other immunosuppressive therapy are sometimes given biologic immunomodulators, such as the TNF inhibitors infliximab or adalimumab. These therapies are not approved by the FDA or other regulatory agencies for the treatment of sarcoidosis, and are also associated with serious potential side effects, including malignancy. The efficacy of these agents has not been well established clinically. Given the known toxicities of long-term OCS, immunosuppressive and immunomodulatory biologic therapeutic regimens, treatment of patients with sarcoidosis is limited to those who are symptomatic and whose disease is considered active. The presence of granulomas from sarcoidosis define the disease as active, and granulomatous inflammation is the major cause of fibrosis in pulmonary sarcoidosis. Studies to date have not clearly demonstrated that OCS or other immunomodulatory therapies prevent disease progression or formation of fibrosis. We believe there remains a substantial unmet need for safer, more effective therapies for sarcoidosis that could reduce or replace the requirement for long-term OCS or other immunosuppressive therapy. To our knowledge, efzofitimod is the most advanced drug candidate currently in development for the treatment pulmonary sarcoidosis.

Our second indication for efzofitimod is SSc-ILD. SSc-ILD remains difficult to treat, with limited options. Few randomized studies have been conducted, and first line standard of care remains off-label immunosuppressive agents. Their impact is modest and they are associated with adverse events. In contrast to sarcoidosis, corticosteroids are not recommended for the treatment of SSc-ILD. Despite not being approved for SSc-ILD, the immunosuppressants mycophenolate mofetil and cyclophosphamide are typically used as first-line treatment, with mycophenolate the preferred option due to a better safety and tolerability profile. Two products were recently approved for the treatment of SSc-ILD, but remain second line treatment options. Ofev (nintedanib), a small molecule tyrosine-kinase inhibitor originally approved for the treatment of IPF in 2014 and marketed globally by Boehringer Ingelheim International GmbH, received FDA approval in 2019 for slowing the rate of decline in pulmonary function in patients with SSc-ILD. In 2020, the approval was further expanded to include patients with chronic fibrosis ILD with a progressive phenotype. Actemra (tocilizumab), an anti-IL6 antibody originally approved in 2010 for the treatment of giant cell arteritis and marketed globally by F. Hoffmann-La Roche Ltd. and Chugai Pharmaceutical Co Ltd., was approved by the FDA in 2021 for slowing the rate of decline in pulmonary function in adult patients with SSc-ILD. These therapies have demonstrated the ability to slow decline in lung function as measured by FVC in controlled clinical studies but are associated with significant side effects, continued symptoms, and progressive disease in the majority of patients.

Rituximab, a biologic immunosuppressant targeting B-cells, is occasionally used, but there is little clinical evidence supporting its efficacy in this indication.

If efzofitimod is successful for the treatment of pulmonary sarcoidosis and SSc-ILD, we believe it may have applications in other ILD indications and potentially in other severe immune disorders. Immunosuppressive therapy has traditionally been used to treat most ILD despite little clinical evidence in these indications. The exception is a specific form of ILD, IPF, where immunosuppressive treatment was demonstrated to be harmful in clinical trials and antifibrotic therapy has become standard of care. Based on an analysis from an independent consultant that we engaged during 2022, we currently estimate that there is a \$2-3 billion dollar global market opportunity in non-IPF ILDs, including pulmonary sarcoidosis.

There are a number of companies engaged in the clinical development of potential new treatments for ILD, including Boehringer Ingelheim International GmbH, Merck & Co. Inc., Amgen Inc., Prometheus Biosciences, Inc., and Kinevant Sciences GmbH among others.

Sales and Marketing

We intend, where strategically appropriate, to build the commercial infrastructure necessary to effectively support the commercialization of our product candidates, if and when we believe a regulatory approval of the first of such product candidates in a particular geographic market appears imminent. We may elect to utilize strategic partners, distributors, or contract sales forces to assist in the commercialization of our product candidates in selected geographic locations or for particular indications. For example, we have licensed the rights to Kyorin to develop and commercialize efzofitimod in Japan.

Additional capabilities important to the marketing of therapeutics include the management of key stakeholders such as managed care organizations, group-purchasing organizations, specialty pharmacies, and government accounts. To develop the appropriate commercial infrastructure, we will have to invest significant amounts of financial and management resources, some of which will be committed prior to any confirmation that any of our product candidates will be approved.

Manufacturing

We currently contract with third parties for the manufacturing and testing of our product candidates, including efzofitimod, to support preclinical studies and clinical trials, and we intend to do so in the future. We do not own or operate manufacturing or testing facilities for the clinical or commercial production of our product candidates. We currently have no plans to build our own clinical or commercial scale manufacturing capabilities. The use of contracted development and manufacturing organizations (CDMOs) is cost-efficient and has eliminated the need for our direct investment in manufacturing facilities and additional resources early in development. Although we rely on CDMOs, we employ personnel with extensive biologics development and manufacturing experience to oversee such CDMOs.

Efzofitimod is a fusion protein that is expressed in recombinant *E.coli*. We have worked with CDMOs in the United States and internationally on the development and manufacture of products using current Good Manufacturing Practices (cGMP) to produce drug substance and drug product to support preclinical and clinical development. We have also contracted with CDMOs to conduct the labeling, storage and distribution of our drug product candidates to clinical sites.

To date, our CDMOs have met our manufacturing and testing requirements for clinical development and we expect that our current supply chain is capable of providing sufficient quantities of our product candidates to meet our anticipated clinical development needs. However, we, and our CDMOs are currently experiencing delays due to the COVID-19 pandemic in the delivery of key raw materials which are essential for the production of efzofitimod, the result of which may cause delays in our ability to manufacture sufficient efzofitimod to meet our projected clinical development needs. Currently we have sufficient efzofitimod on hand to meet our projected needs for the EFZO-FIT study and our planned Phase 2 study in SSc-ILD.

Patents and Proprietary Rights

We strive to protect the proprietary technologies that we believe are important to our business, including seeking and maintaining patent protection intended to cover the composition of matter of our product candidates, their methods of use, related technology and other inventions that are important to our business. We own, or have exclusive licenses to, over 300 issued patents or allowed patent applications with predicted expiration dates ranging from 2026 to 2034. In addition to patent protection, we also rely on trade secrets and careful monitoring of our proprietary information to protect aspects of our business that are not amenable to, or that we do not consider appropriate for, patent protection.

Our success will depend significantly on our ability to obtain and maintain patent and other proprietary protection for commercially important technology, inventions and know-how related to our business, defend and enforce our patents, maintain our licenses to use intellectual property owned by third parties, preserve the confidentiality of our trade secrets and operate without infringing

the valid and enforceable patents and other proprietary rights of third parties. We also rely on know-how, continuing technological innovation and in-licensing opportunities to develop, strengthen, and maintain our proprietary position in the field of extracellular tRNA synthetase biology, their receptors and associated signaling pathways, including, for example, antibody diagnostics and therapeutics to NRP2.

A third party may hold intellectual property, including patent rights, which is important or necessary to the development of our products. It may be necessary for us to use the patented or proprietary technology of third parties to commercialize our products, in which case we would be required to obtain a license from these third parties on commercially reasonable terms, or our business could be harmed, possibly materially.

We plan to continue to expand our intellectual property estate by filing patent applications directed to new methods of treatment, therapeutics and additional new product forms thereof with new therapeutic or pharmacokinetic properties. Specifically, we seek patent protection in the United States and internationally for novel compositions of matter covering our protein therapeutics, antibody therapeutics, next generation product forms and the use of these compositions in a variety of therapies.

The patent positions of biopharmaceutical companies like us are generally uncertain and involve complex legal, scientific and factual questions. In addition, the coverage claimed in a patent application can be significantly reduced before the patent is issued, and its scope can be reinterpreted after issuance. Consequently, we do not know whether any of our product candidates will be protectable or remain protected by enforceable patents. We cannot predict whether the patent applications we are currently pursuing will issue as patents in any particular jurisdiction or whether the claims of any issued patents will provide sufficient proprietary protection from competitors. Any patents that we hold may be challenged, circumvented or invalidated by third parties.

Because patent applications in the United States and certain other jurisdictions are maintained in secrecy for 18 months, and since publication of discoveries in the scientific or patent literature often lags behind actual discoveries, we cannot be certain of the priority of inventions covered by pending patent applications. Moreover, we may have to participate in interference proceedings declared by the United States Patent and Trademark Office (USPTO), or a foreign patent office to determine priority of invention or in post-grant challenge proceedings, such as oppositions, that challenge priority of invention or other features of patentability. Such proceedings could result in us incurring substantial costs, even if the eventual outcome is favorable to us.

Efzofitimod

Our efzofitimod patent portfolio is comprised of a number of patent families related to derivatives of HARS, including the HARS amino 2-60, related splice variants, combinations with other therapeutics, and next-generation product forms with modified therapeutic activity or pharmacokinetic characteristics. As of March 2023, our efzofitimod patent portfolio includes a patent family that is jointly owned by us and our 98% owned subsidiary, Pangu BioPharma, and includes issued patents in the United States, Australia, Canada, China, Europe, Japan and Hong Kong, and pending patent applications in the United States. The U.S. patents are expected to expire between 2030 and 2031, absent any patent term extension for regulatory delays, and the ex-U.S. patents, and patents that issue from these patent applications, if any, are expected to expire in 2030, absent any patent term extension.

The efzofitimod patent portfolio includes another patent family jointly owned by us and Pangu BioPharma, which includes patent applications directed to related splice variants of HARS. This patent family includes issued patents in the United States, Australia, Canada, China, Japan, New Zealand and Hong Kong. The issued patents and any patents that issue from these patent applications, if any, are expected to expire in 2031, absent any patent term extension.

Also included within the efzofitimod patent portfolio are issued patents and pending patent applications directed to specific product forms of efzofitimod, and other HARS splice variants, including patent families directed to Fc fusion proteins, and combinations for treating lung inflammation, among other indications. One family directed to specific Fc fusion proteins includes issued patents in Australia, the United States, Europe, Hong Kong, and Japan, and pending applications in the United States, Canada, China, Hong Kong, India, and Japan. If issued, the patents that derive from the patent applications are predicted to expire between 2034 and 2038, absent any patent term extensions.

tRNA Synthetases

Our pipeline of extracellular tRNA synthetase proteins is covered by a series of patent families, which are directed to all 20 human cytosolic tRNA synthetases. Numerous patents are issued in the United States and elsewhere, including issued U.S. patents directed to specific therapeutic protein compositions, the corresponding protein polynucleotide sequences, and certain antibody compositions to specific splice variants. These cases are jointly owned by us and Pangu BioPharma, and include issued patents and/or pending applications in the United States, Australia, Canada, Europe, China and Japan. Patents that issue from these applications, if any, would be expected to expire in 2031, absent any patent term extension. Additional patent applications have also been separately filed on GARS (Glycyl-tRNA synthetase), DARS, YARS (tyrosyl-tRNA synthetase), and other tRNA synthetases, and any patents issuing from these patent applications are expected to expire between 2026 and 2030, absent any patent term extension.

The term of individual patents depends upon the legal term of the patents in the countries in which they are obtained. In most countries in which we file, the patent term is generally 20 years from the earliest date of filing the non-provisional patent application from which the patent issued.

In the United States, the patent term of a patent that covers a drug approved by the FDA, may also be eligible for patent term extension, which permits patent term restoration as compensation for the patent term lost during the FDA regulatory review process. The Hatch-Waxman Act permits a patent term extension of up to five years beyond the expiration of the patent. The length of the patent term extension is related to the length of time the drug is under regulatory review. Patent extension cannot extend the remaining term of a patent beyond a total of 14 years from the date of product approval and only one patent applicable to an approved drug may be extended. Similar provisions are available in Europe and other non-United States jurisdictions to extend the term of a patent that covers an approved drug. In the future, if and when our pharmaceutical products receive FDA approval, we expect to apply for patent term extensions on patents covering those products. We intend to seek patent term extensions to any of our issued patents in any jurisdiction where these are available, however there is no guarantee that the applicable authorities, including the FDA in the United States, will agree with our assessment of whether such extensions should be granted, and even if granted, the length of such extensions.

We also rely on trade secret protection for our confidential and proprietary information. Although we take steps to protect our proprietary information and trade secrets, including through contractual means with our employees and consultants, third parties may independently develop substantially equivalent proprietary information and techniques or otherwise gain access to our trade secrets or disclose our technology. Thus, we may not be able to meaningfully protect our trade secrets. It is our policy to require our employees, consultants, outside scientific collaborators, sponsored researchers and other advisors to execute confidentiality agreements upon the commencement of employment or consulting relationships with us. These agreements provide that all confidential information concerning our business or financial affairs developed or made known to the individual during the course of the individual's relationship with us is to be kept confidential and not disclosed to third parties except in specific circumstances. In the case of employees, the agreements provide that all inventions conceived by the individual, and which are related to our current or planned business or research and development or made during normal working hours, on our premises or using our equipment or proprietary information, are our exclusive property.

Government Regulation

Government authorities in the United States, including federal, state, and local authorities, and in other countries, extensively regulate, among other things, the manufacturing, research and clinical development, marketing, labeling and packaging, storage, distribution, post-approval monitoring and reporting, advertising and promotion, and export and import of biological products, such as those we are developing. Pricing of such products is also subject to regulation in many countries. The process of obtaining regulatory approvals and the subsequent compliance with appropriate federal, state, local, and foreign statutes and regulations require the expenditure of substantial time and financial resources.

U.S. Government Regulation

In the United States, the FDA regulates biologics under the Federal Food, Drug, and Cosmetic Act and the Public Health Service Act and their implementing regulations. FDA approval is required before any new unapproved biologic or dosage form, including a new use of a previously approved biologic, can be marketed in the United States. Biologics are also subject to other federal, state, and local statutes and regulations. If we fail to comply with applicable FDA or other requirements at any time during the product development process, clinical testing, approval process or after approval, we may become subject to administrative or judicial sanctions. These sanctions could include the FDA's refusal to approve pending applications, license suspension or revocation, untitled or warning letters, product recalls, product seizures, total or partial suspension of production or distribution, injunctions, fines, civil penalties or criminal prosecution. Any FDA enforcement action could have a material adverse effect on us.

The process required by the FDA before product candidates may be marketed in the United States generally involves the following:

- completion of extensive preclinical laboratory tests and preclinical animal studies, performed in accordance with the good laboratory practice regulations, where applicable;
- submission to the FDA of an IND which must become effective before human clinical trials may begin and must be updated annually;
- approval by an independent institutional review board (IRB) or ethics committee representing each clinical site before each clinical trial may be initiated;
- performance of adequate and well-controlled human clinical trials to establish the safety and efficacy of the product candidate for each proposed indication and conducted in accordance with good clinical practice (GCP) requirements;

- preparation of and submission to the FDA of a biologics license application (BLA) after completion of all pivotal clinical trials;
- potential review of the product application by an FDA advisory committee, where appropriate and if applicable;
- a determination by the FDA within 60 days of its receipt of a BLA to file the application for review;
- satisfactory completion of an FDA pre-approval inspection of the manufacturing facilities where the proposed product is produced to assess compliance with cGMP;
- potential FDA audit of the clinical trial sites that generated the data in support of the BLA; and
- FDA review and approval of a BLA prior to any commercial marketing or sale of the product in the United States.

The preclinical and clinical testing and approval process requires substantial time, effort, and financial resources, and we cannot be certain that any approvals for our product candidates will be granted on a timely basis, if at all.

An IND is a request for authorization from the FDA to administer an investigational new drug or biologic product to humans in clinical trials. The IND submission includes the general investigational plan and the protocol(s) for human trials. The IND also includes results of preclinical testing, including animal and *in vitro* studies, to assess the toxicology, PK, pharmacology, and pharmacodynamic characteristics of the product; chemistry, manufacturing, and controls information; and any available human data or literature to support the use of the investigational new drug. An IND must become effective before human clinical trials may begin. An IND will automatically become effective 30 days after receipt by the FDA, unless before that time the FDA raises concerns or questions related to the proposed clinical trials. In such a case, the IND may be placed on clinical hold and the IND sponsor and the FDA must resolve any outstanding concerns or questions before clinical trials can begin. Accordingly, submission of an IND may or may not result in the FDA allowing clinical trials to commence. The FDA may impose a clinical hold at any time during a clinical trial and may impose a partial clinical hold that would apply certain limits to the trial, for example, imposing dosage limitations or restricting the timeframe of the trial.

Clinical Trials

Clinical trials involve the administration of the investigational new drug to human subjects under the supervision of qualified investigators in accordance with GCPs which include the requirement that all research subjects provide their informed consent for their participation in any clinical trial. Clinical trials are conducted under protocols detailing, among other things, the objectives of the study, the parameters to be used in monitoring safety, and the efficacy criteria to be evaluated. A protocol for each clinical trial and any subsequent protocol amendments must be submitted to the FDA as part of the IND. Additionally, approval must also be obtained from each clinical trial site's IRB before the trials may be initiated, and the IRB must monitor the trial until it is completed. There are also requirements governing the reporting of ongoing clinical trials and clinical trial results to public registries.

The clinical investigation of a drug is generally divided into three phases. Although the phases are usually conducted sequentially, they may overlap or be combined.

- Phase 1. The drug is initially introduced into a relatively small number of healthy human subjects or patients with the target disease or condition. These studies are designed to evaluate the safety, dosage tolerance, metabolism and pharmacologic actions of the investigational new drug in humans, the side effects associated with increasing doses, and if possible, to gain early evidence on effectiveness.
- Phase 2. The drug is administered to a limited patient population to evaluate dosage tolerance and optimal dosage, identify possible adverse side effects and safety risks, and preliminarily evaluate efficacy. Multiple Phase 2 clinical trials may be conducted by the sponsor to obtain information prior to beginning larger and more costly Phase 3 clinical trials.
- Phase 3. The drug is administered to an expanded patient population, generally at geographically dispersed clinical trial sites to generate enough data to evaluate dosage, clinical effectiveness and safety, and establish the overall benefit-risk relationship of the investigational new drug product. A well-controlled, statistically robust Phase 3 trial may be designed to deliver the data that regulatory authorities will use to decide whether or not to approve, and, if approved, how to appropriately label a drug: such Phase 3 studies are referred to as "pivotal."

In some cases, the FDA may condition approval of a BLA for a product candidate on the sponsor's agreement to conduct additional clinical trials after approval. In other cases, a sponsor may voluntarily conduct additional clinical trials after approval to gain more information about the drug. Such post-approval studies are typically referred to as Phase 4 clinical trials. Failure to exhibit due diligence with regard to conducting Phase 4 clinical trials that the FDA requires as a condition of approval could result in FDA withdrawing approval for the product.

A clinical trial sponsor must submit written IND safety reports to the FDA and the investigators for serious and unexpected adverse reactions, any clinically important increase in the rate of a serious suspected adverse reaction over that listed in the protocol or investigator's brochure, or any findings from other studies or animal or *in vitro* testing that suggest a significant risk in humans exposed to the product candidate within 15 calendar days after the sponsor determines that the information qualifies for reporting. The sponsor also must notify the FDA of any unexpected fatal or life-threatening suspected adverse reaction within seven calendar days after the sponsor's initial receipt of the information. The FDA, the IRB, or the clinical trial sponsor may suspend or terminate a clinical trial at any time on various grounds, including a finding that the research subjects are being exposed to an unacceptable health risk. Additionally, some clinical trials are overseen by an independent group of qualified experts organized by the clinical trial sponsor, known as a data safety monitoring board or committee. This group provides authorization for whether or not a trial may move forward at designated check points based on access to certain data from the trial. We may also suspend or terminate a clinical trial based on evolving business objectives or competitive climate.

BLA Submission

Assuming successful completion of all required testing in accordance with all applicable regulatory requirements, detailed information about the investigational biologic product is submitted to the FDA in the form of a BLA requesting approval to market the product for one or more indications. Efzofitimod and our other potential product candidates are proteins that will be regulated as biological products subject to the BLA marketing pathway. Under federal law, the submission of most BLAs is subject to an application user fee, and the sponsor of an approved BLA is also subject to an annual prescription drug product program fee. These fees typically increase annually. Applications for orphan drug products are exempted from the BLA user fees, unless the application includes an indication for other than a rare disease or condition.

A BLA must include all relevant data available from pertinent preclinical studies and clinical trials, including negative or ambiguous results as well as positive findings, together with detailed information relating to the product's chemistry, manufacturing, controls, and proposed labeling, among other things. To support marketing approval, the data submitted must be sufficient in quality and quantity to establish the safety and effectiveness of the investigational new drug product to the satisfaction of the FDA. FDA approval of a BLA must be obtained before a biologic may be marketed in the United States.

Before approving a BLA, the FDA typically will conduct a pre-approval inspection of the facility or facilities where the product is manufactured. The FDA will not approve an application unless it determines that the manufacturing processes and facilities are in compliance with cGMP requirements and adequate to assure consistent production of the product within required specifications. Additionally, before approving a BLA, the FDA will typically inspect one or more clinical sites to assure compliance with GCP.

Additionally, the FDA may refer any NDA or BLA, including applications for novel biologic candidates which present difficult questions of safety or efficacy, to an advisory committee. Typically, an advisory committee is a panel of independent experts, including clinicians and other scientific experts, that reviews, evaluates and provides a recommendation as to whether the application should be approved and under what conditions. The FDA is not bound by the recommendations of an advisory committee, but it considers such recommendations carefully when making decisions.

The FDA's Decision on a BLA

The FDA evaluates a BLA to determine whether the data demonstrate that the biologic is safe, pure, and potent, or effective. After the FDA evaluates the BLA and conducts inspections of manufacturing facilities where the product will be produced, it may issue an approval letter or a Complete Response Letter (CRL). An approval letter authorizes commercial marketing of the drug with specific prescribing information for specific indications. A CRL indicates that the review cycle of the application is complete and the application is not ready for approval. A CRL generally outlines the deficiencies in the submission and may require substantial additional testing or information in order for the FDA to reconsider the application. A CRL may require additional clinical data or an additional pivotal Phase 3 clinical trial(s), or other significant, expensive and time-consuming requirements related to clinical trials, preclinical studies or manufacturing. Even with the submission of this additional information, however, the FDA may ultimately decide that the BLA does not satisfy the criteria for approval and issue a denial.

The FDA could also approve the BLA with a Risk Evaluation and Mitigation Strategy plan to mitigate risks associated with the product, which could include medication guides, physician communication plans, or elements to assure safe use, such as restricted distribution methods, patient registries and other risk minimization tools. The FDA may also condition approval on, among other things, changes to proposed labeling, development of adequate controls and specifications, or a commitment to conduct one or more post-market studies or clinical trials. Such post-market testing may include Phase 4 clinical trials and surveillance to further assess and monitor the product's safety and effectiveness after commercialization. Also, new government requirements, including those resulting from new legislation, may be established, or the FDA's policies may change, which could delay or prevent regulatory approval of our products under development.

Expedited Review and Accelerated Approval Programs

A sponsor may seek approval of its product candidate under programs designed to accelerate FDA's review and approval of NDAs and BLAs. For example, Fast Track designation may be granted to a drug or biologic intended for treatment of a serious or life-threatening disease or condition that has potential to address unmet medical needs for the disease or condition by providing a therapy where none exists or a therapy that may be potentially superior to existing therapy based on efficacy or safety factors. The key benefits of Fast Track designation are more frequent interactions with the FDA during development and testing and eligibility for priority review. The FDA may also review sections of the NDA or BLA for a Fast Track product on a rolling basis before the complete application is submitted, if the sponsor and the FDA agree on a schedule for the submission of the application sections, and the sponsor pays any required user fees upon submission of the first section of the application. Based on results of the Phase 3 clinical trial(s) submitted in a BLA, the FDA may grant the BLA a priority review designation, which sets the target date for FDA action on the application at six months after the FDA accepts the application for filing. Priority review is granted where there is evidence that the proposed product would be a significant improvement in the safety or effectiveness of the treatment, diagnosis, or prevention of a serious condition. If criteria are not met for priority review, the application is subject to the standard FDA review period of ten months after FDA accepts the application for filing. Priority review designation does not change the scientific/medical standard for approval or the quality of evidence necessary to support approval. Fast Track designation may be withdrawn by the sponsor or rescinded by the FDA if the designation is no longer supported by data emerging in the clinical trial process.

Under the accelerated approval program, the FDA may approve a BLA on the basis of either a surrogate endpoint that is reasonably likely to predict clinical benefit or, on a clinical endpoint that can be measured earlier than irreversible morbidity or mortality, that is reasonably likely to predict an effect on irreversible morbidity or mortality or other clinical benefit, taking into account the severity, rarity, or prevalence of the condition and the availability or lack of alternative treatments. Drugs and biologics granted accelerated approval must meet the same statutory standards for safety and effectiveness as those granted traditional approval. Post-marketing trials or completion of ongoing trials after marketing approval are generally required to verify the drug's clinical benefit in relationship to the surrogate endpoint or ultimate outcome in relationship to the clinical benefit. In addition, a sponsor may seek FDA designation of its product candidate as a breakthrough therapy if the drug is intended, alone or in combination with one or more other drugs, to treat a serious or life-threatening disease or condition and preliminary clinical evidence indicates that the drug may demonstrate substantial improvement over existing therapies on one or more clinically significant endpoints, such as substantial treatment effects observed early in clinical development. If so designated, the FDA shall act to expedite the development and review of the product's marketing application, including by meeting with the sponsor throughout the product's development, providing timely advice to the sponsor to ensure that the development program to gather preclinical and clinical data is as efficient as practicable, involving senior managers and experienced review staff in a cross-disciplinary review, and assigning a cross-disciplinary project lead for the FDA review team to facilitate an efficient review of the development program and to serve as a scientific liaison between the review team and the sponsor.

Post-Approval Requirements

Drugs manufactured or distributed pursuant to FDA approvals are subject to pervasive and continuing regulation by the FDA, including, among other things, requirements relating to recordkeeping, periodic reporting, product sampling and distribution, advertising and promotion and reporting of adverse experiences with the product. After approval, most changes to the approved product, such as adding new indications or other labeling claims or some changes to the manufacturing process, are subject to prior FDA review and approval.

Drug manufacturers are subject to periodic unannounced inspections by the FDA and state agencies for compliance with cGMP requirements.

We rely, and expect to continue to rely, on third parties for the production of clinical quantities of our product candidates, and expect to rely in the future on third parties for the production of commercial quantities. Future FDA and state inspections may identify compliance issues at our facilities or at the facilities of our contract manufacturers that may disrupt production or distribution, or require substantial resources to correct. In addition, discovery of previously unknown problems with a product or the failure to comply with applicable requirements may result in restrictions on a product, manufacturer or holder of an approved BLA, including withdrawal or recall of the product from the market or other voluntary, FDA-initiated or judicial action that could delay or prohibit further marketing, or result in the imposition of post-market studies or trials to assess new safety risks.

The FDA strictly regulates marketing, labeling, advertising, and promotion of products that are placed on the market. Drugs may be promoted only for the approved indications and in accordance with the provisions of the approved label. The FDA and other agencies actively enforce the laws and regulations prohibiting the promotion of off-label uses, and a company that is found to have improperly promoted off-label uses may be subject to significant liability.

Orphan Designation and Exclusivity

The FDA may grant orphan drug designation to drugs intended to treat a rare disease or condition that affects fewer than 200,000 individuals in the United States, or if it affects more than 200,000 individuals in the United States and for which there is no reasonable expectation that the cost of developing and making a drug for this type of disease or condition will be recovered from sales in the United States. Orphan drug designation must be requested before submitting an NDA or BLA. After the FDA grants orphan drug designation, the identity of the therapeutic agent and its potential orphan use are disclosed publicly by the FDA.

Orphan drug designation does not convey any advantage in or shorten the duration of the regulatory review and approval process, but it entitles a party to financial incentives such as opportunities for grant funding towards clinical trial costs, tax advantages, and user-fee waivers. In addition, if a product is the first to receive FDA approval for the indication for which it has orphan designation, the product is entitled to orphan drug exclusivity, which means the FDA may not approve any other application to market the same drug for the same indication for a period of seven years, except in limited circumstances, such as a showing of clinical superiority over the product with orphan exclusivity. Orphan drug exclusivity, however, also could block the approval of one of our products for seven years if a competitor obtains approval of the same drug as defined by the FDA for treatment of the same indication or disease.

Pediatric Trials and Exclusivity

Under the Pediatric Research Equity Act of 2003, as amended, BLAs or supplement to a BLA must contain data that are adequate to assess the safety and effectiveness of an investigational drug or biologic product for the claimed indications in all relevant pediatric populations and to support dosing and administration for each pediatric subpopulation for which the drug is safe and effective. A sponsor who is planning to submit a marketing application for a drug product that includes a new active ingredient, new indication, new dosage form, new dosing regimen or new route of administration must submit an initial Pediatric Study Plan (PSP) within sixty days of an end-of-phase 2 meeting or, if there is no such meeting, as early as practicable before the initiation of the Phase 3 or Phase 2/3 clinical trial. The initial PSP must include an outline of the pediatric study or studies that the sponsor plans to conduct, including study objectives and design, age groups, relevant endpoints and statistical approach, or a justification for not including such detailed information, and any request for a deferral of pediatric assessments or a full or partial waiver of the requirement to provide data from pediatric studies along with supporting information. The FDA may, on its own initiative or at the request of the applicant, grant deferrals for submission of some or all pediatric data until after approval of the product for use in adults or full or partial waivers if certain criteria are met. The FDA and the sponsor must reach agreement on the PSP. A sponsor can submit amendments to an agreed-upon initial PSP at any time if changes to the pediatric plan need to be considered based on data collected from preclinical studies, early phase clinical trials, and/or other clinical development programs. The requirements for pediatric data do not apply to any drug or biologic for an indication for which orphan designation has been granted, except under certain circumstances.

Pediatric exclusivity is another type of non-patent exclusivity in the United States and, if granted, provides for the attachment of an additional six months of marketing protection to the term of any existing regulatory exclusivity, including orphan exclusivity. This six-month exclusivity may be granted if a BLA sponsor submits pediatric data that fairly respond to a written request from the FDA for such data.

Rest of World Government Regulation

In addition to regulations in the United States, we will be subject to a variety of regulations in other jurisdictions governing, among other things, clinical trials and any commercial sales and distribution of our products. The cost of establishing a regulatory compliance system for numerous varying jurisdictions can be very significant. Although many of the issues discussed above with respect to the United States apply similarly in the context of the European Union and in other jurisdictions, the approval process varies between countries and jurisdictions and can involve additional product testing and additional administrative review periods. The time required to obtain approval in other countries and jurisdictions might differ from and be longer than that required to obtain FDA approval. Regulatory approval in one country or jurisdiction does not ensure regulatory approval in another, but a failure or delay in obtaining regulatory approval in one country or jurisdiction may negatively impact the regulatory process in others.

Whether or not we obtain FDA approval for a product, we must obtain the requisite approvals from regulatory authorities in foreign countries prior to the commencement of clinical trials or marketing of the product in those countries. Certain countries outside of the United States have a similar process that requires the submission of a clinical trial application much like the IND prior to the commencement of human clinical trials. In the EU, for example, a clinical trial authorization application (CTA) must be submitted for each clinical protocol to each country's national health authority and an independent ethics committee, much like the FDA and IRB, respectively. Once the CTA is accepted in accordance with a country's requirements, the clinical trial may proceed.

The requirements and process governing the conduct of clinical trials vary from country to country. In all cases, the clinical trials are conducted in accordance with GCP the applicable regulatory requirements, and the ethical principles that have their origin in the Declaration of Helsinki.

Pharmaceutical Coverage, Pricing and Reimbursement

Significant uncertainty exists as to the coverage and reimbursement status of any products for which we obtain regulatory approval. In the United States and in other countries, sales of any products for which we receive regulatory approval for commercial sale will depend in part on the availability of coverage and reimbursement from third-party payors. Third-party payors include government authorities, managed care providers, private health insurers and other organizations. Private payors often follow Centers for Medicare & Medicaid Services (CMS's) determinations relating to Medicare and Medicaid with respect to coverage policy and payment limitations in setting their own reimbursement policies. The process for determining whether a payor will provide coverage for a product may be separate from the process for setting the reimbursement rate that the payor will pay for the product. Third-party payors may limit coverage to specific products on an approved list, or formulary, which might not include all of the FDA-approved products for a particular indication. Moreover, a payor's decision to provide coverage for a drug product does not imply that an adequate reimbursement rate will be approved. Adequate third-party reimbursement may not be available or sufficient to enable us to maintain price levels sufficient to realize an appropriate return on our investment in product development.

Third-party payors are increasingly challenging the price and examining the medical necessity and cost-effectiveness of medical products and services, in addition to their safety and efficacy. In order to obtain coverage and reimbursement for any product that might be approved for sale, we may need to conduct expensive pharmacoeconomic studies in order to demonstrate the medical necessity and cost-effectiveness of our products, in addition to the costs required to obtain regulatory approvals. Our product candidates may not be considered medically necessary or cost-effective. If third-party payors do not consider a product to be cost-effective compared to other available therapies, they may not cover the product after approval as a benefit under their plans or, if they do, the level of payment may not be sufficient to allow a company to sell its products at a profit.

The U.S. government, state legislatures and foreign governments have shown significant interest in implementing cost containment programs to limit the growth of government-paid health care costs, including price controls, restrictions on reimbursement and requirements for substitution of generic products for branded prescription drugs. By way of example, the Patient Protection and Affordable Care Act, as amended by the Health Care and Education Reconciliation Act of 2010 (collectively, the ACA) contains provisions that may reduce the profitability of drug products, including, for example, increased rebates for drugs sold to Medicaid programs, extension of Medicaid rebates to Medicaid managed care plans, mandatory discounts for certain Medicare Part D beneficiaries and annual fees based on pharmaceutical companies' share of sales to federal health care programs. There have been executive, judicial and Congressional challenges to certain aspects of the ACA. For example, legislation enacted in 2017, informally titled the Tax Cuts and Jobs Act of 2017, included a provision which repealed, effective January 1, 2019, the tax-based shared responsibility payment imposed by the ACA on certain individuals who fail to maintain qualifying health coverage for all or part of a year that is commonly referred to as the "individual mandate." On June 17, 2021, the Supreme Court dismissed a challenge on procedural grounds that argued the ACA is unconstitutional in its entirety because the "individual mandate" was repealed by Congress. Further, on August 16, 2022, President Biden signed the Inflation Reduction Act of 2022 (IRA) into law, which among other things, extends enhanced subsidies for individuals purchasing health insurance coverage in ACA marketplaces through plan year 2025. The IRA also eliminates the "donut hole" under the Medicare Part D program beginning in 2025 by significantly lowering the beneficiary maximum out-of-pocket cost and creating a new manufacturer discount program. It is possible that the ACA will be subject to judicial or Congressional challenges in the future. It is unclear how any such challenges and the healthcare reform measures of the Biden administration will impact the ACA and our business.

Prior to the Supreme Court ruling, on January 28, 2021, President Biden issued an executive order to initiate a special enrollment period for purposes of obtaining health insurance coverage through the ACA marketplace. The executive order also instructed certain governmental agencies to review and reconsider their existing policies and rules that limit access to healthcare, including among others, reexamining Medicaid demonstration projects and waiver programs that include work requirements, and policies that create unnecessary barriers to obtaining access to health insurance coverage through Medicaid or the ACA. It is possible that the ACA will be subject to judicial or Congressional challenges in the future. It is unclear how any such challenges and the healthcare reform measures of the Biden administration will impact the ACA and our business.

In addition, there has been heightened governmental scrutiny in the United States of pharmaceutical pricing practices in light of the rising cost of prescription drugs and biologics. Such scrutiny has resulted in several recent congressional inquiries and proposed and enacted federal and state legislation designed to, among other things, bring more transparency to product pricing, review the relationship between pricing and manufacturer patient programs, and reform government program reimbursement methodologies for products. For example, in July 2021, the Biden administration released an executive order, "Promoting Competition in the American Economy," with multiple provisions aimed at prescription drugs. In response to Biden's executive order, on September 9, 2021, the Department of Health and Human Services (HHS) released a Comprehensive Plan for Addressing High Drug Prices that outlines principles for drug pricing reform and sets out a variety of potential legislative policies that Congress could pursue as well as potential administrative actions HHS can take to advance these principles. In addition, the IRA, among other things (i) directs HHS to negotiate the price of certain high-expenditure, single-source drugs and biologics covered under Medicare and (ii) imposes rebates under Medicare Part B and Medicare Part D to penalize price increases that outpace inflation. These provisions will take effect progressively starting in fiscal year 2023,

although they may be subject to legal challenges. Further, the Biden administration released an additional executive order on October 14, 2022, directing HHS to report on how the Center for Medicare and Medicaid Innovation can be further leveraged to test new models for lowering drug costs for Medicare and Medicaid beneficiaries. At the state level, legislatures have increasingly passed legislation and implemented regulations designed to control pharmaceutical and biological product pricing, including price or patient reimbursement constraints, discounts, restrictions on certain product access and marketing cost disclosure and transparency measures, and, in some cases, designed to encourage importation from other countries and bulk purchasing. Additional state and federal healthcare reform measures may be adopted in the future.

In the European Community, governments influence the price of pharmaceutical products through their pricing and reimbursement rules and control of national health care systems that fund a large part of the cost of those products to consumers. Some jurisdictions operate positive and negative list systems under which products may only be marketed once a reimbursement price has been agreed to by the government. To obtain reimbursement or pricing approval, some of these countries may require the completion of clinical trials that compare the cost-effectiveness of a particular product candidate to currently available therapies. Other member states allow companies to fix their own prices for medicines, but monitor and control company profits. The downward pressure on health care costs in general, particularly prescription drugs, has become very intense. As a result, increasingly high barriers are being erected to the entry of new products. In addition, in some countries, cross-border imports from low-priced markets exert a commercial pressure on pricing within a country.

The marketability of any products for which we receive regulatory approval for commercial sale may suffer if the government and third-party payors fail to provide adequate coverage and reimbursement. In addition, an increasing emphasis on cost containment measures in the United States and other countries has increased and we expect will continue to increase the pressure on pharmaceutical pricing. Coverage policies and third-party reimbursement rates may change at any time. Even if favorable coverage and reimbursement status is attained for one or more products for which we receive regulatory approval, less favorable coverage policies and reimbursement rates may be implemented in the future.

Other Healthcare Laws and Compliance Requirements

If we obtain regulatory approval for any of our product candidates, we may be subject to various federal and state laws targeting fraud and abuse in the healthcare industry. These laws may impact, among other things, our proposed sales, marketing and education programs. In addition, we may be subject to patient privacy regulation by both the federal government and the states in which we conduct our business. The laws that may affect our ability to operate include:

- the federal Anti-Kickback Statute, which prohibits, among other things, persons and entities from knowingly and willfully soliciting, receiving, offering or paying remuneration, directly or indirectly, to induce, or in return for, the purchase or recommendation of an item or service reimbursable under a federal healthcare program, such as the Medicare and Medicaid programs;
- federal civil and criminal false claims laws and civil monetary penalty laws, including the civil False Claims Act, which prohibit, among other things, individuals or entities from knowingly presenting, or causing to be presented, claims for payment from Medicare, Medicaid, or other third-party payors that are false or fraudulent;
- the federal Health Insurance Portability and Accountability Act of 1996 (HIPAA), which created new federal criminal statutes that prohibit executing a scheme to defraud any healthcare benefit program and making false statements relating to healthcare matters;
- the federal transparency laws, including the provision of the ACA referred to as the federal Physician Payments Sunshine Act, that requires certain drug and biologics manufacturers to disclose payments and other transfers of value provided to physicians (defined to include doctors, dentists, optometrists, podiatrists, and chiropractors), certain other healthcare professionals (such as physician assistants and nurse practitioners), and teaching hospitals and ownership interests of physicians and their immediate family members;
- HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act and its implementing regulations, which imposes certain requirements on HIPAA covered entities, their business associates and their covered subcontractors relating to the privacy, security and transmission of individually identifiable health information; and
- state law equivalents of each of the above federal laws, such as anti-kickback and false claims laws that may apply to items or services reimbursed by any third-party payor, including commercial insurers, and state laws governing transparency, marketing and drug pricing reporting, and the privacy and security of health information in certain circumstances, many of which differ from each other in significant ways and may not have the same effect, thus complicating compliance efforts.

The ACA broadened the reach of the fraud and abuse laws by, among other things, amending the intent requirement of the federal Anti-Kickback Statute and certain other criminal healthcare fraud statutes. Pursuant to the statutory amendment, a person or entity no longer needs to have actual knowledge of this statute or specific intent to violate it in order to have committed a violation. In addition, the ACA provides that the government may assert that a claim including items or services resulting from a violation of the federal Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the civil False Claims Act or the civil monetary penalties statute. Many states have adopted laws similar to the federal Anti-Kickback Statute, some of which apply to the referral of patients for healthcare items or services reimbursed by any source, not only the Medicare and Medicaid programs.

We are also subject to the U.S. Foreign Corrupt Practices Act (FCPA), which prohibits improper payments or offers of payments to foreign governments and their officials for the purpose of obtaining or retaining business. Safeguards we implement to discourage improper payments or offers of payments by our employees, consultants, and others may be ineffective, and violations of the FCPA and similar laws may result in severe criminal or civil sanctions, or other liabilities or proceedings against us, any of which would likely harm our reputation, business, financial condition and result of operations.

If our operations are found to be in violation of any of the laws described above or any other governmental regulations that apply to us, we may be subject to penalties, including significant administrative, civil and criminal penalties, exclusion from participation in government healthcare programs, such as Medicare and Medicaid and imprisonment, disgorgement, damages, fines, additional reporting requirements and regulatory oversight and the curtailment or restructuring of our operations, any of which could adversely affect our ability to operate our business and our results of operations.

Employees and Human Capital Resources

As of December 31, 2022, we had 70 employees, 65 of which were full-time employees. 46 of our employees serve in roles related to research and development, clinical, manufacturing and regulatory affairs, and 17 serve in general and administrative capacities. As of December 31, 2022, all our employees were based in the United States. We also engage temporary consultants and contractors. All of our employees are “at-will,” which means that each employee can terminate his or her relationship with us and we can terminate our relationship with him or her, at any time. None of our employees are represented by a labor union or covered by collective bargaining agreements. We consider our relationship with our employees to be good.

We compete in the highly competitive biotechnology industry. Attracting, developing and retaining talented employees is crucial to executing our strategy and our ability to compete effectively. Our ability to recruit and retain such talent depends on several factors, including compensation and benefits, talent development and career opportunities, and work environment. To that end, we invest in our employees to be an employer of choice.

Our Code of Business Conduct and Ethics (Code of Conduct) ensures that our core values of respect, integrity, collaboration, innovation, trust, and excellence are applied throughout our operations. Our Code of Conduct serves as a critical tool to help all of us recognize and report unethical conduct, while preserving and nurturing our culture of honesty and accountability.

The physical health, financial wellbeing, work-life balance and mental health of our employees is vital to our success. Our environmental, health and safety team stays abreast of local, regional and global concerns and trends and ensures safety procedures are in place to mitigate workplace injuries and safety risks. Our employees are required to complete training in various safety procedures for the laboratories and manufacturing facilities and specialized safety training based on particular job duties. Our Designated Safety Officers and response teams oversee safety-related initiatives and a safety committee that provides input on safety procedures, practices, and policies. Our employees are required to wear personal protective equipment relevant for their particular job duties. Occupational injuries at our facilities are extremely low and are always investigated to determine if any environmental or other changes need to be implemented.

Since the onset of the COVID-19 pandemic, strict safety protocols have been put in place for employees working on-site, including following federal and local guidelines and mandates to ensure the safety of our workforce. We provide the necessary personal protective equipment to those who are working in our facility. Regular communication and training about the virus and how individuals can protect themselves and others is ongoing with employees.

Financial Information about Segments

We operate in a single accounting segment. Refer to Note 1 to our consolidated financial statements included elsewhere in this Annual Report.

Corporate Information

We were incorporated under the laws of the State of Delaware in September 2005. Our principal executive office is located at 10240 Sorrento Valley Road, Suite 300, San Diego, California 92121, and our telephone number is (858) 731-8389. Our website address is www.atyrpharma.com.

You are advised to read this Annual Report in conjunction with other reports and documents that we file from time to time with the SEC. Our Annual Reports on Form 10-K, Quarterly Reports on Form 10-Q, Current Reports on Form 8-K, and amendments to these reports filed or furnished pursuant to Section 13(a) or 15(d) of the Exchange Act, are available free of charge on our website as soon as reasonably practicable after such reports and amendments are electronically filed with, or furnished to, the SEC. You may obtain copies of these reports directly from us or from the SEC. In addition, the SEC maintains information for electronic filers (including aTyr Pharma, Inc.) at its website at www.sec.gov. We also make available copies of our news releases and other financial information and updates with respect to our business on our website. We do not incorporate the information on or accessible through our website into this Annual Report, and you should not consider any information on, or that can be accessed through, our website as part of this Annual Report.

Item 1A. Risk Factors

You should carefully consider the following risk factors, as well as the other information in this Annual Report on Form 10-K (Annual Report) and in our other public filings with the SEC. The occurrence of any of these risks could harm our business, financial condition, results of operations and/or growth prospects or cause our actual results to differ materially from those contained in forward-looking statements we have made in this Annual Report and those we may make from time to time. You should consider all of the risk factors described in our public filings when evaluating our business.

Risks related to the discovery, development and regulation of our product candidates

We may encounter substantial delays and other challenges in our planned clinical trials or we may fail to demonstrate safety and efficacy to the satisfaction of applicable regulatory authorities.

Before obtaining marketing approval from regulatory authorities for the sale of our product candidates, we must conduct extensive clinical trials to demonstrate the safety and efficacy of the product candidates in humans. Clinical trials are expensive, time-consuming, often delayed and uncertain as to outcome. We cannot guarantee that future trials we may plan to conduct, will be initiated or conducted as planned or completed on schedule, if at all. We cannot assure you that our product candidates will not be subject to new clinical holds or significant delay in the future. For example, in our completed Phase 1b/2a clinical trial of efzofitimid in patients with pulmonary sarcoidosis, a form of interstitial lung disease (ILD), FDG-PET/CT was not evaluable due to incomplete data primarily caused by operational issues related to the COVID-19 pandemic. Any inability to initiate or complete clinical trials of our product candidates in the United States, as a result of clinical holds or otherwise, would delay our clinical development plans, may require us to incur additional clinical development costs and could impair our ability to obtain U.S. regulatory approval for such product candidates.

A failure of one or more clinical trials can occur at any stage of testing, and our clinical trials may not be successful. Events that may prevent successful or timely completion of clinical development include, but are not limited to:

- our inability to generate sufficient preclinical, toxicology, or other *in vivo* or *in vitro* data to support the initiation of human clinical trials, including trials of certain dosages;
- delays in reaching consensus with regulatory agencies on trial design, including the endpoints for our global pivotal Phase 3 study of efzofitimid in patients with pulmonary sarcoidosis (the EFZO-FIT study), and prioritization of outcome measurements that would best support the evaluation of efzofitimid's efficacy;
- delays in reaching agreement on acceptable terms with prospective clinical contract research organizations (CROs) and clinical trial sites, including any delays resulting from changes in CROs;
- delays in obtaining required institutional review board or Ethics Committee approval at each clinical trial site;
- delays in recruiting suitable patients to participate in our clinical trials, or delays that may result if the number of patients required for a clinical trial is larger than we anticipate;
- imposition of a clinical hold by regulatory agencies, which may occur at any time before or during a clinical trial, including after our submission of data to these agencies or an inspection of our clinical trial operations or trial sites;
- failure by our CROs, investigators, other third parties or us to adhere to clinical trial requirements;
- failure to perform in accordance with the good clinical practices (GCPs) of the Food and Drug Administration (FDA) or applicable regulatory requirements in other countries;
- delays in the testing, validation, manufacturing and delivery of our product candidates to the clinical sites;

- delays in having patients complete participation in a trial or return for post-treatment follow-up;
- disagreements with regulators regarding our interpretation of data from preclinical studies or clinical trials;
- occurrence of adverse events associated with a product candidate that are viewed to outweigh its potential benefits; or
- changes in regulatory requirements and guidance that require amending or submitting new clinical protocols.

Any delay in or inability to successfully complete preclinical and clinical development (including any delays resulting from any changes in our CRO) could result in additional costs to us and impair our ability to generate revenue. In addition, if we make manufacturing or formulation changes to our product candidates (including our technology transfer to another CDMO for bulk drug substance and production capacity changes for efzofitmod), we may need to conduct additional studies to bridge our modified product candidates to earlier versions.

If the results of our future clinical trials are perceived to be negative or inconclusive, or if there are safety concerns or adverse events associated with our product candidates, we may be required to perform additional clinical trials to support approval or be subject to additional post-marketing testing requirements; be delayed in obtaining marketing approval for our product candidates, if at all; obtain approval for indications or patient populations that are not as broad as intended or desired; obtain approval with labeling that includes significant use or distribution restrictions or safety warnings; be subject to changes in the way the product is manufactured or administered; have regulatory authorities withdraw their approval of the product or impose restrictions on its distribution in the form of a modified risk evaluation and mitigation strategy; be subject to litigation; or experience damage to our reputation.

To date, the safety and efficacy of efzofitmod has only been studied in a limited number of humans. Accordingly, efzofitmod and any future product candidates could potentially cause unexpected adverse events. In addition, the inclusion of critically ill patients in our clinical trials may result in deaths or other adverse medical events due to the natural progression of the disease.

Further, if patients drop out of any future trials, miss scheduled doses or follow-up visits or otherwise fail to follow trial protocols, or if our trials are otherwise disrupted due to the COVID-19 pandemic and the ongoing Ukraine-Russia conflict or actions taken to slow its spread, the integrity of data from our trials may be compromised or not accepted by the FDA or other regulatory authorities, which would represent a significant setback for the applicable program. In addition, the COVID-19 pandemic and the ongoing Ukraine-Russia conflict have impacted clinical trials broadly, including our completed efzofitmod Phase 1b/2a trial in patients with pulmonary sarcoidosis, where many sites stopped enrollment and patients chose not to enroll or continue participating in the trial due to the impact of COVID-19. While we completed the clinical trial, the availability of results from the Phase 1b/2a clinical trial was delayed to September 2021. We may experience delays in site initiation and patient enrollment, failures to comply with study protocols, delays in the manufacture of study drug for clinical testing and other difficulties in starting or completing our future trials due to the COVID-19 pandemic, including the emergence of new variants of COVID-19, as well as the ongoing Ukraine-Russia conflict.

If we are unable to successfully complete or otherwise advance clinical development, obtain regulatory or marketing approval for, or successfully commercialize our therapeutic product candidates, including efzofitmod, or experience significant delays in doing so, our business will be materially harmed.

To date, we have expended significant time, resources and effort on the discovery and development of product candidates related to the extracellular proteins derived from the histidyl tRNA synthetase (HARS) family and NRP2 biology, including conducting preclinical studies and clinical trials. We have not yet completed any evaluation of our product candidates in human clinical trials designed to demonstrate efficacy to the satisfaction of the FDA. Before we can market or sell our therapeutic candidates in the United States or foreign jurisdictions, we will need to commence and complete additional clinical trials (including our planned Phase 2 study in systemic sclerosis (SSc, also known as scleroderma)-associated ILD (SSc-ILD) and larger, pivotal trials like the EFZO-FIT study), manage clinical and manufacturing activities, obtain necessary regulatory approvals from the FDA in the United States and from similar regulatory authorities in other jurisdictions, obtain adequate clinical and commercial manufacturing supplies, build commercial capabilities, which may include entering into a marketing collaboration with a third party, and in some jurisdictions, obtain reimbursement authorization, among other things. We cannot assure you that we will be able to successfully complete the necessary clinical trials, obtain regulatory approvals, secure an adequate commercial supply for, or otherwise successfully commercialize our therapeutic candidates. If we do not receive regulatory approvals for our product candidates, and even if we do obtain regulatory approvals, we may never generate significant revenues, if any, from commercial sales. If we fail to successfully commercialize our therapeutic candidates, we may be unable to generate sufficient revenues to sustain and grow our company, and our business, prospects, financial condition and results of operations will be adversely affected.

The FDA has not approved any product candidate for the treatment of patients with pulmonary sarcoidosis, and as such, there is no established FDA regulatory pathway for approval of a drug in that indication. As a result, the EFZO-FIT study, even if successful, may not be sufficient to support FDA approval, which would materially and adversely harm our business.

During the third quarter of 2022, we initiated the EFZO-FIT study. To date, the FDA has not approved any product for the treatment of patients with pulmonary sarcoidosis, and as such, there is no established FDA regulatory pathway for approval of a drug in that indication. The most appropriate efficacy endpoints to demonstrate clinically meaningful treatment effects have not been established. In this instance, without regulatory precedent for established endpoints, the FDA has not endorsed a specific means for measurement of steroid reduction. Therefore, we are measuring steroid reduction in multiple ways in an effort to support an approval. Our rationale for selecting endpoints for the EFZO-FIT study is based on the anticipated effects of efzofitmod in pulmonary sarcoidosis consistent with the results of our completed Phase 1b/2a study in patients with pulmonary sarcoidosis. The FDA has highlighted the risk of proceeding with a larger study of longer duration based on our limited Phase 1b/2a data, and our inability to replicate the findings in our Phase 1b/2a study would not support FDA approval and will adversely affect our business, prospects, financial condition and results of operations.

In addition, the FDA has substantial discretion in the approval process and may refuse to accept any application or decide that our data are insufficient for approval and require additional preclinical, clinical or other trials, which would be costly and significantly delay the potential for regulatory approval. In particular, even if we were to receive positive data from the EFZO-FIT study, the FDA may determine that the data is not compelling enough for approval. The FDA may also require a panel of experts, referred to as an Advisory Committee, to deliberate on the adequacy of the safety and efficacy data to support approval. The opinion of the Advisory Committee, although not binding, may have a significant impact on our ability to obtain approval of efzofitmod based on the completed clinical trials.

Interim, top-line and preliminary data from our clinical trials that we announce or publish from time to time may change as more patient data become available and are subject to audit and verification procedures that could result in material changes in the final data.

From time to time, we may publicly disclose preliminary or top-line data from our clinical studies, which are based on a preliminary analysis of then-available data, and the results and related findings and conclusions are subject to change following a more comprehensive review of the data related to the particular study or trial. We also make assumptions, estimations, calculations and conclusions as part of our analyses of data, and we may not have received or had the opportunity to fully and carefully evaluate all data. As a result, the top-line results that we report may differ from future results of the same studies, or different conclusions or considerations may qualify such results, once additional data have been received and fully evaluated. Top-line data also remain subject to audit and verification procedures that may result in the final data being materially different from the preliminary data we previously published. As a result, top-line data should be viewed with caution until the final data are available. From time to time, we may also disclose interim data from our clinical studies.

In addition, we may report interim analyses of only certain endpoints rather than all endpoints. Interim data from clinical trials that we may complete are subject to the risk that one or more of the clinical outcomes may materially change as patient enrollment continues and more patient data become available. Adverse differences between preliminary or interim data and final data could significantly harm our business prospects. Further, disclosure of interim data by us or by our competitors could result in volatility in the price of our common stock.

Further, others, including regulatory agencies, may not accept or agree with our assumptions, estimates, calculations, conclusions or analyses or may interpret or weigh the importance of data differently, which could impact the value of the particular program, the approvability or commercialization of a particular product candidate or product and our company in general. In addition, the information we choose to publicly disclose regarding a particular study or clinical trial is based on what is typically extensive information, and you or others may not agree with what we determine is material or otherwise appropriate information to include in our disclosure, and any information we determine not to disclose may ultimately be deemed significant with respect to future decisions, conclusions, views, activities or otherwise regarding a particular product, product candidate or our business. If the top-line data that we report differ from actual results, or if others, including regulatory authorities, disagree with the conclusions reached, our ability to obtain approval for, and commercialize, our product candidates may be harmed, which could harm our business, operating results, prospects or financial condition.

We have encountered and may continue to encounter delays and difficulties enrolling patients in our clinical trials for a variety of reasons, including the limited number of patients who have the diseases for which certain of our product candidates are being studied, which could delay or halt the clinical development of our product candidates.

Identifying and qualifying patients to participate in clinical trials for our product candidates is critical to our success. Certain of the conditions for which we may elect to evaluate our product candidates may be rare diseases with limited patient pools from which to draw for clinical trials.

For example, we are conducting the EFZO-FIT study in patients with pulmonary sarcoidosis. While estimates of pulmonary sarcoidosis prevalence vary, we estimate that pulmonary sarcoidosis affects an estimated 200,000 patients in the United States. Of that population, however, we estimate that approximately 30% experience progressive disease such that our targeted population is significantly smaller. The eligibility criteria for any of our future clinical trials may further limit the pool of available participants in our trials. For example, if patients have been previously prescribed certain other medications to treat pulmonary sarcoidosis, they may not be eligible to participate in the EFZO-FIT study, thus further reducing our patient pool. We may be unable to identify and enroll a sufficient number of patients with the disease in question and who meet the eligibility criteria for, and are willing to participate in, the clinical trials. Once enrolled, patients may decide or be required to discontinue from the clinical trial due to inconvenience, burden of trial requirements, adverse events associated with efzofitimid, limitations required by trial protocols or other reasons. Additionally, we plan to conduct a Phase 2 study in patients with SSc-ILD. It is estimated that approximately 100,000 people in the U.S. are affected by SSc and up to 80% may develop ILD.

Our ability to identify, recruit, enroll and maintain a sufficient number of patients, or those with required or desired characteristics to achieve diversity in future clinical trials in a timely manner may also be affected by other factors, including, but not limited to:

- proximity and availability of clinical trial sites for patients;
- severity of the disease under investigation;
- design of the study protocol and the burdens to patients of compliance with our study protocol;
- perceived risks and benefits of the product candidate under study;
- availability of competing therapies and clinical trials for the patient populations and indications under study;
- efforts to facilitate timely enrollment in clinical trials;
- patient referral practices of physicians; and
- ability to monitor patients adequately during and after treatment.

We plan to seek initial marketing approval in the United States. We may not be able to initiate or continue clinical trials if we cannot enroll a sufficient number of eligible patients to participate in the clinical trials required by the FDA or other regulatory agencies. Our ability to successfully initiate, enroll and complete a clinical trial in any foreign country is subject to numerous risks unique to conducting business in foreign countries, including, but not limited to:

- difficulty in establishing or managing relationships with or changes in CROs and physicians;
- different requirements and standards for the conduct of clinical trials;
- our inability to locate qualified local consultants, physicians and partners; and
- the potential burden of complying with a variety of foreign laws, medical standards and regulatory requirements, including the regulation of biotechnology products and treatment.

Additionally, if patients are unwilling to participate in our clinical trials because of negative publicity from adverse events in our clinical trials or in the biotechnology or protein therapeutics industries or for other reasons, including competitive clinical trials for similar patient populations or complications arising from the ongoing Ukraine-Russia conflict, the timeline for recruiting patients, conducting studies and obtaining regulatory approval of potential products may be delayed. These delays could result in increased costs, delays in advancing our product development or termination of our clinical trials altogether. If we have difficulty enrolling and maintaining a sufficient number of patients to conduct our clinical trials as planned for any reason, we may need to delay, limit or terminate clinical trials, any of which would have an adverse effect on our business, prospects, financial condition and results of operations.

Furthermore, clinical trial delays could also shorten any periods during which we may have the exclusive right to commercialize our product candidates or allow our competitors to bring products to market before we do, which could impair our ability to obtain orphan exclusivity and successfully commercialize our product candidates and may have an adverse effect on our business, financial condition and results of operations.

Our current product candidates and any other product candidates that we may develop from our discovery engine represent novel therapeutic approaches, which may cause significant delays or may not result in any commercially viable drugs.

We have concentrated the bulk of our research and development efforts to date on studying extracellular functions of tRNA synthetase biology, a newly discovered area of biology. We have also identified NRP2 as a receptor for efzofitimid and have focused research efforts on NRP2 biology. Our future success is highly dependent on the successful development of product candidates based on these new areas of biology, including efzofitimid, and additional product candidates arising from proteins derived from tRNA

synthetases or targeting the NRP2 receptor or other pathways, including AARS and DARS. Extracellular tRNA synthetase-based biology and NRP2 biology represents a novel approach to drug discovery and development, and to our knowledge, no drugs have been developed using, or based upon, this approach. Despite the successful development of other naturally occurring proteins, such as erythropoietin and insulin, as therapeutics, proteins derived from HARS, AARS or DARS families or targeting the NRP2 receptor and from other tRNA synthetase pathways represent a novel class of protein therapeutics, and our development of these therapeutics is based on our new understanding of human physiology. In particular, the mechanism of action of tRNA synthetases and their role in immunomodulation and tissue regeneration have not been studied extensively, nor has the safety of this class of protein therapeutics been evaluated extensively in humans. The therapeutic product candidates that we elect to develop may not have the physiological functions that we currently ascribe to them, may have limited or no therapeutic applications, or may present safety problems of which we are not yet aware. We cannot be sure that our discovery engine will yield therapeutic product candidates that are safe, effective, approvable by regulatory authorities, manufacturable, scalable, or profitable.

Because our work represents a new therapeutic approach, developing and commercializing our product candidates, including efzofitmod, subjects us to a number of challenges, including:

- defining indications within our targeted diseases and clinical endpoints within each indication that are appropriate to support regulatory approval, including with respect to the EFZO-FIT study and our planned Phase 2 study in SSc-ILD, and prioritization of outcome measurements that would best support the evaluation of efzofitmod's efficacy;
- obtaining regulatory approval from the FDA and other regulatory authorities that have little or no experience with the development of extracellular tRNA synthetase-based therapeutics;
- educating medical personnel regarding the potential side effect profile of each of our product candidates, such as the potential for the development of antibodies against our purified protein therapeutics;
- developing processes for the safe administration of these product candidates, including long-term follow-up for all patients who receive our product candidates;
- sourcing clinical and, if approved, commercial supplies for the materials used to manufacture and process our product candidates;
- developing a manufacturing process and distribution network that ensures consistent manufacture of our product candidates in compliance with current good manufacturing practices (cGMPs) and related requirements, with a cost of goods that allows for an attractive return on investment;
- obtaining and maintaining third-party coverage and adequate reimbursement of our product candidates;
- establishing sales and marketing capabilities after obtaining any regulatory approval to gain market acceptance; and
- developing therapeutics for diseases or indications beyond those addressed by our current product candidates.

Moreover, public perception of safety issues, including adoption of new therapeutics or novel approaches to treatment, may adversely influence the willingness of subjects to participate in clinical trials, or if approved, of physicians to adopt and prescribe novel therapeutics. Physicians, hospitals and third-party payors often are slow to adopt new products, technologies and treatment practices. Physicians may decide the therapy is too complex or unproven to adopt and may choose not to administer the therapy. Based on these and other factors, healthcare providers and payors may decide that the benefits of any therapeutic candidates for which we receive regulatory approval do not or will not outweigh its costs. Any inability to successfully develop commercially viable drugs would have an adverse impact on our business, prospects, financial condition and results of operations.

Data generated in our preclinical studies and patient sample data relating to the immunomodulatory domain of HARS, including efzofitmod, may not be predictive or indicative of the immunomodulatory activity or therapeutic effects, if any, of our product candidates in patients.

Our scientists discovered the activity of the immunomodulatory domain of HARS, including efzofitmod, using *in vitro* and *in vivo* screening systems designed to test potential immunomodulatory activity in animal models of immune activity or inflammation. Translational medicine, or the application of basic scientific findings to develop therapeutics that promote human health, is subject to a number of inherent risks. In particular, scientific hypotheses formed from preclinical observations may prove to be incorrect, and the data generated in animal models or observed in limited patient populations may be of limited value, and may not be applicable in clinical trials conducted under the controlled conditions required by applicable regulatory requirements and our protocols. For example, we have not extensively studied the activity of efzofitmod in patients with ILD.

Our classification of diseases based on the existence of excessive immune cell activation or lack thereof and our hypothesis that these represent potential indications for our product candidates may not prove to be therapeutically relevant. Accordingly, the conclusions that we have drawn from animal studies and patient sample data regarding the potential immunomodulatory activity of efzofitimod may not be substantiated in other animal models or in clinical trials. Further, based on the discovery of the involvement of NRP2 in the mechanism of action of efzofitimod, we are still expanding our knowledge of the role of the NRP2 pathway in regulating immune responses. Although we were able to establish clinical proof-of-concept for efzofitimod in our Phase 1b/2a clinical trial in patients with pulmonary sarcoidosis, this may not be validated in other clinical trials. Any failure to demonstrate in controlled clinical trials the requisite safety and efficacy of our product candidates will adversely affect our business, prospects, financial condition and results of operations.

We have previously conducted and we or our third party collaborators may conduct additional clinical trials of efzofitimod outside of the United States. The FDA, however, may not accept data from such trials, in which case our development plans will be delayed, which could materially harm our business.

In June 2018, we completed a Phase 1 clinical trial of efzofitimod in healthy subjects in Australia. This randomized, double-blind, placebo-controlled study investigated the safety, tolerability, immunogenicity, and pharmacokinetics (PK) of intravenous efzofitimod in 36 healthy volunteers. In addition, we or our third party collaborators may choose to conduct additional clinical trials for efzofitimod in countries outside the United States, subject to applicable regulatory approval. For example, our partner, Kyorin Pharmaceutical Co., Ltd. (Kyorin), conducted an efzofitimod Phase 1 clinical trial in 32 healthy Japanese male volunteers and is participating in the EZFO-FIT™ study. We will seek to enroll subjects in the EZFO-FIT™ study in centers in United States and Europe, and Kyorin will seek to enroll subjects in the EZFO-FIT™ study in centers in Japan.

Although the FDA may accept data from clinical trials conducted outside the United States, acceptance of such study data is generally subject to certain conditions. For example, in cases where data from foreign clinical trials are intended to serve as the basis for marketing approval in the United States, the FDA will generally not approve the application on the basis of foreign data alone unless (i) the data are applicable in the U.S. population and U.S. medical practice; and (ii) the trials were performed by clinical investigators of recognized competence and pursuant to GCP regulations. Additionally, the FDA's clinical trial requirements, including sufficient size of patient populations and statistical powering, must be met. In addition, when studies are conducted only at sites outside of the United States, the FDA generally does not provide advance comment on the clinical protocols for the studies, and therefore there is an additional risk that the FDA could determine that the study design or protocol for a non-U.S. clinical trial was inadequate, which would likely require us to conduct additional clinical trials, in which case our development plans will be delayed, which could materially harm our business.

Conducting clinical trials outside the United States also exposes us to additional risks, including risks associated with:

- additional foreign regulatory requirements;
- foreign exchange fluctuations;
- compliance with foreign manufacturing, customs, shipment and storage requirements;
- cultural differences in medical practice and clinical research;
- evolving geopolitical and macroeconomic developments, including the ongoing Ukraine-Russia conflict; and
- diminished protection of intellectual property in some countries.

Further, as a result of the COVID-19 pandemic, the integrity of data from any clinical trials conducted outside of the United States may not be acceptable to the FDA.

Our therapeutic product candidates may cause undesirable side effects or have other properties that could delay or prevent their regulatory approval, limit the commercial profile of an approved label, or result in significant negative consequences following marketing approval, if any.

Undesirable side effects caused by our product candidates, or safety, tolerability or toxicity issues that may occur in our preclinical studies, clinical trials or in the future, could cause us or regulatory authorities to interrupt, restrict, delay, or halt clinical trials and could result in a more restrictive label or the delay or denial of regulatory approval by the FDA or other comparable foreign authorities.

In our Phase 1b/2 clinical trials for our first clinical trial candidate, ATYR1940 (slightly truncated recombinant HARS protein), completed in 2016 and 2017, we observed low levels of antibodies to ATYR1940 in some subjects in response to the administration of ATYR1940. Although these antibody observations were without associated clinical symptoms, the development of higher levels of such antibodies over a longer course of treatment may ultimately limit efficacy and trigger a negative autoimmune response. In addition, some patients in our Phase 1b/2 clinical trials of ATYR1940 experienced generalized infusion related reactions (IRRs) and discontinued dosing. We established procedural measures, including a decreased concentration and intravenous delivery rate of ATYR1940, in an

effort to minimize the occurrence of generalized IRRs and the formation of anti-drug antibodies. After implementation of these procedures, we observed a decreased rate of IRRs in our clinical trials of ATYR1940. We did not observe IRRs in our completed Phase 1b/2a clinical trial of efzofitimod in patients in pulmonary sarcoidosis or in our other efzofitimod clinical trials, but we cannot assure that this will be the case in any future clinical trials. Generalized IRRs and other complications or side effects could harm further development and/or commercialization of our product candidates, including efzofitimod. Additionally, our product candidates are designed to be administered by intravenous injection, which may cause side effects, including acute immune responses and injection site reactions. The risk of adverse immune responses remains a significant concern for protein therapeutics, and we cannot assure that these or other risks will not occur in any of our clinical trials our product candidates. There is also a risk of delayed adverse events as a result of long-term exposure to protein therapeutics that must be administered repeatedly for the management of chronic conditions, such as the development of antibodies, which may occur over time. If any such adverse events occur, which may include the development of a negative autoimmune response from antibodies or the occurrence of IRRs associated with antibodies, further advancement of our clinical trials could be halted or delayed, which would have a material adverse effect on our business, prospects, financial condition and results of operations.

If one or more of our product candidates receives marketing approval, and we or others later identify undesirable side effects or other safety concerns caused by such products, a number of potentially significant negative consequences could result.

Any of these events could prevent us from achieving or maintaining market acceptance of the particular product candidate, if approved, and could significantly harm our business, prospects, financial condition and results of operations.

We may not be successful in our efforts to identify or discover additional product candidates.

A key element of our strategy is to expand applications of efzofitimod to additional immune-mediated diseases and leverage our discovery engine to identify the therapeutic potential of NRP2 biology and extracellular proteins derived from tRNA synthetases to help identify or discover additional product candidates. A significant portion of the research that we are conducting involves new compounds and drug discovery methods, including our proprietary technology. Our drug discovery activities using our proprietary technology may not be successful in identifying product candidates that are useful in treating diseases. Our research programs may initially show promise in identifying potential product candidates, yet fail to yield product candidates for clinical development for a number of reasons, including:

- the research methodology used may not be successful in identifying appropriate potential product candidates; or
- potential product candidates may, on further study, be shown to have harmful side effects or other characteristics that indicate that they are unlikely to be product candidates that will receive marketing approval and achieve market acceptance.

Research programs to identify new product candidates require substantial technical, financial and human resources. We may choose to focus our efforts and resources on a potential product candidate that ultimately proves to be unsuccessful. If we are unable to identify suitable product candidates for preclinical and clinical development and regulatory approval, we will not be able to generate product revenues, which would have an adverse impact on our business, prospects, financial condition and results of operations.

We may face manufacturing stoppages and other challenges associated with the clinical or commercial manufacture of our product candidates.

All entities involved in the preparation of therapeutics for clinical trials or commercial sale, including our existing CDMOs for our product candidates, are subject to extensive regulation. Components of a finished therapeutic product approved for commercial sale or use in late-stage clinical trials must be manufactured in accordance with cGMPs. These regulations govern manufacturing processes and procedures (including record keeping) and the implementation and operation of quality systems to control and assure the quality of investigational products and products approved for sale. Poor control of production processes can lead to the introduction of contaminants or to inadvertent changes in the properties or stability of our product candidates that may not be detectable in final product testing. We or our CDMOs must supply all necessary documentation in support of a biologics license application (BLA) on a timely basis and must adhere to the FDA's Good Laboratory Practices and cGMP regulations enforced by the FDA through its facilities inspection program. The facilities and quality systems of our CDMOs and other CROs must pass a pre-approval inspection for compliance with applicable regulations as a condition of regulatory approval of our product candidates. If these facilities do not pass a pre-approval plant inspection, FDA approval of the products will not be granted. If global health concerns prevent the FDA or other regulatory authorities from conducting their regular inspections, it could impact the ability of our CDMOs to provide us with product for clinical trials.

The regulatory authorities also may, at any time following approval of a product for sale, audit the facilities in which the product is manufactured. If any such inspection or audit of our facilities or those of our CDMOs and CROs identifies a failure to comply with applicable regulations or if a violation of our product specifications or applicable regulations occurs independently of such an inspection

or audit, we or the relevant regulatory authority may require remedial measures that may be costly or time-consuming for us or a third party to implement and that may include the temporary or permanent suspension of a clinical trial or commercial sales or the temporary or permanent closure of a facility. Any such remedial measures imposed upon us or third parties with whom we contract could materially harm our business.

In addition, quarantines, shelter-in-place and similar government orders, or the perception that such orders, shutdowns or other restrictions on the conduct of business operations could occur, related to the COVID-19 pandemic or other infectious diseases could impact personnel at our CDMOs and CROs, which could disrupt our clinical timelines and have a material adverse effect on our business, prospects, financial condition and results of operations. Additionally, the production of COVID-19 vaccines may disrupt the availability of raw materials and consumables required to manufacture our product candidates, which could result in decreased manufacturing and supply of these product candidates to support our planned clinical trials or regulatory filings.

If we or any of our CDMOs and CROs fail to maintain regulatory compliance, the FDA can impose regulatory sanctions including, among other things, refusal to approve a pending application for a new biologic product, or revocation of a pre-existing approval. Additionally, if supply from one approved manufacturer is interrupted, there could be a significant disruption in clinical or commercial supply. An alternative manufacturer would need to be qualified through a BLA supplement which could result in further delay. The regulatory agencies may also require additional studies if a new manufacturer is relied upon for commercial production. Switching manufacturers may involve substantial costs and is likely to result in a delay in our desired clinical and commercial timelines.

In addition, the manufacture of our product candidates presents challenges associated with biologics production, including the inherent instability of larger, more complex molecules and the need to ensure uniformity of the drug substance produced in different facilities or across different batches. The process of manufacturing biologics is extremely susceptible to product loss due to contamination, equipment failure or improper installation or operation of equipment, or vendor or operator error. Even minor deviations from normal manufacturing and distribution processes for any of our product candidates could result in reduced production yields, product defects, and other supply disruptions. Furthermore, although tRNA synthetases represent a class of proteins that may share immunomodulatory properties in various physiological pathways, each tRNA synthetase has a different structure and may have unique manufacturing requirements that are not applicable across the entire class. For example, fusion proteins, such as efzofitmod, include an additional antibody domain to improve PK characteristics, and may therefore require a more complex and time-consuming manufacturing process than other tRNA synthetase-based therapeutic candidates. Currently, we are producing our efzofitmod molecule in *E.coli*. The manufacturing processes for one of our product candidates may not be readily adaptable to other product candidates that we develop, and we may need to engage multiple third-party manufacturers to produce our product candidates. For example, we recently engaged an additional CDMO to manufacture efzofitmod and will need to complete a technology transfer and validation process before the new CDMO will be able to produce additional bulk drug substance. Any adverse developments affecting manufacturing operations for our product candidates may result in shipment delays, inventory shortages, lot failures, withdrawals or recalls or other interruptions in the supply of our drug substance and drug product which could delay the development of our product candidates. We may also have to write off inventory, incur other charges and expenses for supply of drug product that fails to meet specifications or expires, undertake costly remediation efforts, or seek more costly manufacturing alternatives. Any manufacturing stoppage or delay, or any inability to consistently manufacture adequate supplies of our product candidates for our clinical trials or on a commercial scale will harm our business, prospects, financial condition and results of operations.

Even if we complete the necessary preclinical studies and clinical trials, we cannot predict when or if we will obtain regulatory approval to commercialize a product candidate, and the scope of any approval may be narrower than we expect.

We cannot commercialize a product until the appropriate regulatory authorities have reviewed and approved the product candidate. Even if our product candidates demonstrate safety and efficacy in clinical trials, the regulatory agencies may not complete their review processes in a timely manner, or we may not be able to obtain regulatory approval.

Additional delays may result if an FDA advisory committee or regulatory authority recommends non-approval or restrictions on approval. In addition, we may experience delays or rejections based upon additional government regulation from future legislation or administrative action, or changes in regulatory agency policy during the period of product development, clinical trials and the review process. Regulatory agencies also may approve a product candidate for fewer or more limited indications than requested, may impose restrictions on dosing or may grant approval subject to the performance of post-marketing studies. In addition, regulatory agencies may not approve the labeling claims that are necessary or desirable for the successful commercialization of our product candidates.

Although we have obtained orphan drug designation for efzofitmod for the treatment of sarcoidosis and systemic sclerosis in the United States and for the treatment of sarcoidosis in the EU we may not receive orphan drug designation for efzofitmod in other jurisdictions or for other indications that we may pursue, or for any other product candidates we may develop under any new

applications for orphan drug designation that we may submit, and any orphan drug designations that we have received or may receive may not confer marketing exclusivity or other expected commercial benefits.

The FDA granted orphan drug designation to efzofitmod for the treatment of sarcoidosis in January 2022 and SSc in April 2022. In January 2023, the European Commission, on the basis of the opinion of the European Medicines Agency (EMA) Committee for Orphan Medicinal Products (COMP) granted orphan drug designation to efzofitmod for the treatment of sarcoidosis. We may apply for orphan drug designation for efzofitmod for other indications and product candidates in the United States and the EU.

Under the Orphan Drug Act, the FDA may designate a drug or biologic product as an orphan drug if it is intended to treat a rare disease or condition, defined as a patient population of fewer than 200,000 in the United States, or a patient population greater than 200,000 in the United States where there is no reasonable expectation that the cost of developing the drug will be recovered from sales in the United States. In the EU, the EMA's COMP grants orphan drug designation to promote the development of products that are intended for the diagnosis, prevention, or treatment of a life-threatening or chronically debilitating condition affecting not more than five in 10,000 persons in the EU. Additionally, designation is granted for products intended for the diagnosis, prevention, or treatment of a life-threatening, seriously debilitating or serious and chronic condition when, without incentives, it is unlikely that sales of the drug in the EU would be sufficient to justify the necessary investment in developing the drug or biological product or where there is no satisfactory method of diagnosis, prevention, or treatment, or, if such a method exists, the medicine must be of significant benefit to those affected by the condition.

Orphan drug status confers up to ten years of marketing exclusivity in Europe, and up to seven years of marketing exclusivity in the United States, for a particular product in a specified indication. Obtaining an orphan drug designation can be difficult and we cannot assure you that we will be able to obtain orphan drug designation in other jurisdictions or for other indications, or rely on orphan drug or similar designations to exclude other companies from manufacturing or selling products using the same principal mechanisms of action for the same indications that we pursue beyond these timeframes. Furthermore, marketing exclusivity in Europe can be reduced from ten years to six years if the initial designation criteria have significantly changed since the market authorization of the orphan product. Even if we are the first to obtain marketing authorization for an orphan drug indication, there are circumstances under which a competing product may be approved for the same indication during the period of marketing exclusivity, such as if the later product is shown to be clinically superior to the orphan product, or if the later product is deemed a different product than ours. Further, the marketing exclusivity would not prevent competitors from obtaining approval of the same product candidate as ours for indications other than those in which we have been granted orphan drug designation, or for the use of other types of products in the same indications as our orphan product.

A breakthrough therapy or Fast Track designation by the FDA, including the Fast Track designation we received for efzofitmod, may not lead to expedited development or regulatory review or approval

In 2022, the FDA granted Fast Track designation to efzofitmod for the treatment of pulmonary sarcoidosis and for the treatment of SSc. We may seek, from time to time, breakthrough therapy or Fast Track designation for our product candidates. A breakthrough therapy designation is for a product candidate intended to treat a serious or life-threatening condition, and preliminary clinical evidence indicates that the product candidate may demonstrate substantial improvement on a clinically significant endpoint(s) over available therapies. A Fast Track designation is for a product candidate that treats a serious or life-threatening condition, and preclinical or clinical data demonstrate the potential to address an unmet medical need. The FDA has broad discretion whether or not to grant these designations. Accordingly, even if we believe a particular product candidate is eligible for breakthrough therapy or Fast Track designation, we cannot assure you that the FDA would decide to grant it. Even if we receive breakthrough therapy or Fast Track designation, we may not experience a faster development process, review or approval compared to conventional FDA procedures. The FDA may withdraw breakthrough therapy or Fast Track designation if it believes that the product no longer meets the qualifying criteria. In addition, the breakthrough therapy program is a relatively new program. As a result, we cannot be certain whether any of our product candidates can or will qualify for breakthrough therapy designation. Our business may be harmed if we are unable to avail ourselves of these or any other expedited development and regulatory pathways.

Disruptions at the FDA and other government agencies caused by funding shortages or global health concerns could negatively impact our business.

The ability of the FDA to review and approve proposed clinical trials or new products can be affected by a variety of factors, including government budget and funding levels, statutory, regulatory, and policy changes, the FDA's ability to hire and retain key personnel and accept the payment of user fees, and other events that may otherwise affect the FDA's ability to perform routine functions. Average review times at the agency have fluctuated in recent years as a result. In addition, government funding of other government agencies that fund research and development activities is subject to the political process, which is inherently fluid and unpredictable. Disruptions at the FDA and other agencies may also slow the time necessary for new product candidates to be reviewed and/or approved by necessary government agencies, which would adversely affect our business. For example, over the last several years, including for 35 days beginning on December 22, 2018, the U.S. government has shut down several times and certain regulatory agencies, such as the FDA, have had to furlough critical FDA employees and stop critical activities.

Even if we obtain regulatory approval for a product candidate, our products will remain subject to regulatory scrutiny.

Even if we obtain regulatory approval for a product candidate, such product will be subject to ongoing regulatory requirements for manufacturing, labeling, packaging, storage, advertising, promotion, sampling, record-keeping, conduct of post-marketing studies, adverse event reporting and submission of safety, efficacy, and other post-market information, including both federal and state requirements in the United States and requirements of comparable foreign regulatory authorities.

We and our CDMOs will be subject to continual review and inspections to assess compliance with cGMPs and adherence to commitments made in any BLA or marketing authorization application (MAA). Accordingly, we and others with whom we work will need to continue to expend time, money, and effort in all areas of regulatory compliance, including manufacturing, production, and quality control.

Any regulatory approvals that we receive for our product candidates may be subject to limitations on the approved indicated uses for which the product may be marketed or to the conditions of approval, or contain requirements for potentially costly post-marketing testing, including Phase 4 clinical trials, and surveillance to monitor the safety and efficacy of the product candidate. If new safety issues emerge, we may be required to change our labeling. Any new legislation addressing drug safety or efficacy issues could result in delays in product development or commercialization, or increased costs to assure compliance.

We will have to comply with requirements concerning advertising and promotion for our products. Violations, including actual or alleged promotion of our products for unapproved, or off-label, uses are subject to enforcement letters, inquiries and investigations, and civil and criminal sanctions. Any actual or alleged failure to comply with labeling and promotion requirements may have a negative impact on our business. In the United States, engaging in impermissible promotion of our products for off-label uses can also subject us to false claims litigation under federal and state statutes, which can lead to civil and criminal penalties and fines, agreements that would materially restrict the manner in which we promote or distribute our drug products and exclusion from Medicare, Medicaid and other federal and state healthcare programs. These false claims statutes include the federal False Claims Act, which allows any individual to bring a lawsuit against a pharmaceutical company on behalf of the federal government alleging submission of false or fraudulent claims, or causing to present such false or fraudulent claims, for payment by a federal program such as Medicare or Medicaid. If the government prevails in the lawsuit, the individual will share in any fines or settlement funds. If we do not lawfully promote our approved products, we may become subject to such litigation and, if we are not successful in defending against such actions, those actions could compromise our ability to become profitable.

The holder of an approved BLA or MAA must submit new or supplemental applications and obtain approval for certain changes to the approved product, product labeling, or manufacturing process. We could also be asked to conduct post-marketing clinical trials to verify the safety and efficacy of our products in general or in specific patient subsets. If original marketing approval were obtained through an accelerated approval pathway, we could be required to conduct a successful post-marketing clinical trial to confirm clinical benefit for our products. An unsuccessful post-marketing study or failure to complete such a trial could result in the withdrawal of marketing approval.

If a regulatory agency discovers previously unknown problems with a product, such as adverse events of unanticipated severity or frequency, or problems with the facility where the product is manufactured, or disagrees with the promotion, marketing or labeling of a product, such regulatory agency may impose restrictions on that product or us, including requiring withdrawal of the product from the market. If we fail to comply with applicable regulatory requirements, a regulatory agency or enforcement authority may, among other things:

- issue untitled or warning letters;
- impose civil or criminal penalties;
- suspend or withdraw regulatory approval;
- suspend any of our ongoing clinical trials;
- refuse to approve pending applications or supplements to approved applications submitted by us;
- impose restrictions on our operations, including closing our CDMOs' facilities; or
- seize or detain products, or require or request a product recall.

Any government investigation of alleged violations of law could require us to expend significant time and resources in response, and could generate negative publicity. Any failure to comply with ongoing regulatory requirements may significantly and adversely affect our ability to commercialize and generate revenue from our products. If regulatory sanctions are applied or if regulatory approval is withdrawn, the value of our company and our operating results will be adversely affected.

Risks related to our financial condition and need for additional capital

We will need to raise additional capital or enter into strategic partnering relationships to fund our operations.

The development of therapeutic product candidates is expensive, and we expect our research and development expenses to fluctuate. As of December 31, 2022, our cash, cash equivalents, restricted cash and available-for-sale investments were approximately \$69.3 million. Additionally, in February 2023, we completed an underwritten follow-on public offering of 23,125,000 shares of our common stock, including the partial exercise of the underwriters' option to purchase additional shares, at a price to the public of \$2.25 per share. The total gross proceeds from the offering were approximately \$52.0 million, before deducting underwriting discounts, commissions and offering expenses payable by us. We also received a \$10.0 million milestone payment from the collaboration and license agreement (Kyorin Agreement) with Kyorin in February 2023. We believe that our current cash, cash equivalents, restricted cash and available-for-sale investments, will be sufficient to meet our material cash requirements for known contractual and other obligations for a period of at least one year from the date of this Annual Report. However, our operating plan may change as a result of many factors currently unknown to us, and we may need to seek additional funds sooner than planned, through equity or debt offerings, grant funding, collaborations, strategic partnerships and/or licensing arrangements. Our future funding requirements are difficult to forecast and will depend on many factors, including but not limited to:

- the type, number, scope progress, expansions, results, costs and timing of, our clinical trials and preclinical studies for our product candidates or other potential product candidates or indications which we are pursuing or may choose to pursue in the future, including any changes in CROs;
- the costs, timing and outcome of regulatory review of our product candidates;
- potential delays of our planned clinical trials of efzofitimod;
- any resulting cost increases as a result of the COVID-19 pandemic, the ongoing Ukraine-Russia conflict, and other geopolitical and macroeconomic conditions including labor shortages, economic slowdowns, recessions or market corrections, inflation and monetary supply shifts, rising interest rates and tightening of credit markets;
- the number and characteristics of product candidates that we pursue;
- the scope, progress, results and costs of preclinical development, and clinical trials for other product candidates;
- the manufacturing of preclinical study and clinical trial materials, including technology transfers to additional CDMOs, and any delays in the manufacturing of study drug as a result of the COVID-19 pandemic, the ongoing Ukraine-Russia conflict, and other geopolitical and macroeconomic conditions including labor shortages, economic slowdowns, recessions or market corrections, inflation, rising interest rates and tightening of credit markets;
- our ability to maintain existing and enter into new collaboration and licensing arrangements and the timing of any payments we may receive under such arrangements;
- the costs and timing of preparing, filing and prosecuting patent applications, maintaining and enforcing our intellectual property rights and defending any intellectual property-related claims;
- the costs and timing of future commercialization activities, including product manufacturing, marketing, sales and distribution, for any of our product candidates for which we receive marketing approval; and
- the extent to which we acquire or in-license other products and technologies and the extent to which we are able to collaborate with a third party on ATYR2810.

In any event, we will require additional capital to complete additional clinical trials, to obtain regulatory approval for, and to commercialize, our product candidates, such as efzofitimod.

Raising funds in the current and future economic environment may present additional challenges. Even if we believe we have sufficient funds for our current or future operating plans, we may seek additional capital if market conditions are favorable or if we have specific strategic considerations. If we are unable to obtain funding on a timely basis, we may be required to significantly curtail, delay or discontinue one or more of our research or development programs or the commercialization of any product candidates, or we may be unable to expand our operations, maintain our current organization and employee base or otherwise capitalize on our business opportunities, as desired, which could materially affect our business, financial condition and results of operations.

The terms of any financing may adversely affect the holdings or the rights of our stockholders and the issuance of additional securities by us, or the possibility of such issuance, may cause the market price of our shares to decline. The sale of additional equity or convertible securities would cause dilution to all of our stockholders. The incurrence of indebtedness would result in fixed payment obligations and may require us to agree to certain restrictive covenants, such as limitations on our ability to incur debt, limitations on our ability to acquire, sell or license intellectual property rights and other operating restrictions that could adversely impact our ability

to conduct our business. As a result of the COVID-19 pandemic and the ongoing Ukraine-Russia conflict, the global credit and financial markets have experienced volatility and disruptions, including severely diminished liquidity and credit availability, declines in consumer confidence, declines in economic growth, increases in unemployment rates, inflation, rising interest rates and uncertainty about economic stability. If the equity and credit markets deteriorate, it may make any necessary debt or equity financing more difficult, more costly and more dilutive. In addition, any fundraising efforts may divert our management from their day-to-day activities, which may adversely affect our ability to develop and commercialize our product candidates.

Additionally, financial markets around the world experienced volatility following the invasion of Ukraine by Russia in February 2022. In response to the invasion, the United States, United Kingdom and European Union (EU), along with others, imposed significant new sanctions and export controls against Russia, Russian banks and certain Russian individuals and may implement additional sanctions or take further punitive actions in the future. The full economic and social impact of the sanctions imposed on Russia (as well as possible future punitive measures that may be implemented), as well as the counter measures imposed by Russia, in addition to the ongoing Ukraine-Russian conflict, which could conceivably expand into the surrounding region, remains uncertain; however, both the conflict and related sanctions have resulted and could continue to result in disruptions to trade, commerce, pricing stability, credit availability and/or supply chain continuity in both Europe and globally, and has introduced significant uncertainty into global markets. In particular, the ongoing Ukraine-Russian conflict has contributed to rapidly rising costs of living (driven largely by higher energy prices) in Europe and other advanced economies. Further, a weak or declining economy could strain our suppliers and manufacturers, possibly resulting in additional supply disruption for the production of efzofitimod. As a result, our business and results of operations may be adversely affected by the ongoing Ukraine-Russia, particularly to the extent it escalates to involve additional countries, further economic sanctions or wider military conflict. We are conducting the EFZO-FIT study and intend to enroll 264 subjects at multiple centers in United States, Europe and Japan and we plan to initiate a Phase 2 study of efzofitimod in patients with SSc-ILD with the intent to enroll 25 patients at multiple centers in the United States.

In addition to the COVID-19 pandemic and the ongoing Ukraine-Russia conflict, global economic and business activities continue to face widespread macroeconomic uncertainties, including labor shortages, inflation and monetary supply shifts, and recession risks, which has resulted in further volatility in the U.S. and global financial markets and which has led to, and may continue to lead to, additional disruptions to trade, commerce, pricing stability, credit availability and supply chain continuity globally. The ultimate long-term impact of the COVID-19 pandemic, the ongoing Ukraine-Russia conflict and other evolving macroeconomic conditions on our business is uncertain, although we continue to actively monitor the impact of these factors on our results of operations, financial condition and cash flows. The extent of the impact of these factors on our operational and financial performance, including our ability to execute our business strategies and initiatives in the expected time frame, will depend on future developments, which are uncertain and cannot be predicted; however, any continued or renewed disruption resulting from these factors could negatively impact our business.

We may decide to enter into additional strategic partnerships, including collaborations with pharmaceutical and biotechnology companies, to enhance and accelerate the development and potential commercialization of our product candidates, such as ATYR2810. We face significant competition in seeking appropriate partners, and the negotiation process is time-consuming and complex. Moreover, we may not be successful in our efforts to establish any new strategic partnership or other collaborative arrangement for any of our product candidates and programs for a variety of reasons, including strategic fit with partners and differences in analysis of commercial value and regulatory risk. We may not be able to negotiate strategic partnerships on a timely basis, on acceptable terms or at all. We are unable to predict when, if ever, we will enter into any new strategic partnership because of the numerous risks and uncertainties associated with establishing strategic partnerships. Even if we are successful in our efforts to establish new strategic partnerships, the terms that we agree upon may not be favorable to us and we may not be able to maintain such strategic partnerships if, for example, we encounter unfavorable results or delays during development or approval of a product candidate or sales of an approved product are lower than expectations.

We are a pre-commercial biotherapeutics company and have incurred significant losses since our inception and anticipate that we will continue to incur significant losses for the foreseeable future.

We are a pre-commercial biotherapeutics company, and we have not yet generated any revenues from product sales. We have incurred net losses in each year since our inception in 2005, including consolidated net losses of \$45.3 million, \$33.8 million and \$16.2 million for the years ended December 31, 2022, 2021 and 2020, respectively. As of December 31, 2022, we had an accumulated deficit of \$417.6 million.

We have devoted most of our financial resources to research and development, including our clinical and preclinical development activities. To date, we have financed our operations primarily through the sale of equity securities and convertible debt and through venture debt, term loans and license and collaboration agreement revenues. The amount of our future net losses will depend, in part, on the rate of our future expenditures and our ability to obtain funding through equity offerings, grant funding, collaborations, strategic partnerships and/or licensing arrangements. We have not completed registrational clinical trials for any product candidate to date and it will be several years, if ever, before we have a product candidate ready for commercialization. Even if we obtain regulatory approval to

market a product candidate, our future revenues will depend, in part, upon the size of any markets in which our product candidates have received approval, and our ability to achieve sufficient market acceptance, reimbursement from third-party payors and adequate market share for our product candidates in those markets.

We expect to continue to incur significant expenses and operating losses for the foreseeable future. We anticipate that our expenses will fluctuate in connection with our ongoing activities as we: continue our research and preclinical and clinical development of efzofitimod or any other product candidates that we may develop; obtain clinical trial materials and further develop the manufacturing process for our product candidates; seek regulatory approvals for our product candidates that successfully complete clinical trials; ultimately establish a sales, marketing and distribution infrastructure to commercialize any products for which we may obtain marketing approval; seek to identify and validate additional product candidates; maintain, protect and expand our intellectual property portfolio; acquire or in-license other product candidates and technologies and collaborate with a third party on ATYR2810; attract and retain skilled personnel; and create additional infrastructure to support our operations as a public company and our product development and planned future commercialization efforts.

Our revenues, expenses and income or losses may fluctuate significantly from quarter to quarter and year to year, such that a period-to-period comparison of our results of operations may not be a good indication of our future performance. In any particular quarter or quarters, our operating results could be below the expectations of securities analysts or investors, which could cause our stock price to decline.

We have never generated any revenue from product sales and may never be profitable.

Our ability to generate revenue and achieve profitability depends on our ability, alone or with strategic collaboration partners, to successfully complete the development of, and obtain the regulatory approvals necessary to commercialize our product candidates. We do not anticipate generating revenues from product sales for the foreseeable future, if ever. Our ability to generate future revenues from product sales depends heavily on our success in:

- completing research, preclinical development and clinical development of our product candidates, potentially with a strategic partner;
- seeking and obtaining regulatory approvals for product candidates for which we complete clinical trials;
- developing a sustainable, scalable, reproducible, and transferable manufacturing process for our product candidates and establishing supply and manufacturing relationships with third parties;
- launching and commercializing product candidates for which we obtain regulatory approval, either by collaborating with a partner or, if launched independently, by establishing a sales force, marketing and distribution infrastructure;
- maintaining, protecting and expanding our intellectual property portfolio;
- obtaining market acceptance of our product candidates as viable treatment options for our target indications;
- identifying and validating new therapeutic product candidates;
- attracting, hiring and retaining qualified personnel; and
- negotiating favorable terms in any licensing, collaboration or other arrangements into which we may enter.

Even if one of our product candidates is approved for commercial sale, we anticipate incurring significant costs associated with commercializing any such approved product candidate. Our expenses could increase beyond expectations if we are required by the FDA or other regulatory agencies, domestic or foreign, to perform clinical trials and other studies in addition to those that we currently anticipate. Even if we are able to generate revenues from the sale of any approved products, we may not become profitable and may need to obtain additional funding to continue operations.

Risks related to our reliance on third parties

We depend on our existing collaborations and may depend on collaborations with additional third parties for the development and commercialization of certain of our product candidates. If our collaborations are not successful, we may not be able to capitalize on the market potential of these product candidates.

We have entered into, and may continue to enter into, research collaborations for the research and development of specified product candidates. Our sole source of revenue depends upon the performance by these collaborators of their responsibilities under these arrangements. For example, while we are eligible to receive up to an additional \$155.0 million in milestone payments under the Kyorin Agreement, as well as tiered royalties ranging from the mid-single digits to mid-teens on any net sales in Japan, whether and when we receive these payments will depend on Kyorin's development and commercialization of efzofitimod in Japan, over which we have

limited control. The development efforts of our collaborators are subject to the same risks and uncertainties described above with respect to our independently developed product candidates.

Some collaborators may not succeed in their product development efforts. It is possible that our collaborators may be unable to obtain regulatory approval of our product candidates or successfully market and commercialize any such products for which regulatory approval is obtained. For example, while we have received \$20.0 million in upfront and milestone payments from Kyorin to date, if Kyorin's operations are limited due to the impacts of the COVID-19 pandemic in Japan or in other regions where Kyorin operates or relies on third party operations, including as a result of the ongoing Ukraine-Russia conflict, the development of efzofitimod in Japan may be significantly delayed and adversely affected, which may in turn delay or limit our receipt of any additional payments under the Kyorin Agreement. Other collaborators may not devote sufficient time or resources to the programs covered by these arrangements, and we may have limited or no control over the time or resources allocated by these collaborators to these programs. The occurrence of any of these events may cause us to derive little or no revenue from these arrangements, lose opportunities to validate our product candidates, or force us to curtail or cease our development efforts in these areas.

Our collaborators may breach or terminate their agreements with us, including termination without cause at subject to certain prior written notice requirements, and we may be unsuccessful in entering into and maintaining other collaborative arrangements for the development of product candidates. For example, Kyorin has the right to terminate the agreement for any reason upon 90 days advance written notice to us. In addition, if we are unable to maintain existing collaboration arrangements or enter into new ones, our ability to generate licensing, milestone or royalty revenues would be materially impaired.

We rely, and expect to continue to rely, on third parties to conduct some or all aspects of our product manufacturing, protocol development, research and preclinical and clinical testing, and these third parties may not perform satisfactorily.

We currently rely, and expect to continue to rely, on third parties to conduct some or all aspects of product manufacturing, protocol development, research and preclinical and clinical testing with respect to our product candidates. Any of these third parties may terminate their engagements with us at any time. If we need to enter into alternative arrangements, it could delay our product development activities. Our reliance on these third parties for research and development activities reduces our control over these activities but does not relieve us of our responsibility to ensure compliance with all required regulations and study protocols. For example, for any product candidates that we develop and commercialize on our own, we will remain responsible for ensuring that each of our clinical trials is conducted in accordance with the applicable study plan and protocols and GCPs so long as we continue to develop and commercialize on our own.

If these third parties do not successfully carry out their contractual duties, meet expected deadlines or conduct our research and development activities, including clinical trials, in accordance with regulatory requirements or our stated study plans and protocols, we will not be able to complete, or may be delayed in completing, the preclinical studies and clinical trials required to support future BLA submissions and approval of our product candidates.

We rely and intend to rely on third parties to produce preclinical, clinical and commercial supplies of our product candidates.

Other than some internal capacity to support preclinical activities, we do not have, nor do we plan to acquire, the infrastructure or capability internally to manufacture our preclinical and clinical quantities of our product candidates, and we lack the internal resources and capability to manufacture any of our product candidates on a clinical or commercial scale. Reliance on CDMOs entails risks to which we would not be subject if we manufactured the product candidates ourselves, including:

- the inability to negotiate manufacturing agreements with third parties under commercially reasonable terms;
- reduced control as a result of using third-party CDMOs for all aspects of manufacturing activities;
- termination or nonrenewal of manufacturing agreements with third parties in a manner or at a time that is costly or damaging to us; and
- disruptions to the operations of our CDMOs or suppliers caused by conditions unrelated to our business or operations, including the insolvency or bankruptcy of the CDMOs or suppliers.

Any of these events could lead to clinical trial delays or failure to obtain regulatory approval, or impact our ability to successfully commercialize future products. Some of these events could be the basis for FDA action, including injunction, recall, seizure or total or partial suspension of production.

Additionally, each CDMO may require licenses to manufacture our product candidates or components thereof if the applicable manufacturing processes are not owned by the CDMO or in the public domain, and we may be unable to transfer or sublicense the intellectual property rights we may have with respect to such activities. These factors could cause the delay of clinical development,

regulatory submissions, required approvals or commercialization of our product candidates, cause us to incur higher costs and prevent us from commercializing our products successfully.

We previously relied on a single CDMO for process development and scale-up of efzofitmod, including the manufacture of bulk drug substance for our projected needs for initial clinical trials. We have entered into an agreement with another CDMO for the transfer of the process, scale-up and manufacturing of bulk drug substance for future clinical trials. Subject to the satisfactory completion of process validation and other requirements, we may contract with this CDMO for larger scale commercial manufacturing. We do not have long-term contracts with our CDMOs, and our CDMOs may terminate their agreements with us for a variety of reasons including technical issues or our material breach of our obligations under the applicable agreement. Furthermore, our CDMOs may reallocate resources away from the production of our product candidates if we delay manufacturing under certain circumstances, and the manufacturing facilities in which our product candidates are made could be adversely affected by earthquakes and other natural disasters, labor shortages, power failures, labor shortages, economic slowdowns, rising interest rates, inflation and monetary supply shifts, evolving geopolitical developments, such as the ongoing Ukraine-Russia conflict, and numerous other factors. If our CDMOs fail to meet contractual requirements, and we are unable to secure one or more replacement CDMOs capable of production at a substantially equivalent cost, our clinical development activities may be delayed, or we could lose potential revenue. Manufacturing biologic drugs is complicated and tightly regulated by the FDA and comparable regulatory authorities around the world, and although alternative CDMOs with the necessary manufacturing and regulatory expertise and facilities exist, it could be expensive and take a significant amount of time to arrange for alternative CDMOs, transfer manufacturing procedures to these alternative CDMOs, and demonstrate comparability of material produced by such new CDMOs. New CDMOs of any product would be required to comply with applicable regulatory requirements. These CDMOs may not be able to manufacture our product candidates at costs, or in quantities, or in a timely manner necessary to complete the clinical development of our product candidates or make commercially successful products.

We rely, and expect to continue to rely, on third parties to conduct, supervise and monitor our clinical trials, and if these third parties perform in an unsatisfactory manner, it may harm our business.

We have relied, and expect to continue to rely, on third-party CROs, clinical investigators and clinical trial sites to ensure our clinical trials are conducted properly and on time. While we have and will continue to enter into agreements governing their activities, we will have limited influence over their actual performance. We will control only certain aspects of our CROs' activities. Nevertheless, we will be responsible for ensuring that each of our clinical trials is conducted in accordance with the applicable protocol, legal and regulatory requirements, and scientific standards, and our reliance on the CROs does not relieve us of our regulatory responsibilities.

We and our investigators and CROs are required to comply with GCPs for conducting, recording and reporting the results of clinical trials to assure that the data and reported results are credible and accurate and that the rights, integrity and confidentiality of clinical trial participants are protected. The FDA enforces GCPs through periodic inspections of study sponsors, principal investigators and clinical trial sites. If we or our investigators and CROs fail to comply with applicable GCPs, the clinical data generated in our future clinical trials may be deemed unreliable and the FDA may require us to perform additional unanticipated clinical trials before approving any marketing applications. Upon inspection, the FDA may determine that our clinical trials did not comply with GCPs. In addition, our future clinical trials will require a sufficient number of test subjects to evaluate the safety and effectiveness of our product candidates. Accordingly, if our investigators and CROs fail to comply with these regulations or fail to recruit a sufficient number of patients, we may be required to repeat such clinical trials, which would delay the regulatory approval process.

Our investigators and CROs are not our employees, and we are therefore unable to directly monitor whether or not they devote sufficient time and resources to our clinical and preclinical programs. They may also have relationships with other commercial entities, including our competitors, for whom they may also be conducting clinical trials or other drug development activities that could harm our competitive position. If our investigators or CROs do not successfully carry out their contractual duties or obligations, fail to meet expected deadlines, or if the quality or accuracy of the clinical data they obtain is compromised due to the failure to adhere to our clinical protocols or regulatory requirements, or for any other reasons, our clinical trials may be extended, delayed or terminated, and we may not be able to obtain regulatory approval for, or successfully commercialize our product candidates. For example, we are currently in the process of transitioning CROs for our ongoing EFZO-FIT study. As a result, enrollment and data integrity from monitoring of the trial may suffer, our financial results could be harmed, our costs could increase, our ability to generate revenues could be delayed and the commercial prospects for our product candidates could be adversely affected.

We are in the process of transitioning our CRO to support our ongoing EFZO-FIT study. Although we are carefully managing the transition of responsibilities, delays in the transition could occur or the transition could not be successful, which could compromise our ability to meet our desired development timelines, cause the transition to become more costly, and divert management's time and attention, all of which could harm our business, financial condition and prospects.

We are currently in the process of transitioning our CRO to support our ongoing EFZO-FIT study. We expect the transition to be substantially completed in the first quarter of 2023. Switching CROs involves additional cost and requires management time and focus. In addition, there is a natural transition period when a new CRO commences work, which could adversely impact trial conduct and monitoring. Although we are carefully managing the transition of responsibilities, delays in the transition could occur or the transition

could not be successful, which could compromise our ability to meet our desired development timelines, cause the transition to become more costly, and divert management's time and attention, all of which could harm our business, financial condition and prospects. In addition, forces beyond our control, including the impacts of the COVID-19 pandemic and other geopolitical and macroeconomic conditions, could disrupt the transition, ultimately impacting the new CRO's ability to timely and adequately support the EFZO-FIT study.

Our reliance on third parties requires us to share our trade secrets, which increases the possibility that a competitor will discover them or that our trade secrets will be misappropriated or disclosed.

We rely on third parties to manufacture our product candidates, and we collaborate with both industry and various academic institutions in the development of our discovery engine for therapeutic applications based on tRNA synthetase and NRP2 biology. In connection with these activities, we are required, at times, to share trade secrets with them. We seek to protect our proprietary technology in part by entering into confidentiality agreements and, if applicable, material transfer agreements, collaborative research agreements, consulting agreements or other similar agreements with our collaborators, advisors, employees and consultants prior to beginning research or disclosing proprietary information. These agreements typically limit the rights of the third parties to use or disclose our confidential information, such as trade secrets. Despite the contractual provisions employed when working with third parties, the need to share trade secrets and other confidential information increases the risk that such trade secrets become known by our competitors, are inadvertently incorporated into the technology of others, or are disclosed or used in violation of these agreements. Given that our proprietary position is based, in part, on our know-how and trade secrets, a competitor's discovery of our trade secrets or other unauthorized use or disclosure would impair our competitive position and may have a material adverse effect on our business, prospects, financial condition and results of operations.

In addition, these agreements typically restrict the ability of our collaborators, advisors, employees and consultants to publish data potentially relating to our trade secrets. Our academic collaborators typically have rights to publish data, provided that we are notified in advance and may delay publication for a specified time in order to secure intellectual property rights to which we are entitled arising from the collaboration. In other cases, publication rights are controlled exclusively by us, although in some cases we may share these rights with other parties. We also conduct joint research and development programs that may require us to share trade secrets under the terms of our research and development partnerships or similar agreements. Despite our efforts to protect our trade secrets, our competitors may discover our trade secrets, either through breach of these agreements, independent development or publication of information including our trade secrets in cases where we do not have proprietary or otherwise protected rights at the time of publication. A competitor's discovery of our trade secrets would impair our competitive position and have an adverse impact on our business, prospects, financial condition and results of operations.

We may not be successful in establishing collaborations for the development, clinical testing, manufacture, and commercialization of ATYR2810.

In the third quarter of 2022, we announced that we intend to focus our resources on the efzofitmod program and made the strategic decision not to use internal resources to initiate a Phase 1 study of ATYR2810. We intend to pursue alternative avenues, including academic or other collaborations with corporations, licensors, licensees, and other parties for the development, clinical testing, manufacture, and commercialization of ATYR2810, although we may not be successful in establishing such collaborations. Any future collaborations for the development, clinical testing, manufacture, and commercialization of ATYR2810 may be terminable at the sole discretion of the collaborator. Replacement collaborators might not be available on attractive terms, or at all. The activities of any collaborator will not be within our control and may not be within our power to influence. Any collaborators may not perform their obligations to our satisfaction, or at all, we may not derive any revenue or profits from such collaborations, and any collaborators may ultimately compete with us. If any collaboration is not pursued, we may require substantially greater capital to undertake development and marketing of our proposed products and may not be able to develop and market such products effectively, if at all. In addition, a lack of development and marketing collaborations may lead to significant delays in introducing ATYR2810 into certain markets and/or reduced sales of proposed products in such markets.

Risks related to our intellectual property

If we are unable to obtain, maintain or protect intellectual property rights related to our product candidates, or if the scope of such intellectual property protection is not sufficiently broad, we may not be able to compete effectively in our markets.

We rely upon a combination of patents, trade secret protection and confidentiality agreements to protect the intellectual property related to our technologies and product candidates. Our success depends in large part on our and our licensors' abilities to obtain and maintain patent and other intellectual property protection in the United States and in other countries for our proprietary technology and product candidates.

We have sought to protect our proprietary position by filing patent applications in the United States and abroad related to our novel technologies and product candidates that are important to our business. This process is expensive and time consuming, and we may not be able to file and prosecute all necessary or desirable patent applications at a reasonable cost or in a timely manner. It is also

possible that we will fail to identify patentable aspects of our research and development output before it is too late to obtain patent protection.

The patentability of inventions, and the validity, enforceability and scope of patents in the biotechnology and pharmaceutical fields involves complex legal and scientific questions and can be uncertain. As a result, patent applications that we own or in-license may not issue as patents with claims that cover our product candidates, or at all, in the United States or in foreign countries for many reasons. For example, there is no assurance that we were the first to invent or the first to file patent applications in respect of the inventions claimed in our patent applications or that our patent applications claim patentable subject matter. We may also be unaware of potentially relevant prior art relating to our patents and patent applications, and this prior art, if any, may be used by third parties as grounds to seek to invalidate a patent or to prevent a patent from issuing from a pending patent application. Even if patents do successfully issue and even if such patents disclose aspects of our product candidates, third parties may challenge their validity, enforceability or scope, which may result in such patents being narrowed or invalidated. Furthermore, even if they are unchallenged, our patents and patent applications may not adequately protect our intellectual property, provide exclusivity for our product candidates or prevent others from designing around our claims. If the breadth or strength of protection provided by the patents and patent applications we hold, license or pursue with respect to our product candidates is threatened, it could threaten our ability to commercialize our product candidates. Further, if we encounter delays in our clinical trials, the period of time during which we could market any of our product candidates under patent protection, if approved, would be reduced. Since patent applications in the United States and most other countries are confidential for a period of time after filing, we cannot be certain that we were the first to file any patent application related to our product candidates. Changes to the patent laws in the United States and other jurisdictions could also diminish the value of our patents and patent applications or narrow the scope of our patent protection. Any of these outcomes could impair our ability to prevent competition from third parties, which may have an adverse effect on our business.

If the patent applications we own or have in-licensed that relate to our programs or product candidates do not issue as patents, if their breadth or strength of protection is threatened, or if they fail to provide exclusivity for our product candidates, it could dissuade companies from collaborating with us to develop product candidates, and threaten our ability to commercialize future products. We cannot offer any assurances about which, if any, patents will issue, the breadth of any such patents or whether any issued patents will be found invalid and unenforceable or will be threatened by third parties. Any successful opposition to these patents or any other patents owned by or licensed to us could deprive us of rights necessary for the successful commercialization of any product candidates that we may develop. In addition, patents have a limited term. In the United States, the natural expiration of a patent is generally 20 years after it is filed. Although various extensions may be available, the life of a patent, and the protection it affords, is limited. Even if a patent does issue for any of our pending patent applications, possible delays in regulatory approvals could mean that the period of time during which we could market a product candidate under patent protection could be reduced from what we generally would expect. Since patent applications in the United States and most other countries are confidential for a period of time after filing, and some remain so until issued, we cannot be certain that we were the first to file any patent application related to a product candidate. Furthermore, if third parties have filed such patent applications, an interference proceeding in the United States can be initiated by a third party to determine who was the first to invent any of the subject matter covered by the patent claims of our applications. Even if patents covering aspects of our product candidates are obtained, once the patent life has expired for a product, we may be open to competition from generic medications.

In addition to the protection afforded by patents, we rely on trade secret protection and confidentiality agreements to protect proprietary know-how that is not patentable or that we elect not to patent, processes for which patents are difficult to enforce and any other elements of our product candidate discovery and development processes that involve proprietary know-how, information or technology that is not covered by patents. However, trade secrets can be difficult to protect. We seek to protect our proprietary technology and processes, in part, by entering into confidentiality agreements with our employees, consultants, scientific advisors and contractors. We also seek to preserve the integrity and confidentiality of our data and trade secrets by maintaining physical security of our premises and physical and electronic security of our information technology systems, but it is possible that these security measures could be breached. Although we expect all of our employees and consultants to assign their inventions to us, and all of our employees, consultants, advisors and any third parties who have access to our proprietary know-how, information or technology to enter into confidentiality agreements, we cannot provide any assurances that all such agreements have been duly executed or that our trade secrets and other confidential proprietary information will not be disclosed or that competitors will not otherwise gain access to our trade secrets or independently develop substantially equivalent information and techniques. For example, any of these parties may breach the agreements and disclose our proprietary information, including our trade secrets, and we may not be able to obtain adequate remedies for such breaches. Misappropriation or unauthorized disclosure of our trade secrets could impair our competitive position and may have a material adverse effect on our business. Additionally, if the steps we take to maintain the confidentiality of our trade secrets are inadequate, we may have insufficient recourse against third parties for misappropriating our proprietary information and processes. In addition, others may independently discover our trade secrets and proprietary information. For example, the FDA, as part of its Transparency Initiative, is currently considering whether to make additional information publicly available on a routine basis, including information that we may consider to be trade secrets or other proprietary information, and it is not clear at the present time how the FDA's disclosure policies may change in the future, if at all.

If due to the effects on our operations of general political and economic conditions, including the COVID-19 pandemic, the invasion of Ukraine by Russia, labor shortages, economic slowdowns, recessions or market corrections, inflation and monetary supply shifts, rising interest rates and tightening of credit markets resulting from the pandemic, the conflict or another cause, we are unable to generate new animal, or *in vitro* data, in time to support new, or updated patent application filings, or prior to patent conversion deadlines, it could materially impact the enforceability or scope of those patent filings.

If we are unable to prevent material disclosure of the non-patented intellectual property related to our technologies to third parties, and there is no guarantee that we will have any such enforceable trade secret protection, we may not be able to establish or maintain a competitive advantage in our market, which could materially adversely affect our business, results of operations and financial condition.

Further, the laws of some foreign countries do not protect proprietary rights to the same extent or in the same manner as the laws of the United States. As a result, we may encounter significant problems in preventing third parties from practicing our inventions in countries outside the United States, or from selling or importing products made using our inventions in and into the United States or other jurisdictions.

Claims that our product candidates or the manufacture, sale or use of our future products infringe the patent or other intellectual property rights of third parties could result in costly litigation or could require substantial time and money to resolve, even if litigation is avoided.

Our commercial success depends in part on our avoiding infringement of the patents and proprietary rights of third parties. There is a substantial amount of litigation, both within and outside the United States, involving patent and other intellectual property rights in the biotechnology and pharmaceutical industries, including patent infringement lawsuits, interferences, oppositions and inter partes reexamination proceedings before the United States Patent and Trademark Office (USPTO) and corresponding foreign patent offices. Numerous U.S. and foreign issued patents and pending patent applications, which are owned by third parties, exist in the fields in which we are pursuing development candidates. As the biotechnology and pharmaceutical industries expand and more patents are issued, the risk increases that our product candidates may be subject to claims of infringement of the patent rights of third parties.

Third parties may assert that we are employing their proprietary technology without authorization. There may be third-party patents or patent applications with claims to materials, formulations, methods of manufacture or methods for treatment related to the use or manufacture of our product candidates. Because patent applications can take many years to issue, there may be currently pending patent applications which may later result in issued patents that our product candidates may infringe. In addition, third parties may obtain patents in the future and claim that use of our technologies infringes upon these patents. If any third-party patents were held by a court of competent jurisdiction to cover the manufacturing process of any of our product candidates, any molecules formed during the manufacturing process or any final product itself, the holders of any such patents may be able to block our ability to commercialize such product candidate unless we obtained a license under the applicable patents, or until such patents expire.

Similarly, if any third-party patents are held by a court of competent jurisdiction to cover aspects of our formulations, processes for manufacture or methods of use, the holders of any such patents may be able to block our ability to develop and commercialize the applicable product candidate unless we obtain a license or until such patent expires. In either case, such a license may not be available on commercially reasonable terms or at all.

Parties making claims against us may obtain injunctive or other equitable relief, which could effectively block our ability to further develop and commercialize one or more of our product candidates. Defense of these claims, regardless of their merit, would involve substantial litigation expense and would be a substantial diversion of employee resources from our business. In the event of a successful claim of infringement against us, we may have to pay substantial damages, including treble damages and attorneys' fees for willful infringement, pay royalties, redesign our infringing products or obtain one or more licenses from third parties, which may not be able to be obtained on reasonable commercial terms or at all, or require substantial time and monetary expenditure.

Patent terms may be inadequate to protect our competitive position on our product candidates for an adequate amount of time.

Patents have a limited lifespan. In the United States, if all maintenance fees are timely paid, the natural expiration of a patent is generally 20 years from its earliest U.S. non-provisional filing date. Various extensions may be available, but the life of a patent, and the protection it affords, is limited. Even if patents covering our product candidates are obtained, once the patent life has expired, we may be open to competition from competitive products, including generics or biosimilars. Given the amount of time required for the development, testing and regulatory review of new product candidates, patents protecting such candidates might expire before or shortly after such candidates are commercialized. As a result, our owned and licensed patent portfolio may not provide us with sufficient rights to exclude others from commercializing products similar or identical to ours.

We may not be successful in obtaining or maintaining necessary rights to our therapeutic product candidates and processes for our development pipeline through acquisitions and in-licenses.

We believe that we have rights to intellectual property, through licenses from third parties and under patents that we own, that is necessary or useful to develop our product candidates. Because our programs may involve additional product candidates that may require

the use of proprietary rights held by third parties, the growth of our business will likely depend in part on our ability to acquire, in-license or use these proprietary rights. In addition, our product candidates may require specific formulations to work effectively and efficiently and these rights may be held by others. We may be unable to acquire or in-license any compositions, methods of use, processes or other third-party intellectual property rights from third parties that we identify on reasonable commercial terms or at all. The licensing and acquisition of third-party intellectual property rights is a competitive area, and a number of more established companies are also pursuing strategies to license or acquire third-party intellectual property rights that we may consider attractive. These established companies may have a competitive advantage over us due to their size, cash resources and greater clinical development and commercialization capabilities.

We sometimes collaborate with U.S. and foreign academic institutions to accelerate our preclinical research or development under written agreements with these institutions. These institutions may provide us with an option to negotiate a license to the institution's rights in technology resulting from the collaboration. Regardless of any such right of first negotiation for intellectual property, we may be unable to negotiate a license within the specified timeframe or under terms that are acceptable to us. If we are unable to do so, the institution may offer the intellectual property rights to other parties, potentially blocking our ability to pursue our program.

In addition, companies that perceive us to be a competitor may be unwilling to assign or license rights to us. We also may be unable to license or acquire third-party intellectual property rights on terms that would allow us to make an appropriate return on our investment. If we are unable to successfully obtain rights to required third-party intellectual property rights, our business, financial condition and prospects for growth could suffer.

If we fail to comply with our obligations in the agreements under which we license intellectual property rights from third parties or otherwise experience disruptions to our business relationships with our licensors, we could lose license rights that are important to our business.

We are a party to a number of intellectual property license agreements that are important to our business and expect to enter into additional license agreements in the future. Our existing license agreements impose, and we expect that future license agreements will impose, various diligence, milestone payment, royalty and other obligations on us. If we fail to comply with our obligations under these agreements, or we are subject to a bankruptcy, the licensor may have the right to terminate the license, in which event we would not be able to market products covered by the license.

We may need to obtain licenses from third parties to advance our research or allow commercialization of our product candidates, and we have done so from time to time. We may fail to obtain any of these licenses at a reasonable cost or on reasonable commercial terms, if at all. In that event, we may be required to expend significant time and resources to develop or license replacement technology. If we are unable to do so, we may be unable to develop or commercialize the affected product candidates, which could harm our business significantly. We cannot provide any assurances that third-party patents do not exist which might be enforced against our current product candidates or future products, resulting in either an injunction prohibiting our sales, or, with respect to our sales, an obligation on our part to pay royalties or other forms of compensation to third parties.

In some cases, patent prosecution of our licensed technology is controlled by the licensor. If our licensors fail to obtain and maintain patent or other protection for the proprietary intellectual property we license from them, we could lose our rights to the intellectual property or our exclusivity with respect to those rights, and our competitors could market competing products using such intellectual property. In certain cases, we may control the prosecution of patents resulting from licensed technology. In the event we breach any of our obligations related to such prosecution, we may incur significant liability to our licensors. Licensing of intellectual property is of critical importance to our business and involves complex legal, business and scientific issues and is complicated by the rapid pace of scientific discovery in our industry. Disputes may arise regarding intellectual property subject to a license agreement, including:

- the scope of rights granted under the license agreement and other interpretation-related issues;
- the extent to which our technology and processes infringe on intellectual property of the licensor that is not subject to the license agreement;
- the sublicensing of patent and other rights under our collaborative development relationships;
- our diligence obligations under the license agreement and what activities satisfy those diligence obligations;
- the ownership of inventions and know-how resulting from the joint creation or use of intellectual property by our licensors and us and our sublicensees or partners, if any; and
- the priority of invention of patented technology.

If disputes over intellectual property that we have licensed prevent or impair our ability to maintain our current licensing arrangements on acceptable terms, we may be unable to successfully develop and commercialize the affected product candidates.

We may become involved in lawsuits to protect or enforce our patents or the patents of our licensors, which could be expensive, time-consuming and unsuccessful.

Competitors may infringe or otherwise violate our patents, the patents of our licensors or our other intellectual property rights. To counter infringement or unauthorized use, we may be required to file infringement claims, which can be expensive and time-consuming. Any claims that we assert against perceived infringers could also provoke these parties to assert counterclaims against us alleging that we infringe their intellectual property rights. In addition, in an infringement proceeding, a court may decide that a patent of ours or our licensors is not valid, is unenforceable or is not infringed, or may refuse to stop the other party from using the technology at issue on the grounds that our patents do not cover the technology in question. An adverse result in any litigation or defense proceedings could put one or more of our patents at risk of being invalidated or interpreted narrowly and could put our patent applications at risk of not issuing.

Interference or derivation proceedings provoked by third parties or brought by us may be necessary to determine the priority of inventions or other matters of inventorship with respect to our patents or patent applications or those of our licensors. We may also become involved in other proceedings, such as re-examination or opposition proceedings, before the USPTO or its foreign counterparts relating to our intellectual property or the intellectual property rights of others. An unfavorable outcome in any such proceedings could require us to cease using the related technology or to attempt to license rights to it from the prevailing party, or could cause us to lose valuable intellectual property rights. Our business could be harmed if the prevailing party does not offer us a license on commercially reasonable terms, if any license is offered at all. Our defense of litigation or interference proceedings may fail and, even if successful, may result in substantial costs and distract our management and other employees. We may not be able to prevent, alone or with our licensors, misappropriation of our intellectual property rights, particularly in countries where the laws may not protect those rights as fully as in the United States. In addition, the uncertainties associated with litigation could have a material adverse effect on our ability to raise the funds necessary to continue our clinical trials, continue our research programs, license necessary technology from third parties, or enter into development partnerships that would help us bring our product candidates to market. We may also become involved in disputes with others regarding the ownership of intellectual property rights. For example, we jointly develop intellectual property with certain parties, and disagreements may therefore arise as to the ownership of the intellectual property developed pursuant to these relationships. If we are unable to resolve these disputes, we could lose valuable intellectual property rights.

Furthermore, because of the substantial amount of discovery required in connection with intellectual property litigation, there is a risk that some of our confidential information could be compromised by disclosure during this type of litigation. There could also be public announcements of the results of hearings, motions or other interim proceedings or developments. If securities analysts or investors perceive these results to be negative, it could have a material adverse effect on the price of our common stock.

We may be subject to claims that our employees, consultants or independent contractors have wrongfully used or disclosed confidential information of third parties or that our employees have wrongfully used or disclosed alleged trade secrets of their former employers.

We employ individuals who were previously employed at universities or other biotechnology or pharmaceutical companies, including our competitors or potential competitors. Although we try to ensure that our employees, consultants and independent contractors do not use the proprietary information or know-how of others in their work for us, we may be subject to claims that we or our employees, consultants or independent contractors have inadvertently or otherwise used or disclosed intellectual property, including trade secrets or other proprietary information, of any of our employee's former employer or other third parties. Litigation may be necessary to defend against these claims. If we fail in defending any such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights or personnel, which could adversely impact our business. Even if we are successful in defending against such claims, litigation could result in substantial costs and be a distraction to management and other employees.

We may be subject to claims challenging the inventorship or ownership of our patents and other intellectual property.

We may be subject to claims that former employees, collaborators or other third parties have an ownership interest in our patents or other intellectual property. For example, we may have inventorship disputes arise from conflicting obligations of consultants or others who are involved in developing our product candidates. Litigation may be necessary to defend against these and other claims challenging inventorship or ownership, or we may enter into agreements to clarify the scope of our rights in such intellectual property. If we fail in defending any such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights, such as exclusive ownership of, or right to use, valuable intellectual property. Such an outcome could have a material adverse effect on our business. Even if we are successful in defending against such claims, litigation could result in substantial costs and be a distraction to management and other employees.

Obtaining and maintaining our patent protection depends on compliance with various procedural, document submission, fee payment and other requirements imposed by governmental patent agencies, and our patent protection could be reduced or eliminated for non-compliance with these requirements.

Periodic maintenance fees, renewal fees, annuity fees and various other governmental fees on patents or applications will be due to be paid to the USPTO and various governmental patent agencies outside of the United States in several stages over the lifetime of the patents or applications. We have systems in place to remind us to pay these fees, and we employ an outside firm and rely on our outside counsel to pay these fees due to non-U.S. patent agencies. The USPTO and various non-U.S. governmental patent agencies require compliance with a number of procedural, documentary, fee payment and other similar provisions during the patent application process. We employ law firms and other professionals to help us comply, and in many cases, an inadvertent lapse can be cured by payment of a late fee or by other means in accordance with the applicable rules. However, there are situations in which non-compliance can result in abandonment or lapse of the patent or patent application, resulting in partial or complete loss of patent rights in the relevant jurisdiction. In such an event, our competitors might be able to enter the market and this circumstance would have a material adverse effect on our business.

Issued patents covering our product candidates could be found invalid or unenforceable if challenged in court.

If we or one of our licensors initiated legal proceedings against a third party to enforce a patent covering one of our product candidates, the defendant could counterclaim that the patent covering our product candidate is invalid or unenforceable. In patent litigation in the United States, defendant counterclaims alleging invalidity or unenforceability are commonplace. Grounds for a validity challenge could be an alleged failure to meet any of several statutory requirements, including lack of novelty, obviousness or non-enablement. Grounds for an unenforceability assertion could be an allegation that someone connected with prosecution of the patent withheld relevant information from the USPTO, or made a misleading statement, during prosecution. Third parties may also raise similar claims before administrative bodies in the United States or abroad, even outside the context of litigation. Such mechanisms include re-examination, post grant review, and equivalent proceedings in foreign jurisdictions (e.g., opposition proceedings). Such proceedings could result in revocation or amendment to our patents in such a way that they no longer cover our product candidates. The outcome following legal assertions of invalidity and unenforceability is unpredictable. With respect to the validity question, for example, we cannot be certain that there is no invalidating prior art, of which we and the patent examiner were unaware during prosecution. If a defendant were to prevail on a legal assertion of invalidity or unenforceability, we would lose at least part, and perhaps all, of the patent protection on our product candidates. Such a loss of patent protection would have a material adverse effect on our business.

Changes in patent law could diminish the value of patents in general, thereby impairing our ability to protect our products.

As is the case with many other biotechnology companies, our success is heavily dependent on intellectual property, particularly patents. Obtaining and enforcing patents in the biotechnology industry involve both technological and legal complexity, and therefore obtaining, maintaining and enforcing biotechnology patents is costly, time-consuming and inherently uncertain. In addition, recent legislative and judicial developments in the United States and elsewhere have in some cases removed the protection afforded to patent owners, made patents more difficult to obtain, or increased the uncertainty regarding the ability to obtain, maintain and enforce patents. For example, Congress has recently passed, and the United States is currently implementing, wide-ranging patent reform legislation, and may pass further patent reform legislation in the future. Recent U.S. Supreme Court rulings have narrowed the scope of patent protection available in certain circumstances and weakened the rights of patent owners in certain situations. For example, in *Association for Molecular Pathology v. Myriad Genetics, Inc.*, the U.S. Supreme Court held that certain claims to naturally occurring substances are not patentable. Although we do not believe that any of the patents owned or licensed by us will be found invalid based on this decision, we cannot predict how future decisions by the courts, the Congress, or the USPTO may impact the value of our patents. In addition to increasing uncertainty with regard to our ability to obtain patents in the future, this combination of events has created uncertainty with respect to the value of patents generally, once obtained. Depending on decisions and actions by the Congress, the federal courts, the USPTO and their respective foreign counterparts, the laws and regulations governing patents could change in unpredictable ways that would weaken our ability to obtain new patents or to maintain and enforce our existing patents and patents that we might obtain in the future.

Patent reform legislation could increase the uncertainties and costs surrounding the prosecution of our patent applications and the validity or defense of our issued patents.

On September 16, 2011, the Leahy-Smith America Invents Act (the Leahy-Smith Act) was signed into law. The Leahy-Smith Act includes a number of significant changes to U.S. patent law, including provisions that affect the way patent applications will be prosecuted and may also affect patent litigation. The USPTO is developing regulations and procedures to govern administration of the Leahy-Smith Act, and many of the substantive changes to patent law associated with the Leahy-Smith Act, and in particular, the first to file provisions, were enacted March 16, 2013. Although it is not clear what, if any, impact the Leahy-Smith Act will have on the operation of our business, the Leahy-Smith Act and its implementation could increase the uncertainties and costs surrounding the prosecution of our patent applications and the enforcement or defense of our issued patents, all of which could have a material adverse effect on our business and financial condition.

We may not be able to protect our intellectual property rights throughout the world.

Filing, prosecuting and defending patents on product candidates in all countries throughout the world would be prohibitively expensive, and our intellectual property rights in some countries outside the United States can be less extensive than those in the United States. In addition, the laws of some foreign countries do not protect intellectual property rights to the same extent as federal and state laws in the United States. Consequently, we may not be able to prevent third parties from practicing our inventions in all countries outside the United States, or from selling or importing products made using our inventions in and into the United States or other jurisdictions. Competitors may use our technologies in jurisdictions where we have not obtained patent protection to develop their own products and further, may export otherwise infringing products to territories where we have patent protection, but enforcement is not as strong as that in the United States. These products may compete with our products and our patents or other intellectual property rights may not be effective or sufficient to prevent them from competing.

Many companies have encountered significant problems in protecting and defending intellectual property rights in foreign jurisdictions. The legal systems of certain countries, particularly certain developing countries, do not favor the enforcement of patents, trade secrets and other intellectual property protection, particularly those relating to biotechnology products, which could make it difficult for us to stop the infringement of our patents or marketing of competing products in violation of our proprietary rights generally. Proceedings to enforce our patent rights in foreign jurisdictions could result in substantial costs and divert our efforts and attention from other aspects of our business, could put our patents at risk of being invalidated or interpreted narrowly and our patent applications at risk of not issuing and could provoke third parties to assert claims against us. We may not prevail in any lawsuits that we initiate and the damages or other remedies awarded, if any, may not be commercially meaningful. Accordingly, our efforts to enforce our intellectual property rights around the world may be inadequate to obtain a significant commercial advantage from the intellectual property that we develop or license.

Risks related to our business operations

We may use our financial and human resources to pursue a particular business strategy, research program or product candidate and fail to capitalize on strategies, programs or product candidates that may be more profitable or for which there is a greater likelihood of success.

Because we have limited resources, we may forego or delay pursuit of certain strategic opportunities or opportunities with certain programs, product candidates or indications that later prove to have greater commercial potential. We may focus on or pursue one indication over another potential indication and such development efforts may not be successful, which would cause us to delay the clinical development and approval of efzofitmod and other product candidates. In addition, our decisions as to which of our discovery programs to advance into preclinical and clinical development could preclude us from advancing others. For example, in the third quarter of 2022, we announced that we intend to focus our resources on the efzofitmod program, and we made the strategic decision not to use internal resources to initiate a Phase 1 study of ATYR2810. Our resource allocation decisions may cause us to fail to capitalize on viable commercial products or profitable market opportunities. For example, based on analysis from an independent consultant that we engaged during 2022, we currently estimate that there is a \$2-3 billion dollar market opportunity in ILD, including pulmonary sarcoidosis and SSc-ILD and excluding idiopathic pulmonary fibrosis. Depending on the accuracy of this estimate, we may not be most efficiently allocating resources toward the advancement of efzofitmod versus the advancement of other development efforts. In addition, we may elect to pursue a research, clinical or commercial strategy that ultimately does not yield the results that we desire. Our spending on current and future research and development programs for product candidates may not result in any commercially viable products. If we do not accurately evaluate the commercial potential or target market for a particular product candidate, we may relinquish valuable rights to that product candidate through strategic collaboration, licensing or other royalty arrangements in cases in which it would have been more advantageous for us to retain sole development and commercialization rights to such product candidate, or we may allocate internal resources to a product candidate in a therapeutic area or market in which it would have been more advantageous to enter into a partnering arrangement. Any failure to allocate resources or capitalize on strategies in a successful manner will have an adverse impact on our business.

Our future success depends on our ability to retain key employees, consultants and advisors and to attract, retain and motivate qualified personnel.

We are highly dependent on principal members of our executive team, the loss of whose services may adversely impact the achievement of our objectives. While we have entered into employment agreements with each of our executive officers, any of them could leave our employment at any time, as all of our employees are “at will” employees. Recruiting and retaining other qualified employees, consultants and advisors for our business, including scientific and technical personnel, will also be critical to our success.

In response to competition, rising inflation rates and labor shortages, we may need to adjust employee cash compensation, which would affect our operating costs and our margins, or equity compensation, which would affect our outstanding share count and cause dilution to existing stockholders. We may not be able to attract and retain personnel on acceptable terms given the competition among numerous pharmaceutical and biotechnology companies for individuals with similar skill sets. In addition, the available pool of skilled

employees may be further reduced if immigration laws change in a manner that increases restrictions on immigration. Further, failure to succeed in preclinical studies or clinical trials may make it more challenging to recruit and retain qualified personnel. The inability to recruit or loss of the services of any executive, key employee, consultant or advisor may impede the progress of our research, development and commercialization objectives.

We may undertake internal restructuring activities in the future that could result in disruptions to our business or otherwise materially harm our results of operations or financial condition.

From time to time we may undertake internal restructuring activities as we continue to evaluate and attempt to optimize our cost and operating structure in light of developments in our business strategy and long-term operating plans. For example, we implemented a corporate and program prioritization plan in May 2018 that included a reduction in our workforce. Any such restructuring activities may result in write-offs or other restructuring charges. There can be no assurance that any restructuring activities that we have undertaken or undertake in the future will achieve the cost savings, operating efficiencies or other benefits that we may initially expect. Restructuring activities may also result in a loss of continuity, accumulated knowledge and inefficiency during transitional periods and thereafter. In addition, internal restructurings can require a significant amount of time and focus from management and other employees, which may divert attention from commercial operations. If any internal restructuring activities we have undertaken or undertake in the future fail to achieve some or all of the expected benefits therefrom, our business, results of operations and financial condition could be materially and adversely affected.

We are subject to a variety of risks associated with international operations that could materially adversely affect our business.

We currently conduct research activities through Pangu BioPharma Limited, in collaboration with the Hong Kong University of Science and Technology. Additionally, we have conducted clinical trials in the EU and in Australia and may conduct future clinical trials internationally. Our partner, Kyorin, conducted an efzofitimid Phase 1 clinical trial in healthy volunteers in Japan, and has joined the EFZO-FIT study, a global Phase 3 clinical trial designed to enroll 264 subjects at multiple centers in United States, Europe and Japan. If any of our product candidates are approved for commercialization outside of the United States, we expect to either use our own sales organization or selectively enter into agreements with third parties to market our products on a worldwide basis or in more limited geographical regions, as with Kyorin and efzofitimid in Japan. We are, and we expect that we will continue to be, subject to a variety of risks related to international operations, including, but not limited to: different regulatory requirements for approval of drugs and biologics in foreign countries; reduced or uncertain protection for intellectual property; unexpected changes in tariffs, trade barriers and regulatory requirements; economic weakness, including labor shortages, economic slowdowns, recessions, inflation and monetary supply shifts, rising interest rates and tightening of credit markets, or political instability in particular foreign economies and markets, including as a result of the ongoing Ukraine-Russia conflict; compliance with tax, employment, immigration and labor laws for employees living or traveling abroad; foreign currency fluctuations, which could result in reduced revenues, and other obligations incident to doing business in another country; and the global impacts of the COVID-19 pandemic.

Any failure to continue our international operations or to commercialize our product candidates outside of the United States may impair our ability to generate revenues and harm our business, prospects and results of operations.

Our employees, principal investigators, consultants and commercial partners may engage in misconduct or other improper activities, including non-compliance with regulatory standards and requirements and insider trading.

We are exposed to the risk of fraud or other misconduct by our employees, principal investigators, consultants and commercial partners. Misconduct by these parties could include intentional failures to comply with the regulations of the FDA and non-U.S. regulators, provide accurate information to the FDA and non-U.S. regulators, comply with healthcare fraud and abuse laws and regulations in the United States and abroad, report financial information or data accurately or disclose unauthorized activities to us. In particular, sales, marketing and business arrangements in the healthcare industry are subject to extensive laws and regulations intended to prevent fraud, misconduct, kickbacks, self-dealing and other abusive practices. These laws and regulations may restrict or prohibit a wide range of pricing, discounting, marketing and promotion, sales commission, customer incentive programs and other business arrangements. Such misconduct could also involve the improper use of information obtained in the course of clinical trials, which could result in significant regulatory sanctions and cause serious harm to our reputation. We have adopted a code of business conduct and ethics applicable to all of our employees, but it is not always possible to identify and deter employee misconduct, and the precautions we take to detect and prevent this activity may not be effective in controlling unknown or unmanaged risks or losses or in protecting us from governmental investigations or other actions or lawsuits stemming from a failure to comply with these laws or regulations. If any such actions are instituted against us, and we are not successful in defending ourselves or asserting our rights, those actions could have a significant impact on our business, including the imposition of significant fines or other sanctions.

We face potential product liability, and, if successful claims are brought against us, we may incur substantial liability and costs. If the use of our product candidates harm patients, or is perceived to harm patients even when such harm is unrelated to our product candidates, our regulatory approvals could be revoked or otherwise negatively impacted and we could be subject to costly and damaging product liability claims.

The use of our product candidates in clinical trials and the sale of any products for which we obtain marketing approval exposes us to the risk of product liability claims. Product liability claims might be brought against us by patients, healthcare providers, pharmaceutical companies or others selling or otherwise coming into contact with our products. There is a risk that our product candidates may induce adverse events. If we cannot successfully defend against product liability claims, we could incur substantial liability and costs. In addition, regardless of merit or eventual outcome, product liability claims may result in:

- impairment of our business reputation;
- withdrawal of clinical trial participants;
- costs due to related litigation;
- distraction of management's attention from our primary business;
- substantial monetary awards to patients or other claimants;
- the inability to commercialize our product candidates; and
- decreased demand for our product candidates, if approved for commercial sale.

We carry product liability insurance for our clinical trials covering \$10.0 million per occurrence and up to \$10.0 million in the aggregate, subject to certain deductibles and exclusions. Although we believe the amount of our insurance coverage is typical for companies similar to us in our industry, we may not have adequate insurance coverage or be able to maintain insurance coverage at a reasonable cost or in sufficient amounts to protect us against losses due to liability. If and when we obtain marketing approval for product candidates, we intend to expand our insurance coverage to include the sale of commercial products; however, we may be unable to obtain product liability insurance on commercially reasonable terms or in adequate amounts. On occasion, large judgments have been awarded in class action lawsuits based on drugs or medical treatments that had unanticipated adverse effects. A successful product liability claim or series of claims brought against us could cause our stock price to decline and adversely affect our reputation and, if judgments exceed our insurance coverage, could adversely affect our results of operations and business.

Patients with the diseases targeted by our product candidates are often already in severe and advanced stages of disease and may have both known and unknown significant pre-existing and potentially life-threatening health risks. During the course of treatment, patients may suffer adverse events, including death, for reasons that may be related to our product candidates. Such events could subject us to costly litigation, require us to pay substantial amounts of money to injured patients, delay, negatively impact or end our opportunity to receive or maintain regulatory approval to market our products, or require us to suspend or abandon our commercialization efforts. Even in a circumstance in which we do not believe that an adverse event is related to our products, the investigation into the circumstance may be time-consuming or inconclusive. These investigations may interrupt our sales efforts, delay our regulatory approval process in other countries, or impact and limit the type of regulatory approvals our product candidates receive or maintain. As a result of these factors, a product liability claim, even if successfully defended, could have a material adverse effect on our business, financial condition or results of operations.

We are, or may become, subject to stringent and evolving U.S. and foreign laws, regulations, rules, policies, contractual obligations and other obligations related to data privacy and security. Our actual or perceived failure to comply with such obligations could have a material adverse effect on our business and financial condition including, a disruption of clinical trials or commercialization of products; regulatory investigations or actions; litigation; fines and penalties; reputational harm; loss of revenue or profits; and other adverse business consequences.

We collect, receive, store, process, use, generate, transfer, disclose, make accessible, protect and share (Process or Processing) personal data and other sensitive information, including information we or our third party partners (such as CROs and clinical trial sites) collect about patients and healthcare providers in connection with clinical trials necessary to operate our business.

Therefore, we are, or may become, subject to data privacy and security laws, regulations, rules, guidance, and industry standards as well as external and internal privacy and security policies, contractual requirements and other obligations that apply to the Processing of personal data both by us and on our behalf (collectively, Data Protection Requirements). The number and scope of the Data Protection Requirements are changing, subject to differing applications and interpretations, and may be inconsistent between jurisdictions. New Data Protection Requirements may be proposed or enacted. Additionally, given the breadth and evolving nature of Data Protection Requirements, preparing for and complying with these requirements is rigorous, time-intensive and requires significant resources and a review of our technologies, systems and practices, as well as those of any third-party collaborators, service providers, contractors or consultants that Process personal data on our behalf. We may at times fail (or be perceived to have failed) to do so. Moreover, despite

our efforts, our personnel or third parties upon whom we rely may fail to comply with such obligations, which could negatively impact our business operations and compliance posture.

If we or the third parties upon which we rely fail, or are perceived to have failed, to address or comply with Data Protection Requirements, this could result in government enforcement actions against us that could include investigations, fines, penalties, audits and inspections, additional reporting requirements and/or oversight, temporary or permanent bans on all or some Processing of personal data, orders to destroy or not use personal data, and imprisonment of company officials. Further, individuals or other relevant stakeholders could bring a variety of claims (including class claims) against us for our actual or perceived failure to comply with the Data Protection Requirements. Any of these events could have a material adverse effect on our reputation, business, or financial condition, and could lead to a loss of actual or prospective customers, collaborators or partners; interrupt or stop clinical trials; result in an inability to Process personal data or to operate in certain jurisdictions; limit our ability to develop or commercialize our products; require us to revise or restructure our operations; or otherwise materially adversely affect our operations (each, a Material Adverse Impact).

In the United States, federal, state and local governments have enacted numerous data privacy and security laws, including data breach notification laws, personal data privacy laws and consumer protection laws (e.g., Section 5 of the Federal Trade Commission Act). and other similar laws (e.g. wiretapping laws). For example, the California Consumer Privacy Act (CCPA) applies to personal information of California consumers, business representatives, and employees, and requires businesses to provide specific disclosures in privacy notices and honor requests of California residents to exercise certain privacy rights. The CCPA provides for civil penalties of up to \$7,500 per violation and allows private litigants affected by certain data breaches to recover significant statutory damages. Although the CCPA exempts some data processed in the context of clinical trials, the CCPA may increase compliance costs and potential liability with respect to other personal data maintained about California residents. In addition, the California Privacy Rights Act of 2020 (CPRA) expands the CCPA's requirements and establishes a regulatory agency to implement and enforce the law. Other states, such as Virginia, Colorado, Utah and Connecticut, have also passed comprehensive privacy laws, and similar laws are being considered in several other states. These developments may further complicate compliance efforts, and may increase legal risk and compliance costs for us and the third parties upon whom we rely. In addition, data privacy and security laws have been proposed at the federal, state and local levels in recent years, which could further complicate compliance efforts.

In addition, we may become subject to an increasing number of foreign privacy laws, particularly as we begin to sponsor clinical trials in foreign jurisdictions. For example, the EU's General Data Protection Regulation (EU GDPR) and the United Kingdom's GDPR (UK GDPR), regulate the collection and use of personal data in the European Economic Area (EEA) and the United Kingdom respectively. The EU and UK GDPR impose strict requirements on controllers and processors of personal data, including special protections for "special categories of personal data", which includes health and genetic information of individuals residing in the EA or in the United Kingdom (UK). Failure to comply with the requirements of the EU and UK GDPR may result in warning letters, litigation, orders banning the processing of personal data, mandatory audits and financial penalties, including fines of up to 4% of the total worldwide annual turnover, or €20,000,000 (17,500,000 British Pounds under the UK GDPR), whichever is greater; or private litigation related to processing of personal data brought by classes of data subjects or consumer protection organizations authorized at law to represent their interests.

In addition, we may be unable to transfer personal data from Europe (including the EEA and UK) and other jurisdictions to the United States or other countries due to data localization requirements or limitations on cross-border data flows. Europe and other jurisdictions have enacted laws requiring data to be localized or limiting the transfer of personal data to other countries. In particular, the EEA and the UK have significantly restricted the transfer of personal data to the United States and other countries whose privacy laws it believes are inadequate. Other jurisdictions may adopt similarly stringent interpretations of their data localization and cross-border data transfer laws. Although there are currently various mechanisms that may be used to transfer personal data from the EEA and UK to the United States in compliance with law, such as the EEA and UK's standard contractual clauses, these mechanisms are subject to legal challenges, and there is no assurance that we can satisfy or rely on these measures to lawfully transfer personal data to the United States. If there is no lawful manner for us to transfer personal data from the EEA, the UK, or other jurisdictions to the United States, or if the requirements for a legally-compliant transfer are too onerous, we could face significant adverse consequences, including the interruption or degradation of our operations, the need to relocate part of or all of our business or data processing activities to other jurisdictions at significant expense, increased exposure to regulatory actions, substantial fines and penalties, the inability to transfer data and work with partners, vendors and other third parties, and injunctions against our processing or transferring of personal data necessary to operate our business. Additionally, companies that transfer personal data out of the EEA and UK to other jurisdictions, particularly to the United States, are subject to increased scrutiny from regulators, individual litigants, and activities groups. Some European regulators have ordered certain companies to suspend or permanently cease certain transfers of personal data out of Europe for allegedly violating the EU and UK GDPR's cross-border data transfer limitations. We are also bound by contractual obligations related to data privacy and security, and our efforts to comply with such obligations may not be successful. For example, certain privacy laws, such as the EU and UK GDPR and the CCPA, may require our customers to impose specific contractual restrictions on their service providers. We also publish privacy policies, marketing materials and other statements, such as compliance with certain certifications, regarding data privacy and security. If these policies, materials or statements are found to be deficient, lacking in transparency, deceptive, unfair,

or misrepresentative of our practices, we may be subject to investigation, enforcement actions by regulators or other adverse consequences.

Unfavorable macroeconomic conditions could adversely affect our business, financial condition or results of operations.

Our results of operations could be adversely affected by general conditions in the global economy and in the global financial markets. For example, the global financial crisis caused volatility and disruptions in the capital and credit markets. In addition, due to general political and economic conditions, including the COVID-19 pandemic and the ongoing Ukraine-Russia conflict, the global credit and financial markets have recently experienced extreme volatility and disruptions, including diminished liquidity and credit availability, declines in consumer confidence, declines in economic growth, increases in unemployment rates, inflation, rising interest rates and uncertainty about economic stability. A severe or prolonged economic downturn, such as the global financial crisis, could result in a variety of risks to our business, including inability to raise additional capital when needed on acceptable terms, if at all. A weak or declining economy could also strain our CDMOs and CROs, possibly resulting in supply disruption. Any of the foregoing could harm our business and we cannot anticipate all of the ways in which the current economic climate and financial market conditions could adversely impact our business.

Adverse developments affecting the financial services industry, such as actual events or concerns involving liquidity, defaults or non-performance by financial institutions or transactional counterparties, could adversely affect our current and projected business operations and our financial condition and results of operations.

Actual events involving limited liquidity, defaults, non-performance or other adverse developments that affect financial institutions, transactional counterparties or other companies in the financial services industry or the financial services industry generally, or concerns or rumors about any events of these kinds or other similar risks, have in the past and may in the future lead to market-wide liquidity problems. For example, on March 10, 2023, Silicon Valley Bank, or SVB, was closed by the California Department of Financial Protection and Innovation, which appointed the Federal Deposit Insurance Corporation, or the FDIC, as receiver. Similarly, on March 12, 2023, Signature Bank and Silvergate Capital Corp. were each swept into receivership. Although a statement by the Department of the Treasury, the Federal Reserve and the FDIC stated that all depositors of SVB would have access to all of their money after only one business day of closure, including funds held in uninsured deposit accounts, borrowers under credit agreements, letters of credit and certain other financial instruments with SVB, Signature Bank or any other financial institution that is placed into receivership by the FDIC may be unable to access undrawn amounts thereunder. If any of our counterparties to any such instruments were to be placed into receivership, we may be unable to access such funds. In addition, if any parties with whom we conduct business are unable to access funds pursuant to such instruments or lending arrangements with such a financial institution, such parties' ability to pay their obligations to us or to enter into new commercial arrangements requiring additional payments to us could be adversely affected. In this regard, counterparties to SVB credit agreements and arrangements, and third parties such as beneficiaries of letters of credit (among others), may experience direct impacts from the closure of SVB and uncertainty remains over liquidity concerns in the broader financial services industry. Similar impacts have occurred in the past, such as during the 2008-2010 financial crisis. As of March 10, 2023, we held less than 2% of our current cash, cash equivalents, restricted cash and available for sale investments with SVB.

Inflation and rapid increases in interest rates have led to a decline in the trading value of previously issued government securities with interest rates below current market interest rates. Although the U.S. Department of Treasury, FDIC and Federal Reserve Board have announced a program to provide up to \$25 billion of loans to financial institutions secured by certain of such government securities held by financial institutions to mitigate the risk of potential losses on the sale of such instruments, widespread demands for customer withdrawals or other liquidity needs of financial institutions for immediately liquidity may exceed the capacity of such program. There is no guarantee that the U.S. Department of Treasury, FDIC and Federal Reserve Board will provide access to uninsured funds in the future in the event of the closure of other banks or financial institutions, or that they would do so in a timely fashion.

Although we assess our banking relationships as we believe necessary or appropriate, our access to funding sources and other credit arrangements in amounts adequate to finance or capitalize our current and projected future business operations could be significantly impaired by factors that affect us, the financial institutions with which we have arrangements directly, or the financial services industry or economy in general. These factors could include, among others, events such as liquidity constraints or failures, the ability to perform obligations under various types of financial, credit or liquidity agreements or arrangements, disruptions or instability in the financial services industry or financial markets, or concerns or negative expectations about the prospects for companies in the financial services industry. These factors could involve financial institutions or financial services industry companies with which we have financial or business relationships, but could also include factors involving financial markets or the financial services industry generally.

The results of events or concerns that involve one or more of these factors could include a variety of material and adverse impacts on our current and projected business operations and our financial condition and results of operations. These could include, but may not be limited to, the following:

- delayed access to deposits or other financial assets or the uninsured loss of deposits or other financial assets;

- loss of access to revolving existing credit facilities or other working capital sources and/or the inability to refund, roll over or extend the maturity of, or enter into new credit facilities or other working capital resources;
- potential or actual breach of contractual obligations that require us to maintain letters or credit or other credit support arrangements; or
- termination of cash management arrangements and/or delays in accessing or actual loss of funds subject to cash management arrangements.

In addition, investor concerns regarding the U.S. or international financial systems could result in less favorable commercial financing terms, including higher interest rates or costs and tighter financial and operating covenants, or systemic limitations on access to credit and liquidity sources, thereby making it more difficult for us to acquire financing on acceptable terms or at all. Any decline in available funding or access to our cash and liquidity resources could, among other risks, adversely impact our ability to meet our operating expenses, financial obligations or fulfill our other obligations, result in breaches of our financial and/or contractual obligations or result in violations of federal or state wage and hour laws. Any of these impacts, or any other impacts resulting from the factors described above or other related or similar factors not described above, could have material adverse impacts on our liquidity and our current and/or projected business operations and financial condition and results of operations.

In addition, any further deterioration in the macroeconomic economy or financial services industry could lead to losses or defaults by parties with whom we conduct business, which in turn, could have a material adverse effect on our current and/or projected business operations and results of operations and financial condition. For example, a party with whom we conduct business may fail to make payments when due, default under their agreements with us, become insolvent or declare bankruptcy. Any bankruptcy or insolvency, or the failure to make payments when due, of any counterparty of ours, or the loss of any significant relationships, could result in material losses to us and may material adverse impacts on our business.

We or the third parties upon whom we depend may be adversely affected by earthquakes, droughts, floods, fires, hurricanes or other natural disasters and our business continuity and disaster recovery plans may not adequately protect us from a serious disaster.

We are located in San Diego, California and our manufacturing activities are conducted by CDMOs and our clinical trials are conducted at various locations in the United States and abroad. Some of these geographic locations have in the past experienced natural disasters, including severe earthquakes. Earthquakes, droughts, floods, fires, hurricanes, disease epidemics or other natural disasters could severely disrupt our operations, and have a material adverse effect on our business, results of operations, financial condition and prospects. If a natural disaster, power outage or other event occurred that prevented us from using all or a significant portion of our facilities, that damaged critical infrastructure, such as the manufacturing facilities of our CDMOs and clinical sites utilized by our CROs, or that otherwise disrupted operations, it may be difficult or, in certain cases, impossible for us to continue our business for a substantial period of time. The disaster recovery and business continuity plans we have in place currently are limited and are unlikely to prove adequate in the event of a serious disaster or similar event. We may incur substantial expenses as a result of the limited nature of our disaster recovery and business continuity plans, as well as limits on our insurance coverage, which could have a material adverse effect on our business, prospects, financial condition and results of operations.

Risks related to the commercialization of our product candidates

If we are unable to establish sales, marketing and distribution capabilities or enter into agreements with third parties to market and sell our product candidates, we may be unable to generate any revenues.

We do not currently have any infrastructure for the sales, marketing and distribution of pharmaceutical products. In order to market our product candidates, if approved by the FDA or any other regulatory body, we must build our sales, marketing, distribution, managerial and other non-technical capabilities or make arrangements with third parties to perform these services. There are risks involved with both establishing our own sales and marketing capabilities and entering into arrangements with third parties to perform these services. For example, recruiting and training a sales force is expensive and time consuming and could delay any product launch. If the commercial launch of a product candidate for which we recruit a sales force and establish marketing capabilities is delayed or does not occur for any reason, we would have prematurely or unnecessarily incurred these commercialization expenses. This may be costly, and our investment would be lost if we cannot retain or reposition our sales and marketing personnel.

If we enter into arrangements or collaborations with third parties to perform sales, marketing and distribution services, our product revenues or the profitability of these product revenues to us are likely to be lower than if we were to market, sell or distribute any medicines that we develop ourselves. In addition, we may not be successful in entering into arrangements with third parties to sell and market our product candidates or may be unable to do so on terms that are favorable to us. We likely will have little control over such third parties, and any of them may fail to devote the necessary resources and attention to sell and market our medicines effectively. If we do not establish sales and marketing capabilities successfully, either on our own or in collaboration with third parties, we will not be successful in commercializing our product candidates.

We rely on third-party manufacturers to produce our product candidates, but we have not entered into agreements with any such manufacturers to support commercialization.

We have not yet secured manufacturing capabilities for commercial quantities of any of our product candidates. Although we intend to rely on third-party manufacturers for commercialization, we have not yet entered into a long-term commercial supply agreement to support full scale commercial production, and we or our CDMOs may be unable to process validation activities necessary to enter into commercial supply agreements or otherwise negotiate agreements with the manufacturers to support our commercialization activities at commercially reasonable terms.

We may run into technical or scientific issues related to development or manufacturing that we may be unable to resolve in a timely manner or with available funds. For example, we recently engaged an additional CDMO to manufacture efzofitmod bulk drug substance and will need to complete a technology transfer and validation process before the new CDMO will be able to produce additional bulk drug substance for our clinical trials or otherwise. The new CDMO has not previously manufactured efzofitmod bulk drug substance, which subjects us to heightened risks that it will experience delays in validating the manufacturing process. If the new CDMO experiences such delays, particularly delays in producing efzofitmod in compliance with cGMP regulations, we could be forced to delay future clinical trials or the submission of regulatory approval applications to the FDA. In addition, due to the fact that all prior cGMP batches of efzofitmod, including those that we intend to use in the EFZO-FIT study, have been produced by our existing CDMO, we will be required to complete comparability studies prior to using efzofitmod produced at the new CDMO's facilities in subsequent clinical trials or submitting regulatory approval applications to the FDA. If we are unable to demonstrate such comparability to the satisfaction of the FDA, it may result in delays to future clinical trials or a deficiency in future regulatory applications. If we or our CDMOs are unable to scale the manufacturing process to produce commercial quantities of our product candidates, or our CDMOs do not pass required regulatory pre-approval inspections, our commercialization efforts will be harmed.

In addition, any significant disruption in our relationships with our CDMOs could harm our business. There are a relatively small number of potential manufacturers for our product candidates, and such manufacturers may not be able to supply our drug products at the times we need them or on commercially reasonable terms. Any disruption to our relationship with our current CDMOs and any manufacturers that we contract with in the future will result in delays in our ability to complete the clinical development of, or to commercialize, our product candidates, and may require us to incur additional costs.

We face intense competition and rapid technological change and the possibility that our competitors may develop therapies that are more advanced or effective than ours, which may adversely affect our financial condition and our ability to successfully commercialize our product candidates.

The biotechnology and pharmaceutical industries are intensely competitive and subject to rapid and significant technological change. We have competitors both in the United States and internationally, including major multi-national pharmaceutical companies, biotechnology companies and universities and other research institutions. Although we believe we are the only company engaged in the discovery and development of therapeutics based on novel functions of tRNA synthetases and NRP2 biology, we are aware of other companies that could compete with our product candidates in their target therapeutic indications, such as our lead candidate, efzofitmod, for the treatment of pulmonary sarcoidosis, SSc-ILD and other ILD.

Many of our competitors have substantially greater financial, technical and other resources, such as larger research and development staff and experienced marketing and manufacturing organizations. Competition may increase further as a result of advances in the commercial applicability of technologies and greater availability of capital for investment in these industries. Our competitors may succeed in developing, acquiring or licensing on an exclusive basis, products that are more effective, safer, more convenient or less costly than any product candidate that we may develop, or achieve earlier patent protection, regulatory approval, product commercialization and market penetration than us. Additionally, technologies developed by our competitors may render our potential product candidates uneconomical or obsolete, and we may not be successful in marketing our product candidates against competitors.

The commercial success of any current product candidate or future product candidates will depend upon the degree of market acceptance by physicians, patients, third-party payors and others in the medical community.

Even with the requisite approval from the FDA and comparable foreign regulatory authorities, the commercial success of our product candidates will depend in part on the medical community, patients, and third-party payors accepting our product candidates as medically useful, cost-effective, and safe. Any product that we bring to the market may not gain market acceptance by physicians, patients, third-party payors and others in the medical community. If these products do not achieve an adequate level of acceptance, we may not generate significant product revenue and may not become profitable.

Even if a potential product displays a favorable efficacy and safety profile in preclinical studies and clinical trials, market acceptance of the product will not be known until after it is launched. Our efforts to educate the medical community and third-party payors on the benefits of the product candidates may require significant resources and may never be successful. Such efforts to educate the marketplace may require more resources than are required by the conventional technologies marketed by our competitors, and our competitors may have substantially greater resources or brand recognition to effectively market their products. If our product candidates

are approved but fail to achieve an adequate level of acceptance by physicians, patients, third-party payors, and others in the medical community, we will not be able to generate sufficient revenue to become or remain profitable.

The insurance coverage and reimbursement status of newly-approved products is uncertain. Failure to obtain or maintain adequate coverage and reimbursement for new or current products could limit our ability to market those products and decrease our ability to generate revenue.

The availability and extent of coverage and adequate reimbursement by third-party payors, including government health administration authorities, private health coverage insurers, managed care organizations and other third-party payors is essential for most patients to be able to afford expensive treatments. Sales of any of our product candidates that receive marketing approval will depend substantially, both in the United States and internationally, on the extent to which the costs of such product candidates will be covered and reimbursed by third-party payors. If reimbursement is not available, or is available only to limited levels, we may not be able to successfully commercialize our product candidates. Even if coverage is provided, the approved reimbursement amount may not be high enough to allow us to establish or maintain pricing sufficient to realize an adequate return on our investment.

There is significant uncertainty related to the insurance coverage and reimbursement of newly approved products. In the United States, the principal decisions about reimbursement for new medicines are typically made by the Centers for Medicare & Medicaid Services (CMS), as CMS decides whether and to what extent a new medicine will be covered and reimbursed under Medicare. Private payors often follow CMS with respect to coverage policy and payment limitations in setting their own reimbursement policies. It is difficult to predict what CMS will decide with respect to reimbursement for fundamentally novel products such as ours, as there is no body of established practices and precedents for these new products. One third-party payor's determination to provide coverage for a product candidate does not assure that other payors will also provide coverage for the product candidate. Further, no uniform policy for coverage and reimbursement exists in the United States, and coverage and reimbursement can differ significantly from payor to payor. As a result, the coverage determination process is often time-consuming and costly. This process will require us to provide scientific and clinical support for the use of our products to each third-party payor separately, with no assurance that coverage and adequate reimbursement will be applied consistently or obtained in the first instance. Reimbursement agencies in Europe may be more conservative than third-party payors in the United States. For example, a number of cancer drugs have been approved for reimbursement in the United States, but have not been approved for reimbursement in certain European countries. There may be significant delays in obtaining reimbursement for newly approved medicines, and our inability to promptly obtain coverage and profitable payment rates from third-party payors for any approved medicines could have a material adverse effect on our business, prospects, financial condition and results of operations.

Outside the United States, international sales are generally subject to extensive governmental price controls and other market regulations, and we believe the increasing emphasis on cost-containment initiatives in Europe, Canada, and other countries has and will continue to put pressure on the pricing and usage of our product candidates. In many countries, the prices of medical products are subject to varying price control mechanisms as part of national health systems. In general, the prices of medicines under such systems are substantially lower than in the United States. Other countries allow companies to fix their own prices for medicines, but monitor and control company profits. Additional foreign price controls or other changes in pricing regulation could restrict the amount that we are able to charge for our product candidates. Accordingly, in markets outside the United States, the reimbursement for our products may be reduced compared with the United States and may be insufficient to generate commercially reasonable revenues and profits. Net prices for medicines may be reduced by mandatory discounts or rebates required by government healthcare programs or private payors and by any future relaxation of laws that currently restrict imports of medicines from countries where they may be sold at lower prices than in the United States.

Moreover, increasing efforts by governmental and third-party payors, in the United States and abroad, to cap or reduce healthcare costs may cause such organizations to limit both coverage and level of reimbursement for new products and, as a result, they may not cover or provide adequate payment for our product candidates. For example, the Patient Protection and Affordable Care Act, as amended by the Health Care and Education Reconciliation Act of 2010 (collectively, the ACA) was passed in March 2010, and substantially changed the way healthcare is financed by both governmental and private insurers, and continues to significantly impact the U.S. pharmaceutical industry. There have been executive, judicial and congressional challenges to certain aspects of the ACA. While Congress has not passed comprehensive repeal legislation, it has enacted laws that modified certain provisions of the ACA such as removing penalties, starting January 1, 2019, for not complying with the ACA's individual mandate to carry health insurance. On June 17, 2021 the U.S. Supreme Court dismissed a challenge on procedural grounds that argued the ACA is unconstitutional in its entirety because the "individual mandate" was repealed by Congress. On August 16, 2022, President Biden signed the Inflation Reduction Act of 2022 (IRA) into law, which among other things, extends enhanced subsidies for individuals purchasing health insurance coverage in ACA marketplaces through plan year 2025. The IRA also eliminates the "donut hole" under the Medicare Part D program beginning in 2025 by significantly lowering the beneficiary maximum out-of-pocket cost and through a newly established manufacturer discount program. It is possible that the ACA will be subject to judicial or Congressional challenges in the future. It is unclear how any such challenges and the healthcare reform measures of the Biden administration will impact the ACA and our business.

In addition, there has been heightened governmental scrutiny in the United States of pharmaceutical pricing practices in light of the rising cost of prescription drugs and biologics. Such scrutiny has resulted in several recent presidential executive orders, congressional inquiries and proposed and enacted federal and state legislation designed to, among other things, bring more transparency to product pricing, review the relationship between pricing and manufacturer patient programs, and reform government program reimbursement methodologies for products. For example, in July 2021, the Biden administration released an executive order, “Promoting Competition in the American Economy,” with multiple provisions aimed at prescription drugs. In response to Biden’s executive order, on September 9, 2021, the U.S. Department of Health and Human Services (HHS) released a Comprehensive Plan for Addressing High Drug Prices that outlines principles for drug pricing reform and sets out a variety of potential legislative policies that Congress could pursue as well as potential administrative actions HHS can take to advance these principles. Further, the IRA, among other things, (1) directs the HHS to negotiate the price of certain single-source drugs and biologics covered under Medicare and (2) imposes rebates under Medicare Part B and Medicare Part D to penalize price increases that outpace inflation. These provisions will take effect progressively starting in fiscal year 2023, although they may be subject to legal challenges. It is currently unclear how the IRA will be implemented but is likely to have a significant impact on the pharmaceutical industry. In addition, the Biden administration released an additional executive order on October 14, 2022, directing HHS to report on how the Center for Medicare and Medicaid Innovation can be further leveraged to test new models for lowering drug costs for Medicare and Medicaid beneficiaries. We expect to experience pricing pressures in connection with the sale of any of our product candidates, due to the trend toward managed healthcare, the increasing influence of health maintenance organizations and additional health reform measures. The downward pressure on healthcare costs in general, particularly prescription drugs and surgical procedures and other treatments, has become very intense. As a result, increasingly high barriers are being erected to the entry of new products.

In addition, drug prices are under significant scrutiny in the markets in which our products may be sold. Drug pricing and other health care costs continues to be subject to intense political and societal pressures which we anticipate will continue and escalate on a global basis. If coverage and reimbursement is available only to limited levels, we may not be able to successfully commercialize our product candidates for which we obtain marketing approval. As a result, we may have difficulty raising capital and our results of operations may be adversely impacted.

Our business operations and current and future relationships with investigators, healthcare professionals, consultants, third-party payors and customers may be subject, directly or indirectly, to federal and state healthcare fraud and abuse laws, false claims laws, transparency laws, health information privacy and security laws and other healthcare laws and regulations. If we are unable to comply, or have not fully complied, with such laws, we could face substantial penalties.

Although we do not currently have any products on the market, our current and future operations may be, directly or indirectly through our prescribers, customers and third-party payors, subject to various federal and state healthcare laws and regulations. The laws that may affect our ability to operate include:

- the federal Anti-Kickback Statute, which prohibits, among other things, persons or entities from knowingly and willfully soliciting, offering, receiving or paying any remuneration (including any kickback, bribe or certain rebates), directly or indirectly, overtly or covertly, in cash or in kind, to induce or reward either the referral of an individual for, or the purchase, lease, order or recommendation of, any good, facility, item or service, for which payment may be made, in whole or in part, under federal and state healthcare programs such as Medicare and Medicaid. A person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation;
- the U.S. federal false claims, including the False Claims Act, which can be enforced through whistleblower actions, and civil monetary penalties laws, which, among other things, impose criminal and civil penalties against individuals or entities for knowingly presenting, or causing to be presented, to the U.S. federal government, claims for payment or approval that are false or fraudulent, knowingly making, using or causing to be made or used, a false record or statement material to a false or fraudulent claim, or from knowingly making a false statement to avoid, decrease or conceal an obligation to pay money to the federal government. In addition, the government may assert that a claim including items and services resulting from a violation of the federal Anti-Kickback Statute constitutes a false or fraudulent claim for purposes of the False Claims Act;
- HIPAA, which imposes criminal and civil liability for, among other things, knowingly and willfully executing, or attempting to execute, a scheme to defraud any healthcare benefit program, or knowingly and willfully falsifying, concealing or covering up a material fact or making any materially false statement, in connection with the delivery of, or payment for, healthcare benefits, items or services; similar to the U.S. federal Anti-Kickback Statute, a person or entity does not need to have actual knowledge of the statute or specific intent to violate it in order to have committed a violation;
- HIPAA, as amended by HITECH, which imposes certain obligations, including mandatory contractual terms, with respect to safeguarding the privacy, security and transmission of individually identifiable health information without appropriate authorization by covered entities, i.e. health plans, healthcare clearinghouses and certain healthcare providers, as well as their business associates and covered subcontractors that perform certain services for or on their behalf involving the use or disclosure of individually identifiable health information;

- the U.S. federal legislation commonly referred to as Physician Payments Sunshine Act, enacted as part of the ACA, and its implementing regulations, which requires certain manufacturers of drugs, devices, biologics and medical supplies that are reimbursable under Medicare, Medicaid or the Children’s Health Insurance Program to report annually to the CMS information related to certain payments and other transfers of value to physicians (defined to include doctors, dentists, optometrists, podiatrists and chiropractors), certain other healthcare professionals (such as physician assistants and nurse practitioners), and teaching hospitals, as well as ownership and investment interests held by the physicians described above and their immediate family members; and
- analogous state and foreign laws and regulations.

If our operations are found to be in violation of any of the laws described above or any other governmental laws and regulations that may apply to us, we may be subject to significant penalties, including civil, criminal and administrative penalties, damages, fines, exclusion from government funded healthcare programs, such as Medicare and Medicaid, or similar programs in other countries or jurisdictions, disgorgement, imprisonment, contractual damages, reputational harm, diminished profits, additional reporting requirements and oversight if we become subject to a corporate integrity agreement or similar agreement to resolve allegations of non-compliance with these laws and the delay, reduction, termination or restructuring of our operations.

Risks related to the ownership of our common stock

The market price of our common stock historically has been highly volatile and is likely to continue to be volatile, and you could lose all or part of your investment.

The market price of our common stock has been volatile and could be subject to wide fluctuations in response to various factors, some of which are beyond our control. In addition to the factors discussed in this “Risk Factors” section and elsewhere in this Annual Report, these factors include:

- adverse results or delays in preclinical studies or clinical trials;
- manufacturing sufficient quantities of product candidates for use in clinical trials;
- the imposition of a clinical hold on our product candidates or our inability to cause the clinical hold to be lifted;
- any delay in filing an IND or BLA for any of our product candidates and any adverse development or perceived adverse development with respect to the FDA’s review of that IND or BLA;
- failure of our strategic partners to perform under our collaborations or early termination of collaborations;
- failure to successfully develop and commercialize our product candidates;
- limited market sizes and pricing for our product candidates;
- failure by us or our licensors to prosecute, maintain or enforce intellectual property rights covering our product candidates and processes;
- changes in laws or regulations applicable to current or future products;
- inability to obtain adequate product supply for our product candidates or the inability to do so at acceptable prices;
- adverse regulatory decisions;
- introduction of new products, services or technologies by our competitors;
- inability to obtain additional capital;
- failure to meet or exceed financial or operational projections we may provide to the public;
- failure to meet or exceed the financial or operational projections of the investment community;
- the perception of the biopharmaceutical industry by the public, politicians, legislatures, regulators and the investment community;
- significant acquisitions, strategic partnerships, joint ventures or capital commitments by us or our competitors;
- disputes or other developments relating to proprietary rights, including patents, litigation matters and our ability to obtain patent protection for our technologies;
- additions or departures of key scientific or management personnel;
- significant lawsuits, including patent or stockholder litigation;

- if securities or industry analysts issue an adverse or misleading opinion regarding our common stock;
- changes in the market valuations of similar companies;
- changes in the structure of healthcare payment systems;
- sales of our common stock by us or our stockholders in the future;
- a potential additional reverse stock split if we are unable to maintain a stock price above \$1.00 per share of common stock;
- trading volume of our common stock; and
- general political and macroeconomic conditions, including the COVID-19 pandemic, the ongoing Ukraine-Russia conflict, and other geopolitical and macroeconomic conditions including labor shortages, economic slowdowns, recessions, inflation and monetary supply shifts, rising interest rates and tightening of credit markets, and the resulting impacts on our business operations or financial condition.

In addition, companies trading in the stock market in general, and on the Nasdaq Capital Market and biotechnology companies in particular, have experienced extreme price and volume fluctuations, and we have in the past experienced volatility that has been unrelated or disproportionate to our operating performance. From January 1, 2022 through March 10, 2023 the closing price of our common stock has ranged between \$1.93 and \$7.24 per share. Broad market and industry factors may negatively affect the market price of our common stock, regardless of our actual operating performance.

Our executive officers, directors, 5% holders and their affiliates currently own a significant percentage of our stock and will be able to exert significant control over matters submitted to stockholders for approval.

As of March 10, 2023, based on the latest information available to us, our executive officers, directors, holders known by us to own 5% of our voting stock and their affiliates own approximately 52.3% of our voting stock. Therefore, our executive officers, directors, holders known by us to own 5% of our voting stock 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 and issuances of equity securities could result in dilution to our stockholders, impose restrictions or limitations on our business and could cause our stock price to fall.

We will need additional capital in the future to continue our planned operations, and we may seek additional funding through a combination of equity offerings, debt, grant funding, collaborations, strategic partnerships and/or licensing arrangements.

In February 2023, we completed an underwritten follow-on public offering of 23,125,000 shares of our common stock, including the partial exercise of the underwriters' option to purchase additional shares, at a price to the public of \$2.25 per share. The total gross proceeds from the offering were approximately \$52.0 million, before deducting underwriting discounts, commissions and offering expenses payable by us.

We and each of our directors and executive officers have agreed with the underwriters that, until April 9, 2023, we and they will not, without the underwriters' prior written consent, subject to certain exceptions, (i) offer, sell, contract to sell, pledge, grant any option to purchase, make any short sale or otherwise transfer or dispose of, directly or indirectly, or file with the SEC a registration statement under the Securities Act of 1933, as amended (Securities Act), relating to, any of our securities that are substantially similar to our common stock, or publicly disclose the intention to make any offer, sale, pledge, disposition or filing or (ii) enter into any swap or other agreement that transfers, in whole or in part, any of the economic consequences of ownership of our common stock or any such other securities, whether any such transaction described in clauses (i) or (ii) above is to be settled by delivery of our common stock or such other securities, in cash or otherwise. We refer to such period as the lock-up period. When the lock-up period expires, we and each of our directors and executive officers will be able to issue and sell, as applicable, our shares in the public market. The underwriters may, in their sole discretion, release any of the securities subject to these lock-up agreements at any time. Sales of a substantial number of such shares upon expiration of the lock-up agreements, the perception that such sales may occur, or early release of these agreements, could cause our stock price to fall or make it more difficult for investors to sell their common stock at a time and price that they deem appropriate.

In April 2022, we entered into an Open Market Sale AgreementSM with Jefferies implementing an "at-the-market" offering program, (the Jefferies ATM Offering Program) pursuant to which we may offer and sell, from time to time and at our option, up to an aggregate of \$65.0 million of shares of our common stock through Jefferies, acting as sales agent. Jefferies is entitled to a fixed

commission rate of up to 3.0% of the gross sales proceeds of shares sold under the Jefferies ATM Offering Program. During the year ended December 31, 2022, we sold an aggregate of 1,421,627 shares of common stock at a weighted-average price of \$3.09 per share for net proceeds of approximately \$4.0 million under the Jefferies ATM Offering Program.

These financing activities may have an adverse effect on our stockholders' rights, the market price of our common stock and on our operations, and may require us to relinquish rights to some of our technologies, intellectual property or product candidates, issue additional equity or debt securities, or otherwise agree to terms unfavorable to us.

In addition, sales of a substantial number of shares of our common stock by our existing 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. Any sales of securities by these stockholders could have a material adverse effect on the trading price of our common stock, even if there is no relationship between such sales and the performance of our business.

We have also registered or plan to register all common stock that we may issue under our employee benefits plans as well as shares of common stock underlying options to purchase shares of our common stock that were granted as inducement grants. As a result, once registered, these shares can be freely sold in the public market upon issuance, subject to restrictions under the securities laws. In addition, our directors and executive officers may establish programmed selling plans under Rule 10b5-1 of the Securities Exchange Act of 1934 (Exchange Act) for the purpose of effecting sales of our common stock. If any of these events cause a large number of our shares to be sold in the public market, the sales could reduce the trading price of our common stock and impede our ability to raise future capital.

Our ability to use our net operating losses to offset future taxable income may be subject to certain limitations.

We have incurred substantial losses during our history, we do not expect to become profitable in the near future and we may never achieve profitability. Net operating loss carryforwards (NOLs) that expire unused will be unavailable to offset future income tax liabilities. Under current law, federal net operating losses incurred in tax years beginning after December 31, 2017, may be carried forward indefinitely, but the deductibility of such federal NOLs, is limited to 80% of taxable income.

In addition, under Section 382 of the Internal Revenue Code of 1986, as amended (Code) a corporation that undergoes an "ownership change" (as defined under Section 382 of the Code and applicable Treasury Regulations) is subject to limitations on its ability to utilize its pre-change NOLs to offset post-change taxable income. We have experienced ownership changes in the past, and may experience future ownership changes, under Section 382 of the Code that could affect our ability to utilize our NOLs to offset our income. Furthermore, our ability to utilize NOLs of companies that we may acquire in the future may be subject to limitations. There is also a risk that due to regulatory changes, such as suspensions on the use of NOLs or other unforeseen reasons, portions of our existing NOLs could expire or otherwise be unavailable to reduce future income tax liabilities, including for state tax purposes. For these reasons, we may not be able to utilize a material portion of our NOLs, even if we attain profitability, which could potentially result in increased future tax liability to us and could adversely affect our operating results and financial condition.

Uncertainties in the interpretation and application of existing, new and proposed tax laws and regulations could materially affect our tax obligations and effective tax rate.

The tax regimes to which we are subject or under which we operate are unsettled and may be subject to significant change. The issuance of additional guidance related to existing or future tax laws, or changes to tax laws or regulations proposed or implemented by the current or a future U.S. presidential administration, Congress, or taxing authorities in other jurisdictions, including jurisdictions outside of the United States, could materially affect our tax obligations and effective tax rate. To the extent that such changes have a negative impact on us, including as a result of related uncertainty, these changes may adversely impact our business, financial condition, results of operations, and cash flows.

The amount of taxes we pay in different jurisdictions depends on the application of the tax laws of various jurisdictions, including the United States, to our international business activities, tax rates, new or revised tax laws, or interpretations of tax laws and policies, and our ability to operate our business in a manner consistent with our corporate structure and intercompany arrangements. The taxing authorities of the jurisdictions in which we operate may challenge our methodologies for pricing intercompany transactions pursuant to our intercompany arrangements or disagree with our determinations as to the income and expenses attributable to specific jurisdictions. If such a challenge or disagreement were to occur, and our position was not sustained, we could be required to pay additional taxes, interest, and penalties, which could result in one-time tax charges, higher effective tax rates, reduced cash flows, and lower overall profitability of our operations. Our financial statements could fail to reflect adequate reserves to cover such a contingency. Similarly, a taxing authority could assert that we are subject to tax in a jurisdiction where we believe we have not established a taxable connection, often referred to as a "permanent establishment" under international tax treaties, and such an assertion, if successful, could increase our expected tax liability in one or more jurisdictions.

We do not intend to pay dividends on our common stock, and therefore any returns will be limited to the value of our stock.

We have never declared or paid any cash dividends on our common stock. We anticipate that we will retain future earnings for the development, operation and expansion of our business and do not anticipate declaring or paying any cash dividends for the foreseeable future. Any return to stockholders will therefore be limited to the appreciation of their stock.

In addition, future debt instruments may materially restrict our ability to pay dividends on our common stock. Any future determination related to dividend policy will be made at the discretion of our board of directors and will depend upon, among other factors, our results of operations, financial condition, capital requirements, tax considerations, legal or contractual restrictions, business prospects, the requirements of current or then-existing debt instruments, general economic conditions and other factors our board of directors may deem relevant.

Provisions in our amended and restated certificate of incorporation and amended and restated bylaws, as well as provisions of Delaware law, could make it more difficult for a third party to remove our current management, acquire us or increase the cost of acquiring us, even if doing so would benefit our stockholders.

Our amended and restated certificate of incorporation, amended and restated bylaws and Delaware law contain provisions that may have the effect of delaying or preventing a change in control of us or changes in our management. Our amended and restated certificate of incorporation and amended and restated bylaws include provisions that:

- authorize “blank check” preferred stock, which could be issued by our board of directors without stockholder approval and may contain voting, liquidation, dividend and other rights superior to our common stock;
- create a classified board of directors whose members serve staggered three-year terms;
- specify that special meetings of our stockholders can be called only by our board of directors, the chairperson of our board of directors, our chief executive officer or our president;
- prohibit stockholder action by written consent;
- establish an advance notice procedure for stockholder approvals to be brought before an annual meeting of our stockholders, including proposed nominations of persons for election to our board of directors;
- provide that our directors may be removed only for cause;
- provide that vacancies on our board of directors may be filled only by a majority of directors then in office, even though less than a quorum;
- specify that no stockholder is permitted to cumulate votes at any election of directors;
- expressly authorize our board of directors to modify, alter or repeal our amended and restated bylaws; and
- require supermajority votes of the holders of our common stock to amend specified provisions of our amended and restated certificate of incorporation and amended and restated bylaws.

These provisions, alone or together, could delay or prevent hostile takeovers and changes in control or changes in our management.

In addition, because we are incorporated in Delaware, we are governed by the provisions of Section 203 of the Delaware General Corporation Law, which limits the ability of stockholders owning in excess of 15% of our outstanding voting stock to merge or combine with us.

Any provision of our amended and restated certificate of incorporation or amended and restated bylaws or Delaware law that has the effect of delaying or deterring a change in control could limit the opportunity for our stockholders to receive a premium for their shares of our common stock, and could also affect the price that some investors are willing to pay for our common stock.

Our amended and restated bylaws provide that the Court of Chancery of the State of Delaware is the exclusive forum for certain disputes between us and our stockholders, which could limit our stockholders’ ability to obtain a favorable judicial forum for disputes with us or our directors, officers or employees.

Our amended and restated bylaws provide that the Court of Chancery of the State of Delaware will 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 employees to our company or our stockholders, (iii) any action asserting a claim against our company arising pursuant to any provision of the Delaware General Corporation Law or our amended and restated certificate of incorporation or bylaws, or (iv) any action asserting a claim against our company governed by the internal affairs doctrine. This choice

of forum provision does not apply to suits brought to enforce a duty or liability created by the Securities Act or the Exchange Act, or any other claim for which the federal courts have exclusive jurisdiction.

This choice of forum provision may limit a stockholder's ability to bring certain claims in a judicial forum that it finds favorable for disputes with us or any of our directors, officers, other employees or stockholders, which may discourage lawsuits with respect to such claims, although our stockholders will not be deemed to have waived our compliance with federal securities laws and the rules and regulations thereunder. If a court were to find this choice of forum provision to be inapplicable or unenforceable in an action, we may incur additional costs associated with resolving such action in other jurisdictions, which could adversely affect our business and financial condition.

General Risk Factors

If we fail to comply with environmental, health and safety laws and regulations, we could become subject to fines or penalties or incur costs that could have a material adverse effect on the success of our business.

We are subject to numerous environmental, health and safety laws and regulations, including those governing laboratory procedures and the handling, use, storage, treatment and disposal of hazardous materials and wastes. Our operations involve the use of hazardous and flammable materials, including chemicals and biological materials. Our operations also produce hazardous waste products. We generally contract with third parties for the disposal of these materials and wastes. We cannot eliminate the risk of contamination or injury from these materials. In the event of contamination or injury resulting from our use of hazardous materials, we could be held liable for any resulting damages, and any liability could exceed our resources. We also could incur significant costs associated with civil or criminal fines and penalties.

Although we maintain workers' compensation insurance to cover us for costs and expenses we may incur due to injuries to our employees resulting from the use of hazardous materials or other work-related injuries, this insurance may not provide adequate coverage against potential liabilities. In addition, we may incur substantial costs in order to comply with current or future environmental, health and safety laws and regulations. These current or future laws and regulations may impair our research, development or production efforts. Failure to comply with these laws and regulations also may result in substantial fines, penalties or other sanctions.

If our information technology systems or data, or those maintained on our behalf, are or were compromised, this could result in a Material Adverse Impact.

In the ordinary course of our business, we and the third-parties upon which we rely Process (as defined above) proprietary, confidential and sensitive information, including personal data (including key-coded data, health information and other special categories of personal data), intellectual property, trade secrets, and proprietary business information owned or controlled by ourselves or other third parties (collectively, Sensitive Information).

We and our third-party service providers utilize information technology systems to process Sensitive Information in connection with our business activities, and we face a variety of evolving threats that could cause security incidents.

Cyber-attacks, malicious internet-based activity, online and offline fraud, and other similar activities threaten the confidentiality, integrity and availability of our Sensitive Information and information technology systems, and those of the third parties upon which we rely. Such threats are prevalent, continue to rise, are increasingly difficult to detect and come from a variety of sources, including traditional computer "hackers," threat actors, "hacktivists," organized criminal threat actors, personnel (such as through theft or misuse), sophisticated nation states, and nation state supported actors. Some actors now engage and are expected to continue to engage in cyber-attacks, including without limitation nation state actors for geopolitical reasons and in conjunction with military conflicts and defense activities. During times of war and other major conflicts, we and the third parties upon which we rely may be vulnerable to a heightened risk of these attacks, including retaliatory cyber-attacks, that could materially disrupt our systems and operations, supply chain, and ability to produce, sell and distribute our goods and services.

We and the third parties upon which we rely are subject to a variety of evolving threats, including but not limited to software bugs; malicious code (such as viruses and worms); denial-of-service attacks (such as credential stuffing); credential harvesting; advanced persistent threat intrusions; natural disasters; terrorism; war; telecommunication and electrical failures; ransomware attacks; social-engineering attacks (including through phishing attacks); server malfunction; software or hardware failures; supply-chain attacks; loss of data or other computer assets; and other similar issues. Particularly, severe ransomware attacks are becoming increasingly prevalent and can lead to significant interruptions, delays, or outages in our operations, disruption of clinical trials, loss of data (including data related to clinical trials), and other Material Adverse Impacts. To alleviate the financial, operational and reputational impact of a ransomware attack, it may be preferable to make extortion payments, but we may be unwilling or unable to do so (including, for example, if applicable laws or regulations prohibit such payments).

Additionally, remote work has become more common and has increased the risk to our information technology assets and data, as more of our employees utilize network connections, computers and devices outside of our premises and networks, including working

at home, while in transit and public locations. Additionally, future or past business transactions could expose us to additional risks and vulnerabilities, as our systems could be negatively affected by vulnerabilities present in acquired or integrated entities' systems and technologies. Furthermore, we may discover security issues that were not found during due diligence of such acquired or integrated entities, and it may be difficult to integrate companies into our information technology environment and security program.

We use third-party service providers and subprocessors to help us operate our business and engage in Processing on our behalf or otherwise share Sensitive Information with our partners or other third parties in conjunction with our business. These third party service providers and technologies operate critical business systems to Process Sensitive Information in a variety of contexts, including, without limitation, cloud-based infrastructure, data center facilities, encryption and authentication technology, employee email, and other functions. Our ability to monitor these third parties' information security practices is limited, and these third parties may not have adequate information security measures in place. If our third-party service providers experience a security incident or other interruption, we could experience Material Adverse Impacts. While we may be entitled to damages if our third-party service providers fail to satisfy their privacy or security-related obligations to us, any award may be insufficient to cover our damages, or we may be unable to recover such award. Similarly, supply chain attacks have increased in frequency and severity, and we cannot guarantee that third parties' infrastructure in our supply chain or our third-party partners' supply chains have not been compromised.

Any of the previously identified or similar threats could cause a security incident or other interruption that could result in unauthorized, unlawful, or accidental acquisition, modification, destruction, loss, alteration, encryption, disclosure of, or access to our Sensitive Information or our information technology systems, or those of the third parties upon whom we rely. A security incident or other interruption could disrupt our ability (and that of third parties upon whom we rely) to provide our services.

We may expend significant resources, fundamentally change our business activities and practices, or modify our operations, including our clinical trial activities, or information technology in an effort to protect against security incidents and to mitigate, detect, and remediate actual and potential vulnerabilities. Applicable Data Protection Requirements (as defined above) may require us to implement specific security measures or use industry-standard or reasonable measures to protect against security incidents.

While we have implemented security measures designed to protect against security incidents, there can be no assurance that we, or any third-party partner, will be successful in preventing a security incident or mitigating their effects. We take steps to detect and remediate vulnerabilities in our information technology systems, but we may not be able to detect and remediate all vulnerabilities because the threats and techniques used to exploit the vulnerability change frequently and are often sophisticated in nature. Therefore, such vulnerabilities could be exploited but may not be detected until after a security incident has occurred. These vulnerabilities pose material risk to our business. Further, we may experience delays in developing and deploying remedial measures designed to address any such identified vulnerabilities.

Furthermore, applicable Data Protection Requirements may require us to notify relevant stakeholders of security breaches. Such disclosures are costly, and the disclosures or the failure to comply with such requirements could lead to Material Adverse Impacts.

If we, our service providers, partners or other relevant third parties have experienced or in the future experience any security incident(s), it may result in a Material Adverse Impact (as defined above). For example, the loss of data from completed clinical trials for our product candidates could result in delays in our regulatory approval efforts and significantly increase our costs. Theft of our Sensitive Information could require substantial expenditures to remedy. If we or the third parties upon which we rely experience a security incident, we could suffer reputational harm or face litigation or adverse regulatory action, fines, other penalties, business interruption, and diversion of funds. As a result, we could experience Material Adverse Impacts.

Our contracts may not contain limitations of liability, and even where they do, there can be no assurance that limitations of liability in our contracts are sufficient to protect us from liabilities, damages, or claims related to our data privacy and security obligations. Furthermore, we cannot be sure that our insurance coverage, will be adequate or otherwise protect us from or adequately mitigate liabilities or damages with respect to claims, costs, expenses, litigation, fines, penalties, business loss, data loss, regulatory actions or Material Adverse Impacts arising out of our Processing operations, privacy and security practices, or security breaches we may experience. The successful assertion of one or more large claims against us that exceeds our available insurance coverage, or results in changes to our insurance policies (including premium increases or the imposition of large excess or deductible or co-insurance requirements), could have a Material Adverse Impact.

In addition to experiencing a security incident, third parties may gather, collect, or infer sensitive information about us from public sources, data brokers, or other means that reveals competitively sensitive details about our organization and could be used to undermine our competitive advantage or market position.

We are subject to anti-corruption laws in the jurisdictions in which we operate.

We are subject to a number of anti-corruption laws, including the Foreign Corrupt Practices Act of 1977, as amended (FCPA), and various other anti-corruption laws. The FCPA generally prohibits companies and their intermediaries from making improper payments to foreign officials for the purpose of obtaining or keeping business and/or other benefits. Our business relies on approvals and licenses from government and regulatory entities, and as a result, we are subject to certain elevated risks associated with interactions with these entities. Although we have adopted a code of business conduct and ethics that includes provisions governing the interactions of employees with government entities to mitigate these risks, there can be no assurance that this will be successful in preventing violations of anti-corruption laws. If we are not in compliance with anti-corruption laws and other laws governing the conduct of business with government entities (including local laws), we may be subject to criminal and civil penalties and other remedial measures, which could harm our reputation and have a material adverse effect on our business, financial condition, results of operations and prospects. Any investigation of any actual or alleged violations of such laws could also harm our reputation or have an adverse impact on our business, prospects, financial condition and results of operations.

We have incurred and will continue to incur significant costs as a result of operating as a public company, and our management will be required to devote substantial time to new compliance initiatives.

As a public company, we have incurred and will continue to incur legal, accounting and other expenses. In addition, the Sarbanes-Oxley Act of 2002 as well as rules subsequently implemented by the SEC and The Nasdaq Stock Market have imposed various requirements on public companies. In July 2010, the Dodd-Frank Wall Street Reform and Consumer Protection Act (the Dodd-Frank Act) was enacted. There are significant corporate governance and executive compensation related provisions in the Dodd-Frank Act that require the SEC to adopt additional rules and regulations in these areas such as “say on pay” and proxy access. Stockholder activism, the current political environment and the current high level of government intervention and regulatory reform may lead to substantial new regulations and disclosure obligations, which may lead to additional compliance costs and impact the manner in which we operate our business in ways we cannot currently anticipate. Our management and other personnel will need to devote a substantial amount of time to these compliance initiatives. Moreover, these rules and regulations will increase our legal and financial compliance costs and will make some activities more time-consuming and costly. For example, we expect these rules and regulations to make it more difficult and more expensive for us to maintain director and officer liability insurance and we have been required to incur substantial costs to maintain our current levels of such coverage.

If securities analysts do not publish research or reports about our business or if they publish negative evaluations of our stock, the price of our stock could decline.

The trading market for our common stock relies in part on the research and reports that industry or financial analysts publish about us or our business. If no or few analysts commence coverage or continue coverage of us, the trading price of our stock would likely decrease. If one or more of the analysts covering our business downgrade their evaluations of our stock, the price of our stock could decline. If one or more of these analysts cease to cover our stock, we could lose visibility in the market for our stock, which in turn could cause our stock price to decline.

We could be subject to securities class action litigation.

In the past, securities class action litigation has often been brought against companies following a decline in the market price of their securities. This risk is especially relevant for us because pharmaceutical companies have experienced significant stock price volatility. If we face such litigation, it could result in substantial costs and a diversion of management’s attention and resources, which could harm our business and cause our stock price to decline.

We have broad discretion in the use of our cash, cash equivalents, restricted cash and available-for-sale investments and are exposed to risks related to the marketable securities we may purchase.

We have considerable discretion in the application of our existing cash, cash equivalents, restricted cash and available-for-sale investments. We expect to use our existing cash to fund research and development activities and for working capital and general corporate purposes, including funding the costs of operating as a public company. In addition, pending their use, we may invest our existing cash in certain short-term investments, including but not limited to investment-grade, interest-bearing securities. Historically, investment in these securities has been highly liquid and has experienced only very limited defaults. However, volatility in the financial markets in recent years has created additional uncertainty regarding the liquidity and safety of these investments. Additionally, we may use this cash, cash equivalents, restricted cash and available-for-sale investments for purposes that do not yield a significant return or any return at all for our stockholders.

Item 1B. Unresolved Staff Comments.

Not applicable.

Item 2. Properties.

We leased our prior headquarters located at 3545 John Hopkins Court, Suite #250, San Diego, California pursuant to a lease agreement that expires on May 15, 2023. The lease covers 20,508 rentable square feet of office and laboratory space.

In May 2022, we entered into a lease (the Lease) with San Diego Creekside, LLC (Landlord), as lessor, pursuant to which we agreed to lease from Landlord approximately 23,696 rentable square feet (subject to increase pursuant to the terms of the Lease) of office and laboratory space located at 10240 Sorrento Valley Road, Suite #300, San Diego, California. This facility serves as our new corporate headquarters. We believe that this facility is sufficient to meet our needs and that suitable additional space will be available as and when needed.

Item 3. Legal Proceedings.

We are not a party to any material legal proceedings at this time. From time to time, we may be subject to various legal proceedings and claims that arise in the ordinary course of our business activities. Although the results of litigation and claims cannot be predicted with certainty, we do not believe we are party to any claim or litigation the outcome of which, if determined adversely to us, would individually or in the aggregate be reasonably expected to have a material adverse effect on our results of operations or financial condition. Regardless of the outcome, litigation can have an adverse effect on us because of defense and settlement costs, diversion of management resources and other factors.

Item 4. Mine Safety Disclosures.

Not applicable.

PART II

Item 5. Market for Registrant’s Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities.

Market Information

Our common stock is traded on the Nasdaq Capital Market under the symbol “LIFE.”

Holders of Record

As of March 10, 2023, there were approximately 31 holders of record of our common stock. The approximate number of holders is based upon the actual number of holders registered in our records at such date and excludes holders in “street name” or persons, partnerships, associations, corporations, or other entities identified in security positions listings maintained by depository trust companies.

Dividend Policy

We have never declared or paid any cash dividends on our common stock. We currently intend to retain all available funds and any future earnings to support our operations and finance the growth and development of our business. We do not intend to pay cash dividends on our common stock for the foreseeable future. Any future determination related to our dividend policy will be made at the discretion of our board of directors and will depend upon, among other factors, our results of operations, financial condition, capital requirements, tax considerations, legal or contractual restrictions, business prospects, the requirements of current or then-existing debt instruments, general economic conditions and other factors our board of directors may deem relevant.

Securities Authorized for Issuance Under Equity Compensation Plans

Information about our equity compensation plans is incorporated herein by reference to Part III, Item 12, under the section entitled “Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters.”

Recent Sales of Unregistered Securities

During the year ended December 31, 2022, we did not issue or sell any unregistered securities not previously disclosed in a Quarterly Report on Form 10-Q or in a Current Report on Form 8-K.

Issuer Purchases of Equity Securities

We did not repurchase any securities during the three months ended December 31, 2022.

Item 6. [Reserved]

Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations.

You should read the following discussion and analysis together with the consolidated financial statements and related notes included elsewhere in this Annual Report on Form 10-K (Annual Report). The following discussion contains forward-looking statements that involve risks and uncertainties. Our actual results could differ materially from those expressed or implied in any forward-looking statements as a result of various factors, including those set forth under the caption "Part I, Item 1A. Risk Factors."

Overview

We are a biotherapeutics company engaged in the discovery and development of first-in-class medicines from our proprietary tRNA synthetase platform. We have concentrated our research and development efforts on a newly discovered area of biology, the extracellular functionality and signaling pathways of tRNA synthetases. Built on more than a decade of foundational science on extracellular tRNA synthetase biology and its effect on immune responses, we have built a global intellectual property estate directed to a potential pipeline of protein compositions derived from 20 tRNA synthetase genes and their extracellular targets, such as neuropilin-2 (NRP2).

Efzofitimod

Our primary focus is efzofitimod, a clinical-stage product candidate which targets NRP2 to resolve chronic inflammation that can lead to fibrosis. Efzofitimod has a novel mechanism of action for potentially treating lung inflammation and fibrosis. We believe by targeting NRP2 on myeloid cells during active inflammation, efzofitimod works upstream of currently available immunomodulators to restore immune homeostasis, thereby resolving chronic inflammation and preventing the progression of fibrosis. We are developing efzofitimod as a potential disease-modifying therapy for patients with interstitial lung disease (ILD). ILDs are predominantly immune-mediated disorders that are characterized by chronic inflammation, which can lead to progressive fibrosis of the lung. There are limited treatment options for ILD and there remains a high unmet medical need. Sarcoidosis and systemic sclerosis (SSc, also known as scleroderma)-associated ILD (SSc-ILD) are two major forms of ILD. During 2022, the U.S. Food and Drug Administration (FDA) granted efzofitimod orphan drug designations for the treatment of sarcoidosis and for the treatment of SSc, and Fast Track designations for the treatment of pulmonary sarcoidosis and for the treatment of SSc-ILD. In January 2023, the European Commission granted efzofitimod an orphan drug designation for the treatment of sarcoidosis based on the opinion of the European Medicines Agency (EMA) Committee for Orphan Medicinal Products (COMP).

In September 2021, we announced positive results and clinical proof-of-concept from a double-blind, placebo-controlled Phase 1b/2a clinical trial in 37 patients with pulmonary sarcoidosis. The study was designed to evaluate the safety, tolerability, immunogenicity and preliminary efficacy of three doses of efzofitimod, 1.0, 3.0 and 5.0 mg/kg, in the context of a forced steroid taper. Efzofitimod was safe and well-tolerated at all doses administered with no serious drug-related adverse events or signal of immunogenicity. Additionally, the study demonstrated consistent dose response for efzofitimod on key efficacy endpoints and improvements compared to placebo, including measures of steroid reduction, lung function, pulmonary sarcoidosis symptom measures and inflammatory biomarkers. These data were subsequently presented at the American Thoracic Society (ATS) International Conference and published in the peer-reviewed journal *CHEST* during 2022.

In February 2022, we met with the FDA in an end-of-Phase 2 meeting to discuss our plans for subsequent clinical development and path to registration for efzofitimod for pulmonary sarcoidosis. Subsequently, we initiated a global pivotal Phase 3 randomized, double-blind, placebo-controlled clinical trial to evaluate the efficacy and safety of efzofitimod in patients with pulmonary sarcoidosis (the EFZO-FIT study). The EFZO-FIT study is a 52-week study consisting of three parallel cohorts randomized equally to either 3.0 mg/kg or 5.0 mg/kg of efzofitimod or placebo dosed intravenously once a month for a total of 12 doses. The study is currently enrolling and intends to enroll 264 subjects with pulmonary sarcoidosis at multiple centers in the United States, Europe and Japan. The trial design incorporates a forced steroid taper. The primary endpoint of the study is steroid reduction. Secondary endpoints include measures of lung function and sarcoidosis symptoms. In September 2022, we dosed the first patient in this study.

Based on the results of the Phase 1b/2a clinical trial, we believe efzofitimod has potential applications in the treatment of other ILDs, such as chronic hypersensitivity pneumonitis (CHP) and connective tissue disease related ILD (CTD-ILD), including SSc-ILD and rheumatoid arthritis-associated ILD. As such, we designed a focused Phase 2 proof-of-concept study of efzofitimod in patients with SSc-ILD and we have received FDA clearance for this study. In February 2023, we announced that we plan to initiate this Phase 2 study of efzofitimod in patients with SSc-ILD in 2023. This planned Phase 2 study is expected to be a randomized, double-blind placebo-controlled proof-of-concept study to evaluate the efficacy, safety and tolerability of efzofitimod in patients with SSc-ILD. This is expected to be a 28-week study with three parallel cohorts randomized 2:2:1 to either 270 mg or 450 mg of efzofitimod or placebo dosed intravenously monthly for a total of six doses. It is expected the study will enroll 25 patients at multiple centers in the United States. The primary objective of the study will be to evaluate the efficacy of multiple doses of intravenous (IV) efzofitimod on pulmonary, cutaneous and systemic manifestations in patients with SSc-ILD. Secondary objectives will include safety and tolerability.

In January 2020, we entered into a collaboration and license agreement (Kyorin Agreement) with Kyorin Pharmaceutical Co., Ltd. (Kyorin) for the development and commercialization of efzofitimod for the treatment of ILD in Japan. Under the Kyorin Agreement,

Kyorin received an exclusive right to develop and commercialize efzofitmod in Japan for all forms of ILD, and is obligated to fund all research, development, regulatory, marketing and commercialization activities in Japan. In September 2020, Kyorin began dosing patients in a Phase 1 clinical trial of efzofitmod (known as KRP-R120 in Japan) and completed the last subject visit in December 2020. The Phase 1 clinical trial, which was conducted and funded by Kyorin, was a placebo-controlled clinical trial to evaluate the safety, pharmacokinetics (PK) and immunogenicity of efzofitmod in 32 healthy Japanese male volunteers. Efzofitmod was observed to be generally well-tolerated with no drug-related serious adverse events, and PK findings were consistent with previous studies of efzofitmod. Kyorin is also participating in the EFZO-FIT study as the local sponsor in Japan. In February 2023, Kyorin dosed the first patient in Japan in the EFZO-FIT study which triggered a \$10.0 million milestone payment to us. To date, the Kyorin Agreement has generated \$20.0 million in upfront and milestone payments to us and we are eligible to receive up to an additional \$155.0 million in the aggregate upon achievement of certain development, regulatory and sales milestones, as well as tiered royalties on any net sales in Japan.

Discovery Pipeline

Extracellular tRNA synthetase biology represents a novel set of potential physiological modulators and therapeutic targets.

Using efzofitmod as a model, we have developed a process to advance novel tRNA synthetase domains from a concept to therapeutic candidate. This process leverages our early discovery work as well as current scientific understanding of tRNA synthetase evolution, protein structure, gene splicing and tissue-specific regulation to identify potentially active protein domains. Screening approaches are employed to identify target cells and extracellular receptors for these tRNA synthetase-derived proteins. These cellular systems can then be used in mechanism-of-action studies to elucidate the role these proteins play in cellular responses and their potential therapeutic utility. We are working to identify new tRNA synthetase based drug candidates through our internal discovery efforts and industry and academic collaborations, including our collaboration with Dualsystems Biotech AG (Dualsystems). Dualsystems has agreed to utilize their proprietary receptor screening technology and research expertise to attempt to identify and validate new target receptors for tRNA synthetases. Through our internal research efforts, the Dualsystems collaboration and other industry and academic collaborators, we intend to continue to advance our product development efforts within our tRNA synthetase biology platform.

We have also advanced our preclinical pipeline of NRP2 targeting antibody candidates through internal research efforts and academic collaborations. ATYR2810 is a product candidate from our NRP2 antibody program that we believe is ready to enter clinical trials. In the third quarter of 2022, we announced that we intend to focus our resources on the efzofitmod program. Therefore, we have made the strategic decision not to use internal resources to initiate a Phase 1 study of ATYR2810 at this time. We intend to pursue alternative avenues to advance this program.

Impact of the COVID-19 Pandemic and Other Geopolitical and Macroeconomic Conditions

The impacts of the COVID-19 pandemic on our business have included the delay in enrollment of our now completed Phase 1b/2a clinical trial in patients with pulmonary sarcoidosis and the discontinuation of some patients in that trial, temporary closures of portions of our facilities and those of our licensees and collaborators, disruptions or restrictions on our employees' ability to travel and delays in certain research and development activities. Other potential impacts to our business include, but are not limited to, disruptions to or delays in other clinical trials, third-party manufacturing supply and other operations, the potential diversion of healthcare resources away from the conduct of clinical trials to focus on pandemic concerns, interruptions or delays in the operations of the FDA or other regulatory authorities, and our ability to raise capital and conduct business development activities.

In February 2022, the U.S. and global financial markets experienced volatility following the invasion of Ukraine by Russia, which has led to disruptions to trade, commerce, pricing stability, credit availability and supply chain continuity globally. In response to the invasion, the United States, United Kingdom and European Union (EU), along with others, imposed significant new sanctions and export controls against Russia, Russian banks and certain Russian individuals and may implement additional sanctions or take further punitive actions in the future. The full economic and social impact of the sanctions imposed on Russia (as well as possible future punitive measures that may be implemented), as well as the counter measures imposed by Russia, in addition to the ongoing Ukraine-Russia conflict, which could conceivably expand into the surrounding region, remains uncertain; however, both the conflict and related sanctions have resulted and could continue to result in disruptions to trade, commerce, pricing stability, credit availability and supply chain continuity in both Europe and globally, and has introduced significant uncertainty into global markets. As a result, our business and results of operations may be adversely affected by the ongoing Ukraine-Russia conflict, particularly to the extent it escalates to involve additional countries, further economic sanctions or wider military conflict.

In addition to the COVID-19 pandemic and the ongoing Ukraine-Russia conflict, global economic and business activities continue to face widespread macroeconomic uncertainties, including labor shortages, inflation and monetary supply shifts, and recession risks, which has resulted in further volatility in the U.S. and global financial markets and which has led to, and may continue to lead to, additional disruptions to trade, commerce, pricing stability, credit availability and supply chain continuity globally. The ultimate long-term impact of the COVID-19 pandemic, the ongoing Ukraine-Russia conflict and other evolving geopolitical and macroeconomic conditions on our business is uncertain, although we continue to actively monitor the impact of these factors on our results of operations, financial condition and cash flows. The extent of the impact of these factors on our operational and financial performance, including our

ability to execute our business strategies and initiatives in the expected timeframe, will depend on future developments, which are uncertain and cannot be predicted; however, any continued or renewed disruption resulting from these factors could negatively impact our business.

Liquidity and Capital Resources

We have incurred losses and negative cash flows from operations since our inception. As of December 31, 2022, we had an accumulated deficit of \$417.6 million, and we expect to continue to incur net losses for the foreseeable future. As of December 31, 2022, we had cash, cash equivalents, restricted cash and available-for-sale investments of \$69.3 million. Additionally, in February 2023, we completed an underwritten follow-on public offering of 23,125,000 shares of our common stock, including the partial exercise of the underwriters' option to purchase additional shares, at a price to the public of \$2.25 per share. The total gross proceeds from the offering were approximately \$52.0 million, before deducting underwriting discounts, commissions and offering expenses payable by us. We also received a \$10.0 million milestone payment from the Kyorin Agreement in February 2023. Additionally, in April 2022, we entered into an Open Market Sale AgreementSM with Jefferies LLC (Jefferies) implementing an "at-the-market" offering program (the Jefferies ATM Offering Program), pursuant to which we may offer and sell, from time to time and at our option, up to an aggregate of \$65.0 million of shares of our common stock through Jefferies, acting as sales agent. Jefferies is entitled to a fixed commission rate of up to 3.0% of the gross sales proceeds of shares sold under the Jefferies ATM Offering Program. During the year ended December 31, 2022, we sold an aggregate of 1,421,627 shares of common stock at a weighted-average price of \$3.09 per share for net proceeds of approximately \$4.0 million under the Jefferies ATM Offering Program. We believe that our current cash, cash equivalents, restricted cash and available-for-sale investments, will be sufficient to meet our material cash requirements from known contractual and other obligations for a period of at least one year from the date of this Annual Report. We believe we will meet longer-term material cash requirements from known contractual and other obligations through a combination of cash, cash equivalents, restricted cash and available-for-sale investments. In addition to the factors discussed under "Material Cash Requirements," our ability to fund our longer-term operating needs beyond the next 12 months will depend on our ability to raise additional funding through equity or debt offerings, grant funding, collaborations, strategic partnerships and/or licensing arrangements, and other factors, including those discussed in Part I, Item 1A. "Risk Factors—Risks related to our financial condition and need for additional capital—We will need to raise additional capital or enter into strategic partnering relationships to fund our operations."

Sources of Cash

From our inception through December 31, 2022, we have financed our operations primarily through the sale of equity securities and convertible debt, venture debt, term loans and through license and collaboration agreement revenues.

Public Offerings

In February 2023, we completed an underwritten follow-on public offering of 23,125,000 shares of our common stock, including the partial exercise of the underwriters' option to purchase additional shares, at a price to the public of \$2.25 per share. The total gross proceeds from the offering were approximately \$52.0 million, before deducting underwriting discounts, commissions and offering expenses payable by us.

In September 2021, we completed an underwritten follow-on public offering of 10,781,250 shares of our common stock, including the full exercise of the underwriters' option to purchase additional shares, at a price to the public of \$8.00 per share. The total net proceeds from the offering were approximately \$80.6 million, after deducting underwriting discounts, commissions and offering expenses payable by us.

In February 2020, we completed an underwritten follow-on public offering of 4,235,294 shares of our common stock at a price to the public of \$4.25 per share. In March 2020, the underwriters fully exercised their option to purchase additional shares resulting in the issuance of an additional 635,294 shares of common stock. The total net proceeds from the offering were approximately \$18.8 million, after deducting underwriting discounts, commissions and offering expenses payable by us.

At-the-Market Offering Programs

In April 2022, we entered into an Open Market Sale AgreementSM with Jefferies implementing the Jefferies ATM Offering Program, pursuant to which we may offer and sell, from time to time and at our option, up to an aggregate of \$65.0 million of shares of our common stock through Jefferies, acting as sales agent. Jefferies is entitled to a fixed commission rate of up to 3.0% of the gross sales proceeds of shares sold under the Jefferies ATM Offering Program. During the year ended December 31, 2022, we sold an aggregate of 1,421,627 shares of common stock at a weighted-average price of \$3.09 per share for net proceeds of approximately \$4.0 million under the Jefferies ATM Offering Program.

In March 2021, we entered into a Capital on DemandTM Sales Agreement with JonesTrading Institutional Services LLC (JonesTrading) for an "at-the-market" offering program (the JonesTrading ATM Offering Program), pursuant to which we were entitled to sell from time to time, at our option, up to an aggregate of \$25.0 million of shares of our common stock through JonesTrading, as

sales agent or principal. JonesTrading was entitled to a commission at a fixed rate of up to 3.0% of the gross proceeds. During 2021, we sold an aggregate of 986,267 shares of common stock at a weighted-average price of \$4.75 per share for net proceeds of \$4.4 million under the JonesTrading ATM Offering Program. In April 2022, we terminated the JonesTrading ATM Offering Program. During 2022 and prior to termination, we sold an aggregate of 260,455 shares of common stock at a weighted-average price of \$6.07 per share for net proceeds of approximately \$1.5 million under the JonesTrading ATM Offering Program.

In May 2019, we entered into a sales agreement with H.C. Wainwright & Co., LLC (Wainwright) for an “at-the-market” offering program (the Wainwright ATM Offering Program) under which we could offer and sell shares of our common stock having an aggregate offering price of up to \$10.0 million. In November 2020, we amended our sales agreement with Wainwright to increase the amount of the ATM Offering Program to \$20.0 million. Wainwright was entitled to a commission at a fixed commission rate equal to 3% of the gross proceeds. In March 2021, the Wainwright ATM Offering Program with Wainwright automatically terminated upon the issuance and sale of all of the shares having an aggregate offering price of \$20.0 million. Under the Wainwright ATM Offering Program, during 2020, we sold an aggregate of 1,657,075 shares of common stock at an average price of \$4.07 per share for net proceeds of \$6.4 million. Prior to the termination of the sales agreement with Wainwright, in 2021, we sold an aggregate of 1,988,254 shares of common stock at an average price of \$4.99 per share for net proceeds of \$9.6 million.

Purchase Agreement

In September 2020, we entered into a common stock purchase agreement (the Purchase Agreement) with Aspire Capital Fund, LLC (Aspire Capital), which provides that, upon the terms and subject to the conditions and limitations set forth therein, Aspire Capital is committed to purchase up to an aggregate of \$20.0 million of shares of our common stock at our request from time to time during the 30 month term of the Purchase Agreement. Concurrently with entering into the Purchase Agreement, we also entered into a registration rights agreement with Aspire Capital, in which we agreed to file one or more registration statements, as permissible and necessary to register under the Securities Act for the resale of the shares of our common stock that have been and may be issued to Aspire Capital under the Purchase Agreement. During 2021, we sold an aggregate of 3,000,000 shares of common stock at a weighted-average price of \$5.09 per share for net proceeds of \$15.2 million under the Purchase Agreement. During the year ended December 31, 2022, there were no issuances or sales under the Purchase Agreement, and this agreement terminated effective March 11, 2023.

Kyorin Agreement Milestone Payments

On February 6, 2023, we announced that our partner Kyorin dosed the first patient in Japan in the EFZO-FIT study, which triggered a \$10.0 million milestone payment by Kyorin to us pursuant to the Kyorin Agreement. We recorded this \$10.0 million milestone as revenue in the year ended December 31, 2022 and received the cash in February 2023. Kyorin is our partner for the development and commercialization of efzofitmod for ILD in Japan. Under the Kyorin Agreement, we have generated \$20.0 million in upfront and milestone payments to date and are eligible to receive up to an additional \$155.0 million in the aggregate upon the achievement of certain development, regulatory and sales milestones, as well as tiered royalties on any net sales in Japan. Kyorin has the exclusive rights to develop and commercialize efzofitmod in Japan for all forms of ILD.

Cash Flows

The following table sets forth a summary of the net cash flow activity for each of the periods indicated (in thousands):

	Years Ended December 31,		
	2022	2021	2020
Net cash provided by (used in):			
Operating activities	\$ (41,886)	\$ (33,075)	\$ (15,301)
Investing activities	47,245	(91,566)	6,900
Financing activities	5,451	110,025	16,143
Net change in cash, cash equivalents and restricted cash	<u>\$ 10,810</u>	<u>\$ (14,616)</u>	<u>\$ 7,742</u>

Operating activities. Net cash used in operating activities was \$41.9 million, \$33.1 million and \$15.3 million for the years ended December 31, 2022, 2021 and 2020, respectively. The net cash used in operating activities in each of these periods was primarily due to cash used for our research and development expenses. The increase in net cash used in each period is primarily due to the advancement of efzofitmod into later stage clinical trials and additional manufacturing campaigns to support those trials and potential future trials.

Investing activities. Net cash provided by (used in) investing activities for the years ended December 31, 2022, 2021 and 2020 was \$47.2 million, \$(91.6) million and \$6.9 million, respectively. The fluctuation in net cash provided by or used in investing activities resulted primarily from the timing differences in investment purchases, sales and maturities, and the fluctuation of our portfolio mix between cash equivalents and investment holdings. The average term to maturity in our investment portfolio as of December 31, 2022 was less than two years. Net cash used for December 31, 2022 included \$1.6 million purchases of property and equipment primarily for tenant improvements associated with our new corporate headquarters facility lease.

Financing activities. Net cash provided by financing activities for the year ended December 31, 2022 was \$5.5 million, primarily due to cash provided by ATM offering programs, net of issuance costs. Net cash provided by financing activities for the year ended December 31, 2021 was \$110.0 million and consisted primarily of \$80.6 million in proceeds from an underwritten follow-on public offering, net of offering costs, \$15.2 million in proceeds from the issuance of common stock through the Purchase Agreement, net of offering costs, and \$14.1 million proceeds from our ATM offering programs, net of issuance costs. Net cash provided by financing activities for the year ended December 31, 2020 was \$16.1 million and consisted primarily of \$18.8 million in proceeds from an underwritten follow-on public offering, net of offering costs, and \$6.4 million proceeds from our ATM offering programs, net of issuance costs, offset in part by \$9.1 million of principal payments and final payment on term loans.

Material Cash Requirements

To date, we have not generated any revenues from product sales. We expect our expenses to increase in connection with our ongoing activities, particularly as we continue to advance efzofitimid in clinical development, manufacturing and technology transfer activities, continue our research and development activities with respect to other potential therapies based on tRNA synthetase biology and NRP2 biology, and seek marketing approval for product candidates that we may develop. In addition, if we obtain marketing approval for any of our product candidates, we expect to incur significant commercialization expenses related to product sales, marketing, manufacturing and distribution. We currently have no sales or marketing capabilities and would need to expand our organization to support these activities. Accordingly, we will need to obtain substantial additional funding in connection with our continuing operations. Our forecast of the period of time through which our financial resources will be adequate to support our operations is a forward-looking statement that involves risks and uncertainties, and actual results could vary materially.

Our future capital requirements are difficult to forecast and will depend on many factors, including:

- the type, number, scope progress, expansions, results, costs and timing of, our clinical trials and preclinical studies for our product candidates or other potential product candidates or indications which we are pursuing or may choose to pursue in the future, including changes in our CROs;
- the costs, timing and outcome of regulatory review of our product candidates;
- potential delays of our planned clinical trials of efzofitimid;
- any resulting cost increases as a result of the COVID-19 pandemic, the ongoing Ukraine-Russia conflict, other geopolitical and macroeconomic conditions, including labor shortages, economic slowdowns, recessions or market corrections, inflation and monetary supply shifts, rising interest rates and tightening of credit markets;
- the number and characteristics of product candidates that we pursue;
- the scope, progress, results and costs of preclinical development, and clinical trials for other product candidates;
- the manufacturing of preclinical study and clinical trial materials, including technology transfers to additional contract development and manufacturing organizations (CDMO), and any delays in the manufacturing of study drug as a result of the COVID-19 pandemic, the ongoing Ukraine-Russia conflict, and other geopolitical and macroeconomic conditions including labor shortages, economic slowdowns, recessions or market corrections, inflation, rising interest rates and tightening of credit markets;
- our ability to maintain existing and enter into new collaboration and licensing arrangements and the timing of any payments we may receive under such arrangements;
- the costs and timing of preparing, filing and prosecuting patent applications, maintaining and enforcing our intellectual property rights and defending any intellectual property-related claims;
- the costs and timing of future commercialization activities, including product manufacturing, marketing, sales and distribution, for any of our product candidates for which we receive marketing approval; and
- the extent to which we acquire or in-license other products and technologies and the extent to which we are able to collaborate with a third party on ATYR2810.

Until such time, if ever, as we can generate substantial product revenues, we expect to finance our cash needs through a combination of equity offerings, grant funding, collaborations, strategic partnerships and/or licensing arrangements, and when we are closer to commercialization of our product candidates potentially through debt financings. To the extent we raise additional capital through the sale of equity, the ownership interest of our stockholders will be diluted, and the terms of these securities may include liquidation or other preferences that adversely affect the rights of our common stockholders. If we raise additional funds through collaborations, strategic partnerships or licensing arrangements with third parties, we may have to relinquish valuable rights to our product candidates, our other technologies, future revenue streams or research programs or grant licenses on terms that may not be favorable to us. The incurrence of additional indebtedness would increase our fixed payment obligations and may require us to agree to

certain restrictive covenants, such as limitations on our ability to incur additional debt, limitations on our ability to acquire, sell or license intellectual property rights and other operating restrictions that could adversely impact our ability to conduct our business. We may be unable to raise additional funds on acceptable terms or at all. If the equity and credit markets deteriorate, it may make any necessary debt or equity financing more difficult, more costly and more dilutive. If we are unable to raise additional funds, we may be required to delay, limit, reduce or terminate our product development or future commercialization efforts or grant rights to develop and market our product candidates even if we would otherwise prefer to develop and market such product candidates ourselves.

As of December 31, 2022, our material cash requirements from known contractual and other obligations consisted primarily of (i) our non-cancelable operating lease for our existing office and laboratory space, (ii) the lease that we entered into in May 2022 for our new corporate headquarters, and (iii) our master financing lease agreement that we entered into in April 2022 for various research and development and informational technology equipment.

Existing Corporate Headquarters Facility Lease

Our non-cancelable operating lease is subject to base lease payments, which escalate over the term of the lease, additional charges for common area maintenance and other costs. In July 2018, we entered into a lease amendment that reduced the space we lease from 24,494 square feet to 20,508 square feet and extended the lease term to May 2023. With the lease amendment, we do not have an option to extend our non-cancelable operating lease.

New Corporate Headquarters Facility Lease

In May 2022, we entered into a lease (Lease) with San Diego Creekside, LLC (Landlord), as lessor, pursuant to which we agreed to lease from Landlord approximately 23,696 rentable square feet (subject to increase pursuant to the terms of the Lease) of office and laboratory space. The term of the lease (the Lease Term) will commence upon the earlier of April 1, 2023 or the completion of certain leasehold improvements to the Premises (as defined in the Lease), but not sooner than March 1, 2023 (the Lease Commencement Date) and continue for 124 months from the Lease Commencement Date. We also have one option to extend the Lease Term for five years. Base rent during such extension period would be at the fair market rent for the Premises. Under the terms of the Lease, the base rent during the first 12 months of the Lease Term will be \$5.75 per square foot of rentable area per month, subject to certain upward adjustments of approximately 3.0% annually. We are entitled to an allowance of up to \$5.5 million for tenant improvements of which as of December 31, 2022, we received \$1.8 million from the Landlord. The Lease also included an option to utilize an additional allowance of up to \$0.6 million, which, if used by us, would be repaid by us as additional monthly base rent, amortized at eight percent (8.0%) per annum during the Lease Term. We provided a \$0.7 million security deposit in the form of a letter of credit which is included in restricted cash as of December 31, 2022.

Financing Lease

In April 2022, we entered into a financing lease to lease various research and development and information technology equipment over a 48-month term. Financing lease liabilities total \$0.8 million as of December 31, 2022. Additionally, we provided \$2.4 million in cash collateral for the financing lease, and this amount is included in restricted cash as of December 31, 2022.

We did not have any off-balance sheet arrangements as of December 31, 2022.

Financial Operations Overview

Organization and Business; Principles of Consolidation

We conduct substantially all of our activities through aTyr Pharma, Inc., a Delaware corporation, at our facility in San Diego, California. aTyr Pharma, Inc. was incorporated in the State of Delaware in September 2005. The consolidated financial statements include our accounts and our 98% majority-owned subsidiary in Hong Kong, Pangu BioPharma, as of December 31, 2022. All intercompany transactions and balances are eliminated in consolidation.

Revenue Recognition

In January 2020, we entered into a collaboration and license agreement with Kyorin for the development and commercialization of efzofitimod for ILD in Japan. Under the Kyorin Agreement, Kyorin received an exclusive right to develop and commercialize efzofitimod in Japan for all forms of ILD. Under the terms of the Kyorin Agreement, Kyorin will fund all research, development, regulatory, marketing and commercialization activities in Japan. The Phase 1 trial, which was conducted and funded by Kyorin, is a placebo-controlled study to evaluate the safety, PK and immunogenicity of efzofitimod in 32 healthy Japanese male volunteers. Efzofitimod was observed to be generally well-tolerated with no drug-related serious adverse events and PK findings were consistent with previous studies of efzofitimod. Kyorin is also participating in the EFZO-FIT study as the local sponsor in Japan. In February 2023, Kyorin dosed the first patient in Japan in EFZO-FIT study. This achievement has triggered a \$10.0 million milestone payment by Kyorin to us pursuant to the Kyorin Agreement. Under the Kyorin Agreement, we have generated \$20.0 million in upfront and milestone payments to date and are eligible to receive up to an additional \$155.0 million in the aggregate upon the achievement of certain

development, regulatory and sales milestones, as well as tiered royalties on any net sales in Japan. Kyorin has the exclusive rights to develop and commercialize efzofitmod in Japan for all forms of ILD.

Kyorin is participating in the EFZO-FIT study and received approval from the Pharmaceuticals and Medical Devices Agency (PMDA) to commence the EFZO-FIT study in Japan during the year ended December 31, 2022. As of December 31, 2022, Kyorin had scheduled site visits for patient screenings which led to first patient dosing in February 2023. We determined that the development milestone achieved in February 2023 became probable of achievement as of December 31, 2022. Because our performance obligations were already completed, we recorded the \$10.0 million collaboration revenue and a receivable from Kyorin as of December 31, 2022. We also recorded an additional \$0.4 million in collaboration revenue from Kyorin during the year ended December 31, 2022 for drug product material sold to Kyorin for the Japan portion of the EFZO-FIT study.

Research and Development Expenses

To date, our research and development expenses have been related primarily to the development of, and clinical trials for, our product candidates, and to research efforts targeting the potential therapeutic application of other tRNA synthetase-based immunomodulators and, more recently research efforts related to NRP2 biology. These expenses consist primarily of:

- salaries and employee-related expenses, including stock-based compensation and benefits for personnel in research and product development functions;
- costs associated with conducting our preclinical, development and regulatory activities, including fees paid to third-party professional consultants, service providers and our scientific, therapeutic and clinical advisory board;
- costs to acquire, develop and manufacture preclinical study and clinical trial materials;
- costs incurred under clinical trial agreements with clinical research organizations (CROs) and investigative sites;
- costs for laboratory supplies; and
- allocated facilities, depreciation and other allocable expenses.

Product candidates in later stages of clinical development generally have higher development costs than those in earlier stages of clinical development, primarily due to the increased size and duration of later-stage clinical trials. We expect that the levels of our research and development expenses will continue to increase in future years and will consist primarily of costs related to our clinical development and manufacturing of efzofitmod for patients with pulmonary sarcoidosis and SSc-ILD, and other potential therapeutics based on tRNA synthetase biology and NRP2 biology.

We cannot determine with certainty the timing of initiation, the duration or the completion costs of current or future preclinical studies and clinical trials of our product candidates. For instance, as a result of the COVID-19 pandemic, many clinical trial sites in our completed Phase 1b/2a clinical trial in patients with pulmonary sarcoidosis temporarily suspended dosing of previously-enrolled patients and/or enrollment of new patients and some patients discontinued from the trial.

At this time, due to the inherently unpredictable nature of preclinical and clinical development and given the early stage of our programs, we are unable to estimate with any certainty the costs we will incur or the timelines we will require in the continued development of our product candidates. Clinical and preclinical development timelines, the probability of success and development costs can differ materially from expectations. We anticipate that we will make determinations as to which product candidates to pursue and how much funding to direct to each product candidate on an ongoing basis in response to the results of ongoing and future preclinical studies and clinical trials, regulatory developments and our ongoing assessments as to each product candidate's commercial potential. In addition, we cannot forecast which programs or product candidates may be subject to future collaborations, when such arrangements will be secured, if at all, and to what degree such arrangements would affect our development plans and capital requirements.

General and Administrative Expenses

General and administrative expenses consist primarily of salaries and related costs for employees in executive, finance and administration, corporate development and administrative support functions, including stock-based compensation expenses and benefits. Other significant general and administrative expenses include accounting, legal services, expenses associated with applying for and maintaining patents, cost of insurance, cost of various consultants, occupancy costs, information systems costs and depreciation.

Critical Accounting Policies and Significant Judgments and Estimates

Our management's discussion and analysis of financial condition and results of operations is based on our consolidated financial statements, which have been prepared in accordance with accounting principles generally accepted in the United States. The preparation of these consolidated financial statements requires us to make estimates and assumptions that affect the reported amounts of assets and

liabilities and the disclosure of contingent assets and liabilities as of the date of the consolidated financial statements, as well as the reported expenses during the reporting periods. We monitor and analyze these items for changes in facts and circumstances, and material changes in these estimates could occur in the future. We base our estimates on our historical experience and on various other factors we believe to be reasonable under the circumstances, the results of which form the basis for making judgments about the carrying value of assets and liabilities that are not readily apparent from other sources. Changes in estimates are reflected in reported results for the period in which they become known. Actual results may differ materially from these estimates under different assumptions or conditions. Though the impact of the COVID-19 pandemic, the ongoing Ukraine-Russian conflict and other geopolitical and macroeconomic conditions on our business and operating results presents additional uncertainty, we continue to use the best information available to us in our critical accounting estimates.

We discuss our accounting policies and assumptions that involve a higher degree of judgment and complexity within Note 2 to our audited consolidated financial statements appearing elsewhere in this Annual Report. We believe that our accounting policies related to research and development expense accruals involve the most significant estimation and judgment in accounting for our reported consolidated financial results.

Research and Development Expense Accruals

As part of the process of preparing our consolidated financial statements, we are required to estimate our accrued expenses. This process involves reviewing open contracts and purchase orders, communicating with our personnel to identify services that have been performed on our behalf and estimating the level of service performed and the associated cost incurred for the service when we have not yet been invoiced or otherwise notified of the actual cost. The majority of our service providers invoice us monthly in arrears for services performed or when contractual milestones are met. We make estimates of our accrued expenses as of each balance sheet date in our consolidated financial statements based on facts and circumstances known to us at that time. We periodically confirm the accuracy of our estimates with the service providers and make adjustments if necessary. Examples of estimated accrued research and development expenses include fees paid to investigative sites and CROs in connection with clinical trials; service providers in connection with preclinical development activities; and service providers related to product manufacturing, development and distribution of clinical supplies.

We currently rely on third parties for the clinical development of our product candidates and the manufacture of our product candidates to support our ongoing and future clinical trials. We pay these third parties, including consultants, CROs, CDMOs and other service providers, pursuant to contractual arrangements, which may include provisions for time and materials-based payments, project-based fees and milestone payments. We base our accrual for these expenses on our estimates of the services received and efforts expended pursuant to our contractual arrangements. The financial terms of these agreements are subject to negotiation, vary from contract to contract and may result in uneven payment flows. There may be instances in which payments made to our service providers will exceed the level of services provided and result in a prepayment of the clinical expense. Payments under some of these contracts depend on factors such as the successful enrollment of patients and the completion of clinical milestones. In accruing service fees, we estimate the time period over which services will be performed and the level of effort to be expended in each period. If the actual timing of the performance of services or the level of effort varies from our estimate, we adjust our accrual or prepaid expenses accordingly.

Although we do not expect our estimates to be materially different from amounts actually incurred, if our estimates of the status and timing of services performed differs from the actual status and timing of services performed, we may report amounts that are too high or too low in any particular period. To date, there have been no material differences between our estimates and the amounts actually incurred.

Results of Operations

Comparison of the Years Ended December 31, 2022 and 2021

The following table summarizes our results of operations for the years ended December 31, 2022 and 2021 (in thousands):

	Years Ended December 31,		Increase /
	2022	2021	(Decrease)
License and collaboration agreement revenues	\$ 10,386	\$ —	\$ 10,386
Research and development expenses	42,808	23,264	19,544
General and administrative expenses	13,982	10,751	3,231
Other income (expense), net	1,061	238	823

License and collaboration agreement revenues. Revenues of \$10.4 million for the year ended December 31, 2022 consisted primarily of the \$10.0 million development milestone earned under the Kyorin Agreement as Kyorin dosed the first patient in the Japan portion of the EFZO-FIT study.

Research and development expenses. Research and development expenses were \$42.8 million and \$23.3 million for the years ended December 31, 2022 and 2021, respectively. The increase of \$19.5 million was due primarily to \$8.7 million in clinical trial costs for the EFZO-FIT study that was initiated during the year ended December 31, 2022, an increase of \$7.1 million in manufacturing costs for efzofitmod and ATYR2810, an increase of \$1.2 million research and development costs for efzofitmod and our discovery programs and an increase of \$2.5 million in compensation-related expenses.

General and administrative expenses. General and administrative expenses were \$14.0 million and \$10.8 million for the years ended December 31, 2022 and 2021, respectively. The increase of \$3.2 million was due primarily to an increase of \$1.9 million in compensation-related expenses, a \$0.5 million increase in professional fees, a \$0.2 million increase in travel costs and \$0.2 million increase in facilities and information technology costs.

Other income (expense), net. Other income (expense), net was \$1.1 million and \$0.2 million for years ended December 31, 2022 and 2021, respectively. The increase was primarily a result of interest earned on higher cash, cash equivalents, restricted cash and available-for-sale investments balances, which resulted primarily from the underwritten follow-on offering in September 2021, as well as higher interest rates as of December 31, 2022 compared to the prior year.

Recent Accounting Pronouncements

For discussion of recently issued accounting pronouncements, refer to the Section titled “Recent Accounting Pronouncements” within Note 2 of our consolidated financial statements included in this Annual Report.

Item 7A. Quantitative and Qualitative Disclosures About Market Risk.

Not Applicable.

Item 8. Financial Statements and Supplementary Data.

Report of Independent Registered Public Accounting Firm

To the Stockholders and Board of Directors of aTyr Pharma, Inc.

Opinion on the Financial Statements

We have audited the accompanying consolidated balance sheets of aTyr Pharma, Inc. (the Company) as of December 31, 2022 and 2021, the related consolidated statements of operations, comprehensive loss, stockholders' equity and cash flows for each of the three years in the period ended December 31, 2022, and the related notes (collectively referred to as the "consolidated financial statements"). In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Company at December 31, 2022 and 2021, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2022, in conformity with U.S. generally accepted accounting principles.

Basis for Opinion

These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on the Company's financial statements based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. The Company is not required to have, nor were we engaged to perform, an audit of its internal control over financial reporting. As part of our audits we are required to obtain an understanding of internal control over financial reporting but not for the purpose of expressing an opinion on the effectiveness of the Company's internal control over financial reporting. Accordingly, we express no such opinion.

Our audits included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that our audits provide a reasonable basis for our opinion.

Critical Audit Matter

The critical audit matter communicated below is a matter arising from the current period audit of the financial statements that was communicated or required to be communicated to the audit committee and that: (1) relates to accounts or disclosures that are material to the financial statements and (2) involved our especially challenging, subjective or complex judgments. The communication of the critical audit matter does not alter in any way our opinion on the consolidated financial statements, taken as a whole, and we are not, by communicating the critical audit matter below, providing a separate opinion on the critical audit matter or on the accounts or disclosures to which it relates.

<i>Accrued clinical and manufacturing costs</i>	
Description of the Matter	<p>During 2022, the Company incurred \$42.8 million for research and development expenses and as of December 31, 2022, recorded an accrual of \$5.2 million of clinical and manufacturing costs. A substantial portion of the Company's ongoing research and development activities are conducted by third-party service providers, including clinical research organizations and contracted development and manufacturing organizations. As described in Note 2 to the consolidated financial statements, external costs for clinical and manufacturing to be paid are accrued and expensed based upon work completed in accordance with contractual arrangements.</p> <p>Auditing management's accounting for accrued clinical and manufacturing costs is especially challenging because it is dependent on data from third parties and involves judgments applied by management to determine the commencement and completion date of vendor tasks as well as the extent of work performed during the reporting period, which may not match the pattern of bills received or payments made to third-party service providers. The testing of accrued clinical and manufacturing costs is dependent upon a high-volume of data and input exchanged between clinical personnel and third-party service providers, which includes the total trial management costs, number of sites activated, number of patients enrolled, and number of patient visits, which is tracked in spreadsheets and other end user computing programs.</p>
How We Addressed the Matter in Our Audit	<p>Our substantive testing procedures over the completeness of the Company's accrued clinical and manufacturing costs include obtaining from third-parties confirmation of total costs billed and work completed as of December 31, 2022, for significant clinical trial and manufacturing activities. We obtained an understanding of the status of significant clinical trial and manufacturing activities from accounting personnel and the clinical project managers to understand the status of significant clinical trial and manufacturing activities. To assess the appropriate measurement of accrued clinical and manufacturing costs, we inspected key terms, timelines of completion, activities and costs for a sample of vendor contracts, including amendments, and compared these to management's analyses used in tracking the progress of service agreements. We also inspected a sample of subsequent payments, obtained invoice support and tested the expense was recorded to the appropriate period.</p>

/s/ Ernst & Young LLP

We have served as the Company's auditor since 2008.

San Diego, California

March 14, 2023

aTyr Pharma, Inc.
Consolidated Balance Sheets
(in thousands, except share and per share data)

	December 31, 2022	December 31, 2021
Assets		
Current assets:		
Cash and cash equivalents	\$ 9,981	\$ 2,336
Available-for-sale investments	56,165	105,575
Other receivables	11,775	435
Prepaid expenses	2,950	5,223
Total current assets	80,871	113,569
Restricted cash	3,165	—
Property and equipment, net	3,059	543
Operating lease, right-of-use assets	7,250	1,267
Financing lease, right-of-use assets	1,248	—
Other assets	193	158
Total assets	<u>\$ 95,786</u>	<u>\$ 115,537</u>
Liabilities and Stockholders' Equity		
Current liabilities:		
Accounts payable	\$ 3,106	\$ 1,031
Accrued expenses	9,862	4,002
Current portion of operating lease liability	630	980
Current portion of financing lease liability	264	—
Total current liabilities	13,862	6,013
Long-term operating lease liability, net of current portion	9,633	398
Long-term financing lease liability, net of current portion	1,007	—
Commitments and contingencies (Note 6)		
Stockholders' equity:		
Preferred stock, \$0.001 par value per share; 5,000,000 undesignated authorized shares as of December 31, 2022 and 2021, respectively; no shares issued or outstanding as of December 31, 2022 and 2021, respectively	—	—
Common stock, \$0.001 par value per share; 85,000,000 and 42,500,000 authorized shares as of December 31, 2022 and 2021, respectively; issued and outstanding shares – 29,498,488 and 27,793,035 as of December 31, 2022 and 2021, respectively	29	28
Additional paid-in capital	489,502	481,832
Accumulated other comprehensive loss	(433)	(263)
Accumulated deficit	(417,634)	(372,296)
Total aTyr Pharma, Inc. stockholders' equity	71,464	109,301
Noncontrolling interest in Pangu BioPharma Limited	(180)	(175)
Total stockholders' equity	71,284	109,126
Total liabilities and stockholders' equity	<u>\$ 95,786</u>	<u>\$ 115,537</u>

See accompanying notes.

aTyr Pharma, Inc.
Consolidated Statements of Operations
(in thousands, except share and per share data)

	Years Ended December 31,		
	2022	2021	2020
Revenues:			
License and collaboration agreement revenues	\$ 10,386	\$ —	\$ 10,455
Total revenues	10,386	—	10,455
Operating expenses:			
Research and development	42,808	23,264	17,291
General and administrative	13,982	10,751	9,075
Total operating expenses	56,790	34,015	26,366
Loss from operations	(46,404)	(34,015)	(15,911)
Total other income (expense), net	1,061	238	(319)
Consolidated net loss	(45,343)	(33,777)	(16,230)
Net loss attributable to noncontrolling interest in Pangu BioPharma Limited	5	9	6
Net loss attributable to aTyr Pharma, Inc.	\$ (45,338)	\$ (33,768)	\$ (16,224)
Net loss per share, basic and diluted	\$ (1.60)	\$ (1.77)	\$ (1.77)
Shares used in computing net loss per share, basic and diluted	28,419,569	19,080,878	9,160,269

See accompanying notes.

aTyr Pharma, Inc.
Consolidated Statements of Comprehensive Loss
(in thousands)

	Years Ended December 31,		
	2022	2021	2020
Consolidated net loss	\$ (45,343)	\$ (33,777)	\$ (16,230)
Other comprehensive loss:			
Change in unrealized loss on available-for-sale investments, net of tax	(170)	(220)	(3)
Comprehensive loss	(45,513)	(33,997)	(16,233)
Comprehensive loss attributable to noncontrolling interest in Pangu BioPharma Limited	5	9	6
Comprehensive loss attributable to aTyr Pharma, Inc. common stockholders	<u>\$ (45,508)</u>	<u>\$ (33,988)</u>	<u>\$ (16,227)</u>

See accompanying notes.

aTyr Pharma, Inc.
Consolidated Statements of Stockholders' Equity
(in thousands, except share data)

	Convertible		Common Stock		Additional		Other		Accumulated		Noncontrolling		Total	
	Preferred Stock		Shares	Amount	Paid-In		Comprehensive		Deficit		Interest		Stockholders'	
	Shares	Amount		\$	Capital		Gain/(Loss)		\$		\$		Equity	
Balance as of December 31, 2019	1,643,961	\$ (1,643,961)	2	\$ 3,891,787	\$ 4	\$ 343,524	\$ (40)		\$ (322,304)		\$ (160)		\$ 21,026	
Conversion of preferred stock to common stock	—	—	(2)	587,444	1	—	—	—	—	—	—	—	—	—
Issuance of common stock from underwritten follow-on offering, net of offering costs	—	—	—	4,870,588	4	18,775	—	—	—	—	—	—	18,779	
Issuance of common stock from at-the-market offerings, net of offering costs	—	—	—	1,657,075	2	6,435	—	—	—	—	—	—	6,437	
Issuance of common stock upon release of restricted stock units	—	—	—	8,678	—	—	—	—	—	—	—	—	—	
Issuance of common stock pursuant to employee stock purchase plan	—	—	—	3,382	—	10	—	—	—	—	—	—	10	
Stock-based compensation	—	—	—	—	—	1,465	—	—	—	—	—	—	1,465	
Net unrealized loss on investments, net of tax	—	—	—	—	—	—	(3)	—	—	—	—	—	(3)	
Net loss	—	—	—	—	—	—	—	—	(16,224)	—	(6)	—	(16,230)	
Balance as of December 31, 2020	—	—	—	11,018,954	11	370,210	(43)	—	(338,528)	—	(166)	—	31,484	
Issuance of common stock upon release of restricted stock units	—	—	—	4,177	—	—	—	—	—	—	—	—	—	
Issuance of common stock upon exercise of stock options	—	—	—	10,751	—	62	—	—	—	—	—	—	62	
Issuance of common stock pursuant to employee stock purchase plan	—	—	—	3,382	—	11	—	—	—	—	—	—	11	
Issuance of common stock from at-the-market offerings, net of offering costs	—	—	—	2,974,521	3	14,067	—	—	—	—	—	—	14,070	
Issuance of common stock from committed purchase agreement, net of offering costs	—	—	—	3,000,000	3	15,233	—	—	—	—	—	—	15,236	
Issuance of common stock from underwritten follow-on offering, net of offering costs	—	—	—	10,781,250	11	80,635	—	—	—	—	—	—	80,646	
Stock-based compensation	—	—	—	—	—	1,614	—	—	—	—	—	—	1,614	
Net unrealized loss on investments, net of tax	—	—	—	—	—	—	(220)	—	—	—	—	—	(220)	
Net loss	—	—	—	—	—	—	—	—	(33,768)	—	(9)	—	(33,777)	
Balance as of December 31, 2021	—	—	—	27,793,035	28	481,832	(263)	—	(372,296)	—	(175)	—	109,126	
Issuance of common stock upon release of restricted stock units	—	—	—	2,500	—	—	—	—	—	—	—	—	—	
Issuance of common stock upon exercise of stock options	—	—	—	259	—	1	—	—	—	—	—	—	1	
Issuance of common stock pursuant to employee stock purchase plan	—	—	—	20,612	—	44	—	—	—	—	—	—	44	
Issuance of common stock from at-the-market offerings, net of offering costs	—	—	—	1,682,082	1	5,471	—	—	—	—	—	—	5,472	
Stock-based compensation	—	—	—	—	—	2,154	—	—	—	—	—	—	2,154	
Net unrealized loss on investments, net of tax	—	—	—	—	—	—	(170)	—	—	—	—	—	(170)	
Net loss	—	—	—	—	—	—	—	—	(45,338)	—	(5)	—	(45,343)	
Balance as of December 31, 2022	—	—	—	29,498,488	29	\$ 489,502	(433)	\$	(417,634)	\$	(180)	\$	71,284	

See accompanying notes.

aTyr Pharma, Inc.
Consolidated Statements of Cash Flows
(in thousands)

	Years Ended December 31,		
	2022	2021	2020
Cash flows from operating activities:			
Consolidated net loss	\$ (45,343)	\$ (33,777)	\$ (16,230)
Adjustments to reconcile net loss to net cash used in operating activities:			
Depreciation and amortization	232	475	569
Stock-based compensation	2,154	1,614	1,465
Debt discount accretion and non-cash interest expense	—	—	346
Amortization of premium of available-for-sale investment securities	533	366	110
Amortization of right-of-use assets	1,463	829	697
Gain (loss) on disposal of property and equipment	(92)	6	3
Changes in operating assets and liabilities:			
Other receivables	(11,923)	1,604	(1,939)
Prepaid expenses and other assets	2,238	(3,378)	(1,122)
Accounts payable and accrued expenses	6,741	47	1,763
Contract liability	—	—	(208)
Operating lease liability	2,111	(861)	(755)
Net cash used in operating activities	(41,886)	(33,075)	(15,301)
Cash flows from investing activities:			
Purchases of property and equipment	(1,641)	(192)	(202)
Purchases of available-for-sale investment securities	(42,118)	(126,506)	(21,066)
Maturities of available-for-sale investment securities	90,825	35,082	28,150
Proceeds from sale of property and equipment	179	50	18
Net cash provided by (used in) investing activities	47,245	(91,566)	6,900
Cash flows from financing activities:			
Proceeds from issuance of common stock through option exercises	1	62	—
Proceeds from issuance of common stock through employee stock purchase plan	44	11	10
Proceeds from issuance of common stock from at-the-market offerings, net of offering costs	5,472	14,070	6,437
Proceeds from issuance of common stock from committed purchase agreement, net of offering costs	—	15,236	—
Proceeds from issuance of common stock from underwritten follow-on offering, net of offering costs	—	80,646	18,779
Principal paid on finance lease liabilities	(66)	—	—
Repayments on borrowings	—	—	(9,083)
Net cash provided by financing activities	5,451	110,025	16,143
Net change in cash, cash equivalents and restricted cash	10,810	(14,616)	7,742
Cash, cash equivalents and restricted cash at beginning of period	2,336	16,952	9,210
Cash, cash equivalents and restricted cash at the end of period	<u>\$ 13,146</u>	<u>\$ 2,336</u>	<u>\$ 16,952</u>
Cash and cash equivalents at the end of period	\$ 9,981	\$ 2,336	\$ 16,952
Restricted cash at the end of period	3,165	—	—
Cash, cash equivalents and restricted cash at the end of period	<u>\$ 13,146</u>	<u>\$ 2,336</u>	<u>\$ 16,952</u>
Supplemental disclosure of cash flow information:			
Interest paid	\$ 54	\$ —	\$ 308
Purchases of property and equipment in accounts payable	\$ 1,194	\$ —	\$ 17
Right-of-use assets obtained in exchange for lease obligation	<u>\$ 8,695</u>	<u>\$ —</u>	<u>\$ —</u>

See accompanying notes.

aTyr Pharma, Inc.

Notes to Consolidated Financial Statements

1. Organization, Business and Basis of Presentation

Organization and Business

We were incorporated in the state of Delaware on September 8, 2005. We are focused on the discovery and development of first-in-class medicines from our proprietary tRNA synthetase platform.

Principles of Consolidation

Our consolidated financial statements include our accounts and our 98% majority-owned subsidiary in Hong Kong, Pangu BioPharma Limited (Pangu BioPharma). All intercompany transactions and balances are eliminated in consolidation.

Liquidity and Financial Condition

We have incurred losses and negative cash flows from operations since our inception. As of December 31, 2022, we had an accumulated deficit of \$417.6 million and we expect to continue to incur net losses for the foreseeable future. As of December 31, 2022, our cash, cash equivalents, available-for-sale investments and restricted cash were \$69.3 million. Additionally, in February 2023, we completed an underwritten follow-on public offering of 23,125,000 shares of our common stock, including the partial exercise of the underwriters' option to purchase additional shares, at a price to the public of \$2.25 per share. The total gross proceeds from the offering were approximately \$52.0 million, before deducting underwriting discounts, commissions and offering expenses payable by us. We also received a \$10.0 million milestone payment from the Kyorin Agreement in February 2023. We believe that our current cash, cash equivalents, available-for-sale investments and restricted cash, will be sufficient to meet our anticipated cash requirements for a period of at least one year from the date of this Annual Report.

We do not expect to generate any revenues from product sales unless and until we successfully complete development and obtain regulatory approval for one or more of our product candidates, which we expect will take a number of years at a minimum. If we obtain regulatory approval for any of our product candidates, we expect to incur significant commercialization expenses related to product sales, marketing, manufacturing and distribution. Accordingly, we will need to raise substantial additional capital to fund our operations. The amount and timing of our future funding requirements will depend on many factors, including the pace and results of our preclinical and clinical development efforts and the timing and nature of the regulatory approval process for our product candidates. We anticipate that we will seek to fund our operations through equity offerings, grant funding, collaborations, strategic partnerships and/or licensing arrangements, and when we are closer to commercialization of our product candidates potentially through debt financings. However, we may be unable to raise additional capital or enter into such arrangements when needed on favorable terms or at all. Our failure to raise capital or enter into such arrangements when needed would have a negative impact on our financial condition and ability to develop our product candidates.

Restricted Cash

As of December 31, 2022, restricted cash was approximately \$3.2 million, which was held as a security deposit in conjunction with our new facility lease and financing leases as discussed further in Note 6 - Commitments and Contingencies.

Use of Estimates

Our consolidated financial statements are prepared in accordance with generally accepted accounting principles (GAAP). The preparation of our consolidated financial statements requires us to make estimates and assumptions that impact the reported amounts of assets, liabilities and expenses and the disclosure for these items in our consolidated financial statements and accompanying notes. The most significant estimates in our consolidated financial statements relate to the fair value of equity issuances and awards, and clinical trial and research and development expenses. Although these estimates are based on our knowledge of current events and actions we may undertake in the future, actual results may ultimately differ materially from these estimates and assumptions.

Segment Reporting

Operating segments are identified as components of an enterprise about which separate discrete financial information is available for evaluation by the chief operating decision-maker in making decisions regarding resource allocation and assessing performance. We view our operations and manage our business in one operating segment.

2. Summary of Significant Accounting Policies

Cash and Cash Equivalents and Restricted Cash

Cash and cash equivalents and restricted cash consist primarily of readily available checking, money market accounts and money market funds. We consider all highly liquid investments that mature in three months or less when purchased to be cash equivalents.

Investment Securities

Investment securities primarily consist of investment grade corporate and municipal bond securities and commercial paper. We classify all investment securities as available-for-sale. Investment securities are carried at fair value, with the unrealized gains and losses, if any, reported as a component of other comprehensive income (loss) in stockholders' equity until realized. Realized gains and losses from the sale of investment securities, if any, are determined on a specific identification basis. A decline in the market value of any investment security below cost that is determined to be other than temporary will result in an impairment charge to earnings and a new cost basis for the security is established. No such impairment charges were recorded for any period presented. Premiums and discounts are amortized or accreted over the life of the related security as an adjustment to yield using the straight-line method and are included in interest income. Interest income is recognized when earned. As of December 31, 2022, we held an aggregate total of \$56.2 million of investment securities which consisted of corporate debt securities, municipal bonds and commercial paper all of which will mature in less than two years, and there was an unrealized loss of approximately \$0.4 million between the amortized cost and fair value of these investment securities. As of December 31, 2021, we held \$105.6 million of corporate debt securities, municipal bonds and commercial paper, all of which mature in less than one year, and there was an unrealized loss of approximately \$0.2 million between the amortized cost and fair value of these investment securities.

Concentration of Credit Risk

Financial instruments that potentially subject us to significant concentration of credit risk consist primarily of cash, cash equivalents, restricted cash and investment securities. We have established guidelines regarding diversification of investments and their maturities, which are designed to maintain principal and maximize liquidity. We maintain deposits in federally insured financial institutions in excess of federally insured limits. We have not experienced any losses in such accounts and we believe that we are not exposed to significant credit risk due to the financial position of the depository institutions in which those deposits are held.

Property and Equipment

Property and equipment are stated at cost and depreciated on a straight-line basis over the estimated useful life of the related assets (generally three to seven years). Leasehold improvements are stated at cost and amortized on a straight-line basis over the lesser of the remaining term of the related lease or the estimated useful life of the leasehold improvements. Repairs and maintenance costs are charged to expense as incurred.

Impairment of Long-Lived Assets

Long-lived assets consist primarily of property and equipment and right-of-use assets (ROU) associated with our operating and financing leases. An impairment loss is recorded if and when events and circumstances indicate that assets might be impaired and the undiscounted cash flows estimated to be generated by those assets are less than the carrying amount of those assets. While our current and historical operating losses are indicators of impairment, we believe that future cash flows to be received support the carrying value of our long-lived assets and, accordingly, have not recognized any impairment losses since inception.

Accrued Expenses

Accrued expenses include salaries, wages, benefits costs, consulting fees, legal, tenant improvement costs for our new corporate headquarters facility and research and development costs. We have entered into contractual arrangements related to our clinical studies with clinical research organizations (CROs) and contracted development and manufacturing organizations (CDMOs) and recognize expense based on work completed and efforts expended pursuant to our contractual arrangements. We make estimates of our accrued CRO costs as of each balance sheet date based on facts and circumstances known at the time and include total trial management costs, sites activated, patients enrolled and number of patient visits. We estimate the time period over which services will be performed and the level of effort to be expended in each period. There may be instances in which payments made to our service providers including CROs and CDMOs, will temporarily exceed the level of services provided and result in a prepayment of the expense. If the actual timing of the performance of services or the level of effort varies from our estimate, we adjust the accrual or prepaid expense balance accordingly. Historically, our estimated accrued liabilities have materially approximated actual expenses incurred.

Leases

We determine if an arrangement is a lease at inception. Short-term leases with an initial term of 12 months or less are not recorded on our balance sheet. For long-term leases with an initial term of greater than 12 months, we recognize a right-of-use asset (ROU) and a lease liability based on the present value of future lease payments using an estimated rate of interest that we would pay to borrow

equivalent funds on a collateralized basis at the lease commencement date. We determine the lease term at the commencement date by considering whether renewal options and termination options are reasonably assured of exercise. Rent expense for operating leases is recognized on a straight-line basis over the lease term and is included in operating expenses in our consolidated statements of operations. For financing leases, interest expense and amortization of the ROU is included in operating expenses in our consolidated statements of operations and variable lease payments are recorded as incurred.

If a lease is modified, the modified contract is evaluated to determine whether it is or contains a lease. If a lease continues to exist, the lease modification is determined to be a separate contract when the modification grants the lessee an additional ROU that is not included in the original lease and the lease payments increase commensurate with the standalone price for the additional ROU. A lease modification that results in a separate contract will be accounted for in the same manner as a new lease. For a modification that is not a separate contract, we reassess the lease classification using the modified terms and conditions and the facts and circumstances as of the effective date of the modification and recognize the amount of the remeasurement of the lease liability for the modified lease as an adjustment to the corresponding lease ROU asset.

Our ROU assets consist of non-cancelable operating lease and financing leases. Non-cancelable operating leases include our existing office and laboratory space and new corporate headquarters. Financing leases include various research and development and information technology equipment.

We do not separate lease and non-lease components for our long-term leases.

Revenue Recognition

We evaluate our agreements under ASC Topic 606, *Revenue from Contracts with Customers* and ASC Topic 808, *Collaborative Arrangements*. We recognize revenue when we transfer promised goods or services to customers in an amount that reflects the consideration to which we expect to be entitled in exchange for those goods or services. In determining the appropriate amount of revenue to be recognized as we fulfill our obligations under our agreement, we perform the following steps: (i) identification of the promised goods or services in the contract; (ii) determination of whether the promised goods or services are performance obligations including whether they are distinct in the context of the contract; (iii) measurement of the transaction price, including the constraint on variable consideration; (iv) allocation of the transaction price to the performance obligations; and (v) recognition of revenue when (or as) we satisfy each performance obligation. As part of the accounting for these arrangements, we must develop assumptions that require judgment to determine the stand-alone selling price for each performance obligation identified in the contract. We use key assumptions to determine the stand-alone selling price, which may include forecasted revenues, development timelines, reimbursement rates for personnel costs, discount rates and probabilities of technical and regulatory success.

We recognize revenue in one of two ways, over time or at a point in time. We recognize revenue over time when we are executing on our performance obligation over time and our partner receives benefit over time. For example, we recognize revenue over time when we provide research and development services. We recognize revenue at a point in time when we transfer control of a distinct performance obligation to our partner. For example, if a license to our intellectual property is determined to be distinct from the other performance obligations identified in the arrangement, we recognize revenues from non-refundable, up-front fees allocated to the license when the license is transferred to the licensee and the licensee is able to use and benefit from the license.

Research and Development Costs

Research and development costs are expensed as incurred. Research and development costs include: salaries and employee-related expenses, including stock-based compensation and benefits for personnel in research and product development functions; costs associated with conducting our preclinical, development and regulatory activities, including fees paid to third-party professional consultants, service providers and our scientific, therapeutic and clinical advisors; costs to acquire, develop and manufacture preclinical study and clinical trial materials; costs incurred under clinical trial agreements with clinical research organizations and investigative sites; costs for laboratory supplies; payments related to licensed products and technologies; allocated facilities and information technology costs; and depreciation.

Patent Costs

Costs related to filing and pursuing patent applications are recorded as general and administrative expense and expensed as incurred since recoverability of such expenditures is uncertain.

Stock-Based Compensation

We evaluate our stock-based compensation arrangements under ASC Topic 718, *Compensation – Stock Compensation*. Stock-based compensation expense represents the grant date fair value of employee stock option and restricted stock unit grants recognized as expense over the requisite service period of the awards (usually the vesting period) on a straight-line basis. We estimate fair value of stock option grants using the Black-Scholes option pricing model. We estimate the fair value using assumptions, including the risk-free

interest rate, the expected volatility of a peer group of similar companies, the expected term of the awards and the expected dividend yield. These estimates involve inherent uncertainties and the application of management's judgment. If factors change and different assumptions are used, our stock-based compensation expense could be materially different in the future.

Income Taxes

We account for income taxes under the asset and liability method, which requires the recognition of deferred tax assets and liabilities for the expected future tax consequences of events that have been included in the financial statements. Under this method, deferred tax assets and liabilities are determined on the basis of the differences between the financial statements and tax basis of assets and liabilities using enacted tax rates in effect for the year in which the differences are expected to reverse. The effect of a change in tax rates on deferred tax assets and liabilities is recognized as income in the period that includes the enactment date.

We recognize net deferred tax assets to the extent that we believe these assets are more likely than not to be realized. In making such a determination, we consider all available positive and negative evidence, including future reversals of existing taxable temporary differences, projected future taxable income, tax-planning strategies and results of recent operations. If we determine that we would be able to realize the deferred tax assets in the future in excess of their net recorded amount, we would make an adjustment to the deferred tax asset valuation allowance, which would reduce the provision for income taxes.

We record uncertain tax positions on the basis of a two-step process whereby (1) we determine whether it is more likely than not that the tax positions will be sustained on the basis of the technical merits of the position and (2) for those tax positions that meet the more-likely-than-not recognition threshold, we recognize the largest amount of tax benefit that is more than 50% likely to be realized upon ultimate settlement with the related tax authority. We recognize interest and penalties related to unrecognized tax benefits within income tax expense. Any accrued interest and penalties are included within the related tax liability.

Net Loss Per Share

Basic net loss per share is calculated by dividing the net loss attributable to common stockholders by the weighted average number of common shares outstanding for the period, without consideration for common stock equivalents. Diluted net loss per share attributable to common stockholders is calculated by dividing the net loss attributable to common stockholders by the weighted average number of common stock and common stock equivalents outstanding for the period determined using the treasury-stock method. Dilutive common stock equivalents are comprised of convertible preferred stock, warrants for common stock, options and restricted stock units outstanding under our stock option plans and inducement grants and estimated shares to be purchased under our employee stock purchase plan. For all periods presented, there is no difference in the number of shares used to calculate basic and diluted shares outstanding due to our net loss position.

Potentially dilutive securities not included in the calculation of diluted net loss per share because to do so would be anti-dilutive are as follows (in common share equivalents):

	Years Ended December 31,		
	2022	2021	2020
Common stock warrants	13,760	13,760	13,904
Common stock options and restricted stock units	3,077,608	1,420,050	584,211
Employee stock purchase plan	34,588	2,045	1,602
Total	<u>3,125,956</u>	<u>1,435,855</u>	<u>599,717</u>

The following table summarizes our net loss per share (in thousands, except per share data):

	Years Ended December 31,		
	2022	2021	2020
Numerator:			
Net loss attributable to aTyr Pharma, Inc.	<u>\$ (45,338)</u>	<u>\$ (33,768)</u>	<u>\$ (16,224)</u>
Denominator:			
Weighted average common shares outstanding	28,419,569	19,080,878	9,160,269
Weighted average common shares subject to repurchase	—	—	—
Shares used in computing net loss per share, basic and diluted	<u>28,419,569</u>	<u>19,080,878</u>	<u>9,160,269</u>
Net loss per share - basic and diluted	<u>\$ (1.60)</u>	<u>\$ (1.77)</u>	<u>\$ (1.77)</u>

Recent Accounting Pronouncements

In June 2016, the Financial Accounting Standards Board issued Accounting Standards Update (ASU) No. 2016-13, *Financial Instruments – Credit Losses* (Topic 326), to provide financial statement users with more decision-useful information about the expected credit losses on financial instruments and other commitments to extend credit held by a reporting entity at each reporting date. To achieve this objective, the amendments in Topic 326 replace the incurred loss impairment methodology in current U.S. GAAP with a methodology that reflects expected credit losses and requires consideration of a broader range of reasonable and supportable information to inform credit loss estimates. Topic 326 is effective for fiscal years beginning after December 15, 2022, including interim periods within those fiscal years for smaller reporting companies. We do not expect the adoption of the amendments in Topic 326 to have a material effect on our consolidated financial position or results of operations when such amendment is effective.

3. Fair Value Measurements

The carrying amounts of cash equivalents, prepaid and other assets, accounts payable and accrued liabilities are considered to be representative of their respective fair values because of the short-term nature of those instruments. Investment securities are recorded at fair value.

The accounting guidance defines fair value, establishes a consistent framework for measuring fair value and expands disclosure for each major asset and liability category measured at fair value on either a recurring or nonrecurring basis. Fair value is defined as an exit price, representing the amount that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants. As such, fair value is a market-based measurement that should be determined based on assumptions that market participants would use in pricing an asset or liability. As a basis for considering such assumptions, the accounting guidance establishes a three-tier fair value hierarchy, which prioritizes the inputs used in measuring fair value as follows:

Level 1: Observable inputs such as quoted prices in active markets.

Level 2: Inputs, other than the quoted prices in active markets that are observable either directly or indirectly.

Level 3: Unobservable inputs in which there is little or no market data, which require the reporting entity to develop its own assumptions.

Financial assets measured at fair value on a recurring basis consist of investment securities. Investment securities are recorded at fair value, defined as the exit price in the principal market in which we would transact, representing the amount that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants. Level 2 securities are valued using quoted market prices for similar instruments, non-binding market prices that are corroborated by observable market data, or discounted cash flow techniques and include our investments in asset-backed securities, commercial paper, corporate debt securities and municipal bonds. We have no financial liabilities measured at fair value on a recurring basis. None of our non-financial assets and liabilities are recorded at fair value on a non-recurring basis. No transfers between levels have occurred during the periods presented.

Assets measured at fair value on a recurring basis are as follows (in thousands):

		Fair Value Measurements Using		
		Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
		Total		
As of December 31, 2022				
Assets:				
Current:				
Cash equivalents	\$	8,585	\$	8,585
Available-for-sale investments:				
Commercial paper		28,074		28,074
Corporate debt securities		26,094		26,094
Municipal bonds		1,997		1,997
Total available-for-sale investments		56,165		56,165
Total assets measured at fair value	\$	64,750	\$	8,585
			\$	56,165
			\$	—

		Fair Value Measurements Using			
		Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)	
		Total			
As of December 31, 2021					
Assets:					
Current:					
Cash equivalents	\$	2,052	\$	2,052	\$ — \$ —
Available-for-sale investments:					
Commercial paper		36,921		—	36,921 —
Corporate debt securities		55,713		—	55,713 —
Municipal bonds		12,941		—	12,941 —
Total available-for-sale investments		105,575		—	105,575 —
Total assets measured at fair value	\$	107,627	\$	2,052	\$ 105,575 \$ —

As of December 31, 2022 and 2021, available-for-sale investments are detailed as follows (in thousands):

December 31, 2022					
	Contractual Maturity	Gross Amortized Cost	Gross Unrealized Gains	Gross Unrealized Losses	Market Value
Available-for-sale investments:					
Commercial paper	Within 1 year	\$ 28,121	\$ —	\$ (47)	\$ 28,074
Corporate debt securities	1 to 2 years	26,401	—	(307)	26,094
Municipal bonds	Within 1 year	2,026	—	(29)	1,997
		<u>\$ 56,548</u>	<u>\$ —</u>	<u>\$ (383)</u>	<u>\$ 56,165</u>

December 31, 2021					
	Contractual Maturity	Gross Amortized Cost	Gross Unrealized Gains	Gross Unrealized Losses	Market Value
Available-for-sale investments:					
Commercial paper	Within 1 year	\$ 36,956	\$ —	\$ (35)	\$ 36,921
Corporate debt securities	1 to 2 years	55,859	—	(146)	55,713
Municipal bonds	1 to 2 years	12,973	—	(32)	12,941
		<u>\$ 105,788</u>	<u>\$ —</u>	<u>\$ (213)</u>	<u>\$ 105,575</u>

At each reporting date, we perform an evaluation of impairment to determine if the unrealized losses are other-than-temporary. Factors considered in determining whether a loss is other-than-temporary include the length of time and extent to which fair value has been less than the cost basis, the financial condition of the issuer, and our intent and ability to hold the investment until recovery of its amortized cost basis. Based on our evaluation, we determined that the unrealized losses were not other-than-temporary as of December 31, 2022.

As of December 31, 2022, 20 out of 25 available-for-sale investments, were in a gross unrealized loss position of which 12 available-for-sale investments with a market value of \$24.2 million were at such position for greater than 12 months. As of December 31, 2021, all available-for-sale investments were in a gross unrealized loss position and had been in such position for less than twelve months.

4. License, Collaboration and Other Agreements

Kyorin Pharmaceutical Co., Ltd.

In January 2020, we entered into a collaboration and license agreement (Kyorin Agreement) with Kyorin Pharmaceutical Co., Ltd. (Kyorin) for the development and commercialization of efzofitmod for the treatment of interstitial lung disease (ILD) in Japan. Under the Kyorin Agreement, Kyorin received an exclusive right to develop and commercialize efzofitmod in Japan for all forms of ILD, and is obligated to fund all research, development, regulatory, marketing and commercialization activities in Japan. In September 2020, Kyorin began dosing patients in a Phase 1 clinical trial of efzofitmod (known as KRP-R120 in Japan) and completed the last subject visit in December 2020. The Phase 1 clinical trial, which was conducted and funded by Kyorin, was a placebo-controlled clinical

trial to evaluate the safety, pharmacokinetics (PK) and immunogenicity of efzofitimid in 32 healthy Japanese male volunteers. Efzofitimid was observed to be generally well-tolerated with no drug-related serious adverse events, and PK findings were consistent with previous studies of efzofitimid. Kyorin is also participating in the EFZO-FIT study as the local sponsor in Japan. In February 2023, Kyorin dosed the first patient in Japan in the EFZO-FIT study which triggered a \$10.0 million milestone payment to us. To date, the Kyorin Agreement has generated \$20.0 million in upfront and milestone payments to us and we are eligible to receive up to an additional \$155.0 million in the aggregate upon achievement of certain development, regulatory and sales milestones, as well as tiered royalties on any net sales in Japan.

Either party may terminate the Kyorin Agreement in the event that the other party breaches the agreement and fails to cure the breach, becomes insolvent or challenges certain of the intellectual property rights licensed under the agreement.

We assessed our license and collaboration with Kyorin in accordance with Topic 606 and concluded that Kyorin is a customer. We identified the following performance obligations under the Kyorin Agreement: 1) the license of efzofitimid for ILD in Japan; and 2) free clinical trial material for Kyorin's Phase 1 clinical trial. Kyorin is participating in the EFZO-FIT study and received approval from the Pharmaceuticals and Medical Devices Agency (PMDA) to commence the EFZO-FIT study in Japan during the year ended December 31, 2022. As of December 31, 2022, Kyorin had scheduled site visits for patient screenings which led to the first patient dosing in February 2023. We determined that the development milestone achieved in February 2023 became probable of achievement as of December 31, 2022. Because our performance obligations were already completed, we recorded the \$10.0 million collaboration revenue and a receivable from Kyorin as of December 31, 2022. We also recorded an additional \$0.4 million in collaboration revenue from Kyorin during the year ended December 31, 2022 for drug product material sold to Kyorin for the Japan portion of the EFZO-FIT study.

The remaining milestones and royalty payments under the Kyorin Agreement are variable consideration. Since the milestone payments are binary in nature, we will use the "most-likely" method to evaluate whether the milestones should be included as revenue. We will constrain these amounts until the milestone is probable of being achieved. The royalties are dependent on future sales by Kyorin which are at the full discretion of Kyorin. Accordingly, we will apply a constraint to these amounts until the future sales have occurred.

5. Balance Sheet Details

Prepaid expenses consist of the following (in thousands):

	December 31,	
	2022	2021
Prepaid clinical and research expense	\$ 334	\$ 557
Prepaid manufacturing expenses	2,049	4,188
Other prepaid expenses	567	478
	<u>\$ 2,950</u>	<u>\$ 5,223</u>

Property and equipment consist of the following (in thousands):

	December 31,	
	2022	2021
Computer and office equipment	\$ 620	\$ 616
Scientific and laboratory equipment	4,379	4,383
Tenant improvements	4,414	1,701
	<u>9,413</u>	<u>6,700</u>
Less accumulated depreciation and amortization	<u>(6,354)</u>	<u>(6,157)</u>
	<u>\$ 3,059</u>	<u>\$ 543</u>

As of December 31, 2022, 2021 and 2020, depreciation expense was \$0.2 million, \$0.5 million and \$0.6 million, respectively.

Accrued expenses consist of the following (in thousands):

	December 31,	
	2022	2021
Accrued salaries, wages and benefits	\$ 2,781	\$ 2,326
Accrued clinical and manufacturing	5,151	1,004
Other accrued expenses	1,930	672
	<u>\$ 9,862</u>	<u>\$ 4,002</u>

6. Commitments and Contingencies

Operating Leases

Existing Corporate Headquarters Facility Lease

We have a non-cancelable facility lease that is subject to base lease payments, which escalate over the term of the lease, additional charges for common area maintenance and other costs. In July 2018, we entered into a lease amendment that reduced the space we lease from 24,494 square feet to 20,508 square feet and extended the lease term to May 2023. With the lease amendment, we do not have an option to extend the lease.

New Corporate Headquarters Facility Lease

In May 2022, we entered into a lease (the Lease) with San Diego Creekside, LLC (Landlord), as lessor, pursuant to which we agreed to lease from Landlord approximately 23,696 rentable square feet (subject to increase pursuant to the terms of the Lease) of office and laboratory space. The term of the lease (the Lease Term) will commence upon the earlier of April 1, 2023 or the completion of certain leasehold improvements to the Premises (as defined in the Lease), but not sooner than March 1, 2023 (the Lease Commencement Date) and continue for 124 months from the Lease Commencement Date. We also have one option to extend the Lease Term for five years. Base rent during such extension period would be at the fair market rent for the Premises. Under the terms of the Lease, the base rent during the first 12 months of the Lease Term will be \$5.75 per square foot of rentable area per month, subject to certain upward adjustments of approximately 3.0% annually. We are entitled to an allowance of \$5.5 million for tenant improvements, including an option to utilize an additional allowance of up to \$0.6 million, which, if used by us, would be repaid by us as additional monthly base rent, amortized at 8.0% per annum during the Lease Term. We provided a \$0.7 million security deposit in the form of a letter of credit which is included in restricted cash as of December 31, 2022.

Future minimum payments under the non-cancelable operating leases and reconciliation to the operating lease liability as of December 31, 2022 were as follows (in thousands):

	Operating Leases
2023	\$ 1,363
2024	1,961
2025	1,895
2026	1,777
2027	1,831
2028 and thereafter	11,102
Less: Amount representing interest	(6,911)
Present value of lease payments	13,018
Less: Current portion of operating lease liability	(630)
Less: Tenant improvement allowance not yet received	(2,755)
Long-term operating lease liability, net of current portion	<u>\$ 9,633</u>

Operating lease expense was \$1.5 million, \$1.0 million and \$1.0 million for the years ended December 31, 2022, 2021 and 2020, respectively. As of December 31, 2022 and 2021, the weighted average remaining lease term was 9.9 years and 1.4 years, respectively. As of December 31, 2022 and 2021, the weighted average discount rate was 8.8% and 9.6%, respectively.

Financing Leases

In April 2022, we entered into a master financing lease agreement to lease various research and development and information technology equipment over a 48-month term. Future minimum payments under the non-cancelable financing lease and reconciliation to the financing lease liability as of December 31, 2022 were as follows (in thousands):

	Financing Leases
2023	\$ 352
2024	352
2025	352
2026	395
2027	33
Less: Amount representing interest	(213)
Present value of lease payments	1,271
Less: Current portion of financing lease liability	(264)
Long-term financing lease liability, net of current portion	<u>\$ 1,007</u>

As of December 31, 2022, the weighted-average remaining lease term was 3.7 years and the weighted-average discount rate was 7.9%. We provided a \$2.4 million deposit to be held as collateral for the leased equipment, and this deposit is included in restricted cash as of December 31, 2022.

7. Stockholders' Equity

Underwritten Follow-On Public Offerings

In February 2023, we completed an underwritten follow-on public offering of 23,125,000 shares of our common stock, including the partial exercise of the underwriters' option to purchase additional shares, at a price to the public of \$2.25 per share. The total gross proceeds from the offering were approximately \$52.0 million, before deducting underwriting discounts, commissions and offering expenses payable by us.

In September 2021, we completed an underwritten follow-on public offering of 10,781,250 shares of our common stock, including the full exercise of the underwriters' option to purchase additional shares, at a price to the public of \$8.00 per share. The total net proceeds from the offering were approximately \$80.6 million, after deducting underwriting discounts, commissions and offering expenses payable by us.

At-the-Market Offering Programs

In April 2022, we entered into an Open Market Sale AgreementSM with Jefferies LLC (Jefferies) implementing an "at-the-market" offering program (the Jefferies ATM Offering Program), pursuant to which we may offer and sell, from time to time and at our option, up to an aggregate of \$65.0 million of shares of our common stock through Jefferies, acting as sales agent. Jefferies is entitled to a fixed commission rate of up to 3.0% of the gross sales proceeds of shares sold under the Jefferies ATM Offering Program. During the year ended December 31, 2022, we sold an aggregate of 1,421,627 shares of common stock at a weighted-average price of \$3.09 per share for net proceeds of approximately \$4.0 million under the Jefferies ATM Offering Program.

In March 2021, we entered into a Capital on DemandTM Sales Agreement with JonesTrading Institutional Services LLC (JonesTrading) for an at-the-market offering program (the JonesTrading ATM Offering Program), pursuant to which we were entitled to sell from time to time, at our option, up to an aggregate of \$25.0 million of shares of our common stock through JonesTrading, as sales agent or principal. JonesTrading was entitled to a commission at a fixed rate of up to 3.0% of the gross proceeds. During 2021, we sold an aggregate of 986,267 shares of common stock at a weighted-average price of \$4.75 per share for net proceeds of \$4.4 million under the JonesTrading ATM Offering Program. In April 2022, we terminated the JonesTrading ATM Offering Program. During 2022 and prior to termination in April 2022, we sold an aggregate of 260,455 shares of common stock at a weighted-average price of \$6.07 per share for net proceeds of approximately \$1.5 million under the JonesTrading ATM Offering Program.

In May 2019, we entered into a sales agreement with H.C. Wainwright & Co., LLC (Wainwright) for an ATM Offering Program (the Wainwright ATM Offering Program) under which we could offer and sell shares of our common stock having an aggregate offering price of up to \$10.0 million. In November 2020, we amended our sales agreement with Wainwright to increase the amount of the ATM Offering Program to \$20.0 million. Wainwright was entitled to a commission at a fixed commission rate equal to 3% of the gross proceeds. In March 2021, the ATM Offering Program with Wainwright automatically terminated upon the issuance and sale of all of the shares having an aggregate offering price of \$20.0 million. Under the Wainwright ATM Offering Program, during 2020, we sold an aggregate of 1,657,075 shares of common stock at an average price of \$4.07 per share for net proceeds of \$6.4 million. Prior to the

termination of the sales agreement with Wainwright, in 2021, we sold an aggregate of 1,988,254 shares of common stock at an average price of \$4.99 per share for net proceeds of \$9.6 million.

Purchase Agreement

In September 2020, we entered into a common stock purchase agreement (the Purchase Agreement) with Aspire Capital Fund, LLC (Aspire Capital), which provides that, upon the terms and subject to the conditions and limitations set forth therein, Aspire Capital is committed to purchase up to an aggregate of \$20.0 million of shares of our common stock at our request from time to time during the 30 month term of the Purchase Agreement. Concurrently with entering into the Purchase Agreement, we also entered into a registration rights agreement with Aspire Capital, in which we agreed to file one or more registration statements, as permissible and necessary to register under the Securities Act of 1933, as amended, for the resale of the shares of our common stock that have been and may be issued to Aspire Capital under the Purchase Agreement. In 2021, we sold an aggregate of 3,000,000 shares of common stock at a weighted-average price of \$5.09 per share for net proceeds of \$15.2 million under the Purchase Agreement. There were no issuances or sales under the Purchase Agreement during the year ended December 31, 2022, and this agreement has terminated effective March 11, 2023.

2014 Stock Plan

We adopted a stock option plan in 2007 (the 2007 Plan), which was subsequently amended, restated and renamed in July 2014 (the 2014 Plan) to provide for the incentive stock options, nonstatutory stock options, stock and rights to purchase restricted stock to eligible recipients. Recipients of incentive stock options are eligible to purchase shares of our common stock at an exercise price equal to no less than the estimated fair market value of such stock on the date of grant. The maximum term of options under the 2014 Plan is ten years. Options granted generally vest over four years. We ceased granting under the 2014 Plan after our IPO in May 2015. Shares underlying any awards under the 2014 Plan that are forfeited, canceled, reacquired by us prior to vesting, satisfied without the issuance of stock or otherwise terminated (other than by exercise) will be added to shares available for issuance under the 2015 Plan.

2015 Stock Plan

In April 2015, our board of directors adopted, and our stockholders approved, the 2015 Stock Plan (the 2015 Plan) which became effective on May 6, 2015. Awards granted under the 2014 Plan prior to our IPO that are forfeited, canceled, reacquired by us prior to vesting satisfied without the issuance of stock or otherwise terminated (other than by exercise) will be added to shares available for issuance under the 2015 Plan. Total shares available for issuance under the 2015 Plan as of December 31, 2022 were 962,179. Shares underlying any awards under the 2015 Plan that are forfeited, canceled, reacquired by us prior to vesting, satisfied without the issuance of stock or otherwise terminated (other than by exercise) will be added to shares available for issuance under the 2015 Plan.

The maximum term of options granted under 2015 Plan is ten years. For an initial grant to an employee, 25% of the options generally vest on the first anniversary of the original vesting date, with the balance vesting monthly over the remaining three years. For subsequent grants to an employee, the options generally vest monthly over a four-year term.

Inducement Plan

In March 2022, our board of directors approved and adopted our 2022 Inducement Plan (our Inducement Plan). Awards granted under our Inducement Plan are in accordance with Nasdaq Listing Rule 5635(c)(4). A total of 300,000 shares of our common stock were initially reserved for the issuance under our Inducement Plan.

The maximum term of options granted under our Inducement Plan is ten years. Each option vests over a period of four years, with 25% of the shares vesting on the one-year anniversary of the applicable vesting commencement date and the remaining 75% vesting in equal monthly installments over three years, thereafter, subject to continuous employment.

During year ended December 31, 2022, we granted nonstatutory stock options under our Inducement Plan to purchase an aggregate of 205,600 shares of our common stock, with a weighted-average exercise price of \$3.94 per share as inducement awards to new employees.

Employee Stock Purchase Plan

In April 2015, our board of directors adopted, and our stockholders approved, our 2015 Employee Stock Purchase Plan (the 2015 ESPP) which became effective on May 6, 2015. As of December 31, 2022, total shares reserved for issuance under the 2015 ESPP were 801,321.

Stock-based Compensation

Stock Options

Stock option activity is summarized as follows:

	Number of Outstanding Stock Options	Weighted- Average Exercise Price	Weighted Remaining Contractual Term	Aggregate Intrinsic Value
Outstanding as of December 31, 2021	1,412,550	\$ 12.01		
Granted	1,590,844	\$ 3.43		
Exercises	(259)	\$ 3.77		
Canceled/forfeited/expired	(46,965)	\$ 8.59		
Outstanding as of December 31, 2022	2,956,170	\$ 7.45	8.47	\$ —

The assumptions used in the Black-Scholes option pricing model to determine the fair value of the employee stock option grants were as follows:

	Years Ended December 31,		
	2022	2021	2020
Expected term (in years)	5.98 – 6.08	5.50 – 6.08	5.50 – 6.08
Risk-free interest rate	1.7% – 4.2%	0.6% – 1.3%	0.3% – 1.5%
Expected volatility	84.2% – 86.5%	86.3% – 104.8%	102.2% – 109.7%
Expected dividend yield	0.0%	0.0%	0.0%

The assumptions used in the Black-Scholes option pricing model to determine the fair value of the ESPP offering were as follows:

	Years Ended December 31,		
	2022	2021	2020
Expected term (in years)	0.50	0.50	0.50
Risk-free interest rate	0.06% – 4.54%	0.04% – 0.12%	0.1% – 1.6%
Expected volatility	51.9% – 95.9%	89.7% – 108.12%	89.7% – 143.2%
Expected dividend yield	0.0%	0.0%	0.0%

Expected term. The expected term represents the period of time that options are expected to be outstanding. Because we do not have sufficient history of exercise behavior, we determine the expected life assumption using the simplified method, which is an average of the contractual term of the option and its vesting period.

Risk-free interest rate. We base the risk-free interest rate assumption on the U.S. Treasury's rates for U.S. Treasury zero-coupon bonds with maturities similar to those of the expected term of the award being valued.

Expected volatility. The expected volatility assumption is based on our historical volatility as well as the volatilities of a peer group of similar companies whose share prices are publicly available. The peer group was developed based on companies in the biotechnology industry.

Expected dividend yield. We base the expected dividend yield assumption on the fact that we have never paid cash dividends and have no present intention to pay cash dividends.

Restricted Stock Units

Occasionally, we grant restricted stock units to employees. The fair value of restricted stock is determined by the closing price of the our common stock reported on the Nasdaq Capital Market on the date of grant. Restricted stock unit activity is summarized as follows:

	Number of Outstanding Restricted Stock Units	Weighted-Average Grant Date Fair Value
Balance as of December 31, 2021	7,500	\$ 4.08
Granted	116,438	\$ 5.13
Released	(2,500)	\$ 4.13
Balance as of December 31, 2022	121,438	\$ 5.09

The allocation of stock-based compensation for all options, including performance options with market condition and restricted stock units is as follows (in thousands):

	Years Ended December 31,		
	2022	2021	2020
Research and development	\$ 528	\$ 295	\$ 254
General and administrative	1,626	1,319	1,211
Total stock-based compensation expense	\$ 2,154	\$ 1,614	\$ 1,465

The weighted-average grant date fair value per share of stock options granted by us, during the years ended December 31, 2022, 2021 and 2020 was \$2.49, \$3.82 and \$3.39, respectively. The total grant date fair value of restricted stock units granted by us during the years ended December 31, 2022, 2021, and 2020 was approximately \$597,000, \$16,000 and \$21,000, respectively. The aggregate intrinsic value of stock options exercised during the years ended December 31, 2022, 2021 and 2020 was approximately \$1,000, \$80,000 and \$0, respectively. The aggregate intrinsic value of restricted stock units released during the years ended December 31, 2022, 2021 and 2020 was approximately \$6,000, \$31,000 and \$34,000, respectively. As of December 31, 2022, total unrecognized share-based compensation expense related to unvested stock options and restricted stock units was approximately \$5.5 million and \$0.4 million, respectively. As of December 31, 2022, these unrecognized costs for options and restricted stock units are expected to be recognized ratably over a weighted-average period of approximately 3.0 years and 2.2 years, respectively.

Warrants

Warrants outstanding for the purchase of common stock as of December 31, 2022 were as follows:

Number Outstanding	Exercise Price Per Share	Expiration Date
1,066	\$ 281.50	July 2023
6,830	\$ 43.93	November 2023
2,978	\$ 50.37	June 2024
2,886	\$ 51.98	December 2024
13,760		

Common Stock Reserved for Future Issuance

Common stock reserved for future issuance was as follows:

	December 31, 2022
Common stock warrants	13,760
Common stock options and restricted stock units	3,077,608
Shares available under the 2015 equity incentive plan	962,179
Shares available under the 2022 inducement plan	98,400
Shares available under the employee stock purchase plan	801,321
	4,953,268

8. Income Tax

Pretax losses were generated by both domestic and foreign operations as follows (in thousands):

	Years Ended December 31,		
	2022	2021	2020
United States	\$ (45,086)	\$ (33,316)	\$ (15,950)
Foreign	(254)	(458)	(280)
Worldwide pre-tax loss	<u>\$ (45,340)</u>	<u>\$ (33,774)</u>	<u>\$ (16,230)</u>

For the years ended December 31, 2022, 2021, and 2020, we did not record a provision for income taxes due to a full valuation allowance against our deferred taxes. A reconciliation of the expected statutory federal income tax provision to the actual income tax provision is summarized as follows (in thousands):

	Years Ended December 31,		
	2022	2021	2020
Expected income taxes benefit at federal statutory rate	\$ (9,521)	\$ (7,093)	\$ (3,408)
State income taxes, net of federal benefit	(380)	(2,313)	(12)
Permanent items and other	438	592	169
Stock compensation	44	90	804
Research credits	(4,415)	(1,253)	(835)
Unrecognized tax benefits	2,454	500	334
Foreign rate differential	11	21	13
Change in tax rate	34	52	(7)
Change in valuation allowance	11,335	9,404	2,942
Income tax (benefit) expense	<u>\$ —</u>	<u>\$ —</u>	<u>\$ —</u>

Deferred income taxes are provided for temporary differences in recognizing certain income and expense items for financial and tax reporting purposes. The deferred tax assets consisted primarily of the income tax benefits from net operating loss (NOL) carryforwards, research and development credits and capitalized research and development expenses, along with other accruals and reserves. Valuation allowances of \$95.5 million and \$84.1 million as of December 31, 2022 and 2021, respectively, have been recorded to offset deferred tax assets as realization of such assets does not meet the more-likely-than-not threshold under ASC 740, *Accounting for Income Taxes*.

Significant components of our deferred tax assets are summarized as follows (in thousands):

	December 31,	
	2022	2021
Deferred tax assets:		
Net operating loss carryforwards	\$ 52,752	\$ 48,833
Capitalized research and development expenses	22,576	18,086
Research credits and other state credits	16,021	13,695
Intangible assets	1,278	1,465
Reserve and accruals	596	641
Share-based compensation expense	1,628	1,369
Lease liability	2,157	290
Total tax assets	97,008	84,379
Valuation allowance	(95,484)	(84,112)
Total deferred tax assets	<u>\$ 1,524</u>	<u>\$ 267</u>
Deferred tax liabilities:		
Right of use lease assets	(1,524)	(267)
Total deferred tax liabilities	<u>(1,524)</u>	<u>(267)</u>
Net deferred tax assets	<u>\$ —</u>	<u>\$ —</u>

The Tax Cuts and Jobs Act of 2017 requires taxpayers to capitalize and amortize research and development (R&D) expenditures under section 174 for tax years beginning after December 31, 2021. This rule became effective at the beginning of 2022 which resulted in a capitalization of R&D costs of approximately \$41.0 million. We will amortize these costs for tax purposes over 5 years if the R&D was performed in the U.S. and over 15 years if the R&D was performed outside the U.S.

As of December 31, 2022, we had federal NOL carryforwards of approximately \$221.0 million, with \$108.5 million of NOLs generated after December 31, 2017 carrying forward indefinitely and \$112.5 million of NOLs that will begin to expire in 2025. NOL carryforwards generated after January 1, 2018 are subject to an 80% of taxable income limitation in accordance with the Tax Cuts and Jobs Act of 2017. We had state net operating loss carryforwards of approximately \$194.4 million, and foreign net operating loss carryforwards of \$9.0 million. The state net operating losses began to expire in 2022. The foreign net operating losses carry over indefinitely.

As of December 31, 2022, we had federal and state research and development credit carryforwards of approximately \$8.3 million and \$5.2 million, respectively, which begin to expire in 2026 for both federal and state purposes. We had \$15.4 million of federal Orphan Drug Credits as of December 31, 2022, which will begin to expire in 2035.

Utilization of the domestic NOL and research and development credit carryforwards may be subject to a substantial annual limitation due to ownership change limitations that may have occurred or that could occur in the future, as required by Sections 382 and 383 of the Internal Revenue Code of 1986, as amended (the Code), as well as similar state and foreign provisions. These ownership changes may limit the amount of NOL and research and development credit carryforwards that can be utilized annually to offset future taxable income and tax, respectively. In general, an “ownership change” as defined by Section 382 of the Code results from a transaction or series of transactions over a three-year period resulting in an ownership change of more than 50 percentage points of the outstanding stock of a company by certain stockholders. Since the Company’s formation, we raised capital through the issuance of capital stock on several occasions which on its own or combined with the purchasing stockholders’ subsequent disposition of those shares, has resulted in such an ownership change, and could result in an ownership change in the future.

Upon the occurrence of an ownership change under Section 382 as outlined above, utilization of the NOL and research and development credit carryforwards become subject to an annual limitation under Section 382 of the Code, which is determined by first multiplying the value of our stock at the time of the ownership change by the applicable long-term, tax-exempt rate, which could be subject to additional adjustments. Any limitation may result in expiration of a portion of our NOL or research and development credit carryforwards before utilization. Due to the existence of the valuation allowance, any impact to the NOL and research and development tax credit carryforwards from Section 382 analysis will be offset by a corresponding adjustment to valuation allowance, resulting in no tax provision impact.

We recognize a tax benefit from an uncertain tax position when it is more likely than not that the position will be sustained upon examination, including resolutions of any related appeals or litigation processes, based on the technical merits. Income tax positions must meet a more-likely-than-not recognition threshold to be recognized.

Our practice is to recognize interest and penalties related to income tax matters in income tax expense. We had no accrual for interest and penalties on our balance sheet and had not recognized interest or penalties in the consolidated statements of operations for the years ended December 31, 2022, 2021 and 2020.

Due to the existence of the valuation allowance, future changes in unrecognized tax benefits will not impact our effective tax rate.

Uncertain tax positions are evaluated based upon the facts and circumstances that exist at each reporting period. Subsequent changes in judgment based upon new information may lead to changes in recognition, derecognition, and measurement. Adjustments may result, for example, upon resolution of an issue with the taxing authorities, or expiration of a statute of limitations barring an assessment for an issue.

The activity related to our unrecognized tax benefits is summarized as follows (in thousands):

	December 31,		
	2022	2021	2020
Balance as of beginning of year	\$ 22,232	\$ 21,707	\$ 21,302
Increase (decrease) related to prior year tax positions	(48)	(9)	3
Increase related to current year tax positions	2,961	534	402
Balance as of end of year	<u>\$ 25,145</u>	<u>\$ 22,232</u>	<u>\$ 21,707</u>

We do not anticipate that the amount of unrecognized tax benefits as of December 31, 2022 will change within the next twelve months.

We are subject to taxation in the United States, Hong Kong and state jurisdictions. Our tax years from inception are subject to examination by the United States, Hong Kong and various state authorities due to carry forward of unutilized NOLs and research and development credits.

9. Employee Benefits

401(k) Plan

We maintain a defined contribution 401(k) plan available to eligible employees. Employee contributions are voluntary and are determined on an individual basis, limited to the maximum amount allowable under federal tax regulations. In April 2015, our Board of Directors approved a policy, beginning on June 1, 2015, to match employee contributions equal to 50% of the participant's contribution of up to a maximum of 6% of the participant's annual salary. We made discretionary contributions totaling \$0.2 million during each of the years ended December 31, 2022, 2021 and 2020.

10. Subsequent Events

Achievement of Development Milestone by Kyorin

On February 6, 2023, we announced that our partner Kyorin dosed the first patient in Japan in the EFZO-FIT study. This achievement triggered a \$10.0 million milestone payment by Kyorin to us pursuant to the Kyorin Agreement and we received the cash payment of \$10.0 million in February 2023. Kyorin is our partner for the development and commercialization of efzofitmod for ILD in Japan. Under the Kyorin Agreement, we have generated \$20.0 million in upfront and milestone payments to date and are eligible to receive up to an additional \$155.0 million in the aggregate upon the achievement of certain development, regulatory and sales milestones, as well as tiered royalties on any net sales in Japan. Kyorin has the exclusive rights to develop and commercialize efzofitmod in Japan for all forms of ILD.

Follow-On Public Offering

In February 2023, we completed an underwritten follow-on public offering of 23,125,000 shares of our common stock, including the partial exercise of the underwriters' option to purchase additional shares, at a price to the public of \$2.25 per share. The total gross proceeds from the offering were approximately \$52.0 million, before deducting underwriting discounts, commissions and offering expenses payable by us.

Sales of Common Stock through the ATM Offering Program

From January 1, 2023 through March 14, 2023, we sold an aggregate of 516,453 shares of common stock at a weighted-average price of \$2.35 per share through the ATM Offering Program for net proceeds of \$1.2 million.

Silicon Valley Bank Closure

On March 10, 2023, we became aware of reports indicating the closure of Silicon Valley Bank (SVB) and the appointment of the Federal Deposit Insurance Corporation as receiver. As of March 10, 2023, we hold less than 2% of our current cash, cash equivalents, restricted cash and available-for-sale investments with SVB.

Item 9. Changes in and Disagreements With Accountants on Accounting and Financial Disclosure.

None

Item 9A. Controls and Procedures.

Evaluation of Disclosure Controls and Procedures

We maintain disclosure controls and procedures, as defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act that are designed to ensure that information required to be disclosed in our periodic and current reports that we file with the SEC is recorded, processed, summarized and reported within the time periods specified in the SEC's rules and forms, and that such information is accumulated and communicated to our management, including our Principal Executive Officer and Principal Financial Officer, as appropriate, to allow timely decisions regarding required disclosure. In designing and evaluating the disclosure controls and procedures, management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable and not absolute assurance of achieving the desired control objectives. In reaching a reasonable level of assurance, management necessarily is required to apply its judgment in evaluating the cost-benefit relationship of possible controls and procedures. In addition, the design of any system of controls also is based in part upon certain assumptions about the likelihood of future events, and there can be no assurance that any design will succeed in achieving its stated goals under all potential future conditions; over time, control may become inadequate because of changes in conditions, or the degree of compliance with policies or procedures may deteriorate. Because of the inherent limitations in a cost-effective control system, misstatements due to error or fraud may occur and not be detected.

We carried out an evaluation, under the supervision and with the participation of our management, including our Principal Executive Officer and Principal Financial Officer, of the effectiveness of the design and operation of our disclosure controls and procedures, as defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act. Based on this evaluation, our Principal Executive Officer and Principal Financial Officer concluded that our disclosure controls and procedures were effective at the reasonable assurance level as of December 31, 2022.

Management's Report on Internal Control Over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting as such term is defined in Rules 13a-15(f) and 15d-15(f) of the Exchange Act. Internal control over financial reporting is a process designed under the supervision and with the participation of our management, including our Principal Executive Officer and Principal Financial Officer, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with accounting principles generally accepted in the United States of America.

As of December 31, 2022, our management assessed the effectiveness of our internal control over financial reporting using the criteria set forth by the Committee of Sponsoring Organizations of the Treadway Commission in Internal Control – 2013 Integrated Framework (2013 Framework). Based on this assessment, our management concluded that our internal control over financial reporting was effective as of December 31, 2022.

This Annual Report does not include an attestation report of our registered public accounting firm under Section 404(b) of the Sarbanes-Oxley Act (15 U.S.C. 7262(b)).

Changes in Internal Control Over Financial Reporting

During the quarter ended December 31, 2022, there have been no changes in our internal control over financial reporting, as such term is defined in Rules 13a-15(f) and 15d-15(f) promulgated under the Exchange Act, that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

Item 9B. Other Information.

None.

Item 9C. Disclosure Regarding Foreign Jurisdictions that Prevent Inspections.

Not applicable.

PART III

Item 10. Directors, Executive Officers and Corporate Governance.

Except as set forth below, the information required by this item will be contained in our Definitive Proxy Statement to be filed with the SEC in connection with our 2023 Annual Meeting of Stockholders within 120 days after the end of the fiscal year ended December 31, 2022, under the sections headed "Proposal 1 – Election of Directors," "Executive Officers" and "Delinquent Section 17(a) Reports," and is incorporated herein by reference.

We have adopted a written code of ethics for directors, officers (including our principal executive officer, principal financial officer and principal accounting officer or persons performing similar functions) and employees, known as the Code of Business Conduct and Ethics. The Code of Business Conduct and Ethics is available on our website at <http://www.atyrpharma.com> under the Corporate Governance section of our Investors and Media page. If we make any substantive amendments to, or grant any waivers from, the Code of Business Conduct and Ethics for any officer or director, we will disclose the nature of such amendment or waiver on our website or in a Current Report on Form 8-K.

Item 11. Executive Compensation.

The information required by this item will be contained in our Definitive Proxy Statement and is incorporated herein by reference.

Item 12. Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters.

The information required by this item will be contained in our Definitive Proxy Statement, under the sections headed "Proposal 4 – Approval of an Amendment to the 2015 Stock Plan" and "Security Ownership of Certain Beneficial Owners and Management," and is incorporated herein by reference.

Item 13. Certain Relationships and Related Transactions, and Director Independence.

The information required by this item will be contained in our Definitive Proxy Statement, under the sections headed “Proposal 1 – Election of Directors” and “Certain Relationships and Related Transactions,” and is incorporated herein by reference.

Item 14. Principal Accountant Fees and Services.

The information required by this item will be contained in our Definitive Proxy Statement, under the section headed “Proposal 2 – Ratification of Auditors,” and is incorporated herein by reference.

PART IV

Item 15. Exhibit and Financial Statement Schedules.

(a) The following documents are filed as part of this Annual Report.

1. *Index list to Financial Statements:*

	Page
Report of Independent Registered Public Accounting Firm (PCAOB ID: 42)	70
Consolidated Balance Sheets	72
Consolidated Statements of Operations	73
Consolidated Statements of Comprehensive Loss	74
Consolidated Statements of Stockholders’ Equity	75
Consolidated Statements of Cash Flows	76
Notes to Consolidated Financial Statements	77

2. *Financial Statement Schedules.*

Schedules have been omitted as all required information has been disclosed in the financial statements and related footnotes.

3. *Exhibits.*

The Exhibits listed in the Exhibit Index are filed as a part of this Annual Report.

EXHIBIT INDEX

Exhibit Number	Exhibit Title	Form	Incorporated by Reference		Filing Date
			File No.	Exhibit	
3.1	Restated Certificate of Incorporation of the Registrant	S-1/A	333-203272	3.2	May 1, 2015
3.2	Certificate of Amendment to Restated Certificate of Incorporation of the Registrant	8-K	001-37378	3.1	June 28, 2019
3.3	Certificate of Amendment to Restated Certificate of Incorporation of the Registrant	10-Q	001-37378	3.3	May 12, 2020
3.4	Certificate of Amendment to Restated Certificate of Incorporation of the Registrant	8-K	001-37378	3.1	May 4, 2021
3.5	Certificate of Amendment to Restated Certificate of Incorporation of the Registrant	8-K	001-37378	3.1	April 29, 2022
3.6	Amended and Restated Bylaws of the Registrant	10-Q	333-203272	3.6	November 11, 2022
4.1	Specimen Common Stock Certificate	S-1/A	333-203272	4.1	April 27, 2015
4.2	Warrant to Purchase Stock issued to Silicon Valley Bank on July 24, 2013	S-1	333-203272	4.4	April 6, 2015
4.3	Warrant to Purchase Stock issued to Silicon Valley Bank on November 18, 2016	10-K	001-37378	4.5	March 16, 2017
4.4	Warrant to Purchase Stock issued to Solar Capital Ltd on November 18, 2016	10-K	001-37378	4.6	March 16, 2017
4.5	Warrant to Purchase Stock issued to Silicon Valley Bank on June 30, 2017	10-Q	001-37378	4.7	August 14, 2017
4.6	Warrant to Purchase Stock issued to Solar Capital Ltd on June 30, 2017	10-Q	001-37378	4.8	August 14, 2017
4.7	Warrant to Purchase Stock issued to Silicon Valley Bank on December 22, 2017	10-K	001-37378	4.8	March 20, 2018
4.8	Warrant to Purchase Stock issued to Solar Capital Ltd on December 22, 2017	10-K	001-37378	4.9	March 20, 2018
4.9	Description of Common Stock of the Registrant	—	—	—	Filed herewith
10.1*	2014 Stock Plan and forms of agreements thereunder	S-1/A	333-203272	10.1	April 27, 2015
10.2*	2015 Stock Option and Incentive Plan, as amended	8-K	001-37378	10.1	April 29, 2022
10.3*	Forms of agreement under 2015 Stock Option and Incentive Plan	S-1/A	333-203272	10.2	April 27, 2015
10.4	Lease by and between the Registrant and BMR-John Hopkins Court LLC, dated December 22, 2011	S-1	333-203272	10.9	April 6, 2015
10.5	First Amendment to Lease between the Registrant and BMR-3545-3575 JOHN HOPKINS LP (as successor-in-interest to BMR-John Hopkins Court LLC), dated January 4, 2017	10-K	001-37378	10.8	March 16, 2017
10.6	Form of Indemnification Agreement entered into between the Registrant and its directors	S-1/A	333-203272	10.12	April 27, 2015
10.7	Form of Indemnification Agreement entered into between the Registrant and its officers	S-1/A	333-203272	10.13	April 27, 2015
10.8*	2015 Employee Stock Purchase Plan	S-1/A	333-203272	10.14	April 29, 2022
10.9*	Senior Executive Cash Incentive Bonus Plan	8-K	001-37378	10.1	January 29, 2016

Exhibit Number	Exhibit Title	Form	Incorporated by Reference		Filing Date
			File No.	Exhibit	
10.10*	Executive Severance and Change in Control Policy	10-K	001-37378	10.16	March 30, 2016
10.11*	Registrant's Non-Qualified Stock Option Agreement for Non-Plan Inducement Grant	10-Q	001-37378	10.1	November 14, 2016
10.12	Second Amendment to Lease between the Registrant and BMR-3545-3575 John Hopkins LP (as successor-in-interest to BMR-John Hopkins Court, LLC), dated April 27, 2017	10-Q	001-37378	10.1	May 11, 2017
10.13*	Employment Agreement, dated November 1, 2017, by and between the Registrant and Sanjay S. Shukla, M.D., M.S.	10-Q	001-37378	10.4	November 14, 2017
10.14*	Employment Offer Letter by and between the Registrant and Jill M. Broadfoot, dated July 16, 2018	8-K	001-37378	10.1	August 1, 2018
10.15	Third Amendment to Lease between Registrant and BMR-3545-3575 John Hopkins LP (as successor-in interest to BMR-John Hopkins Court, LLC), dated July 30, 2018	10-Q	001-37378	10.1	November 11, 2018
10.16*	Employment Offer Letter by and between Registrant and Ms. Nancy Krueger, Esq., dated October 7, 2014	10-Q	001-37378	10.2	May 14, 2019
10.17†	Collaboration and License Agreement by and between Registrant and Kyorin Pharmaceutical Co., Ltd., dated January 6, 2020	S-1/A	333-235951	10.21	February 3, 2020
10.18*	First Amendment to Employment Agreement dated February 5, 2021, by and between the Registrant and Sanjay S. Shukla, M.D., M.S.	10-K	001-37378	10.19	March 24, 2021
10.19*	aTyr Pharma, Inc. 2015 Stock Option and Incentive Plan, as amended	8-K	001-37378	10.1	April 29, 2022
10.20*	aTyr Pharma, Inc. 2015 Employee Stock Purchase Plan, as amended	8-K	001-37378	10.2	April 29, 2022
10.21*	aTyr Pharma, Inc. 2022 Inducement Plan	10-Q	001-37378	10.3	May 10, 2022
10.22*	Forms of Grant Notice and Stock Option Agreement under aTyr Pharma, Inc. 2022 Inducement Plan	10-Q	001-37378	10.4	May 10, 2022
10.23	Open Market Sale Agreement SM dated April 22, 2022 by and between the Registrant and Jefferies LLC	8-K	001-37378	1.1	April 22, 2022
10.24	Lease date May 12, 2022, by and between the Registrant and San Diego Creekside, LLC	8-K	001-37378	10.1	May 16, 2022
21.1	Subsidiaries of the Registrant	S-1	333-203272	21.1	April 6, 2015
23.1	Consent of Independent Registered Public Accounting Firm	—	—	—	Filed herewith
24.1	Power of Attorney (included on signature page to this Annual Report)	—	—	—	Filed herewith
31.1	Certification of Principal Executive Officer required by Rule 13a-14(a) or Rule 15d-14(a) of the Securities Exchange Act of 1934, as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002	—	—	—	Filed herewith
31.2	Certification of Principal Financial Officer required by Rule 13a-14(a) or Rule 15d-14(a) of the Securities Exchange Act of 1934, as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002	—	—	—	Filed herewith
32.1#	Certification of Principal Executive Officer pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002	—	—	—	Filed herewith
32.2#	Certification of Principal Financial Officer pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002	—	—	—	Filed herewith

Exhibit Number	Exhibit Title	Form	Incorporated by Reference		Filing Date
			File No.	Exhibit	
101.INS	Inline XBRL Instance Document	—	—	—	Filed herewith
101.SCH	Inline XBRL Taxonomy Extension Schema Document	—	—	—	Filed herewith
101.CAL	Inline XBRL Taxonomy Extension Calculation Linkbase Document	—	—	—	Filed herewith
101.DEF	Inline XBRL Taxonomy Extension Definition Linkbase Document	—	—	—	Filed herewith
101.LAB	Inline XBRL Taxonomy Extension Label Linkbase Document	—	—	—	Filed herewith
101.PRE	Inline XBRL Taxonomy Extension Presentation Linkbase Document	—	—	—	Filed herewith
104	Cover Page Interactive Data File (embedded within the Inline XBRL and contained in Exhibits 101)	—	—	—	Filed herewith

* Indicates a management contract or compensatory plan, contract or arrangement.

† Certain portions have been omitted because the Registrant has determined that the information is not material and is the type that the Registrant treats as private or confidential.

The information in Exhibits 32.1 and 32.2 shall not be deemed “filed” for purposes of Section 18 of the Exchange Act, or otherwise subject to the liabilities of that section, nor shall it be deemed incorporated by reference in any filing under the Securities Act or the Exchange Act (including this Annual Report on Form 10-K), unless the Registrant specifically incorporates the foregoing information into those documents by reference.

Item 16. Form 10-K Summary.

None.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

aTyr Pharma, Inc.

Date: March 14, 2023

By /s/ Sanjay S. Shukla
Sanjay S. Shukla, M.D., M.S.
President, Chief Executive Officer and Director
(Principal Executive Officer)

POWER OF ATTORNEY

KNOW ALL PERSONS BY THESE PRESENTS, that each person whose signature appears below constitutes and appoints Sanjay S. Shukla, M.D., M.S. and Jill M. Broadfoot, jointly and severally, and each of them, his or her true and lawful attorneys-in-fact, each with full power of substitution, for him or her in any and all capacities, to sign any amendments to this Annual Report on Form 10-K and to file the same, with exhibits thereto and other documents in connection therewith, with the Securities and Exchange Commission, hereby ratifying and confirming all that each of said attorneys-in-fact or their substitute or substitutes may do or cause to be done by virtue hereof.

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacities and on the dates indicated.

Signature	Title	Date
<u>/s/ Sanjay S. Shukla</u> Sanjay S. Shukla, M.D., M.S.	President, Chief Executive Officer and Director (Principal Executive Officer)	March 14, 2023
<u>/s/ Jill M. Broadfoot</u> Jill M. Broadfoot	Chief Financial Officer (Principal Financial and Accounting Officer)	March 14, 2023
<u>/s/ John K. Clarke</u> John K. Clarke	Chairman of the Board	March 14, 2023
<u>/s/ Timothy P. Coughlin</u> Timothy P. Coughlin	Director	March 14, 2023
<u>/s/ Jane A. Gross</u> Jane A. Gross, Ph.D.	Director	March 14, 2023
<u>/s/ Svetlana Lucas</u> Svetlana Lucas, Ph.D.	Director	March 14, 2023
<u>/s/ Paul Schimmel</u> Paul Schimmel, Ph.D.	Director	March 14, 2023
<u>/s/ Sara Zaknoen</u> Sara Zaknoen	Director	March 14, 2023

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aTyr Pharma, Inc.

Stock Listing

NASDAQ: LIFE

Annual Meeting

The Annual Meeting of Stockholders
will be held at 9:00 a.m. Pacific Time on May 17, 2023
at aTyr Pharma Corporate Headquarters

Independent Auditor

Ernst & Young LLP
San Diego, CA

Transfer Agent

American Stock Transfer & Trust Company, LLC
6201 15th Avenue
Brooklyn, NY 11219
800.937.5449

Corporate Headquarters

10240 Sorrento Valley Road, Suite #300
San Diego, CA 92121
858.731.8389
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