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PROSPECTUS SUPPLEMENT
(To Prospectus dated August 24, 2023)

Filed Pursuant to Rule 424(b)(5)
Registration No. 333-273961

45,860,000 Shares of Common Stock
Pre-Funded Warrants to Purchase 700,000 Shares of Common Stock



We are offering 45,860,000 shares of our common stock, par value \$0.001 per share, and, in lieu of the shares of common stock to certain investors that so choose, pre-funded warrants to purchase 700,000 shares of our common stock pursuant to this prospectus supplement and the accompanying prospectus. The public offering price for each share of common stock is \$2.90. The public offering price of each pre-funded warrant will equal the price per share at which shares of our common stock are being sold to the public in this offering, minus \$0.001 per share of common stock, the exercise price of each pre-funded warrant. We are also offering the shares of our common stock that are issuable from time to time upon exercise of the pre-funded warrants.

Our common stock is listed on the Nasdaq Capital Market (“Nasdaq”) under the trading symbol “XFOR.” On October 23, 2025, the last reported sale price of our common stock was \$3.09 per share. There is no established public trading market for the pre-funded warrants, and we do not expect a market to develop. We do not intend to apply for listing of the pre-funded warrants on Nasdaq or any securities exchange or nationally recognized trading system. Without an active trading market, the liquidity of the pre-funded warrants will be limited.

Investing in our securities involves a high degree of risk. Before making an investment decision, you should review carefully and consider all of the information set forth in this prospectus supplement, the accompanying prospectus and the documents incorporated by reference in this prospectus supplement. See “Risk Factors” beginning on page S-5 of this prospectus supplement and in the documents incorporated by reference into this prospectus supplement.

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

	Per Share	Per Pre-Funded Warrant	Total
Public offering price	\$ 2.900	\$ 2.899	\$ 135,023,300
Underwriting discounts and commissions	\$ 0.174	\$ 0.174	\$ 8,101,440
Proceeds to X4 Pharmaceuticals, Inc, before expenses ⁽¹⁾	\$ 2.726	\$ 2.725	\$ 126,921,860

(1) See the section of this prospectus supplement titled “Underwriting” for a description of the compensation payable to the underwriters.

We have granted the underwriters an option to purchase up to an additional 6,984,000 shares of our common stock at the public offering price, less the underwriting discount, for 30 days after the date of this prospectus supplement.

Certain of our officers have indicated an interest in purchasing shares of our common stock in this offering at the public offering price. However, because indications of interest are not binding agreements or commitments to purchase, the underwriter could determine to sell more, less or no shares to any of these potential investors and any of these potential investors could determine to purchase more, less or no shares in this offering. The underwriting discount for any shares sold to these potential investors in the offering will be the same as the underwriting discount for the shares sold to the public.

We are a “smaller reporting company” under the federal securities laws and are subject to reduced public company reporting requirements.

The underwriters expect to deliver the securities being offered hereby to purchasers on or about October 27, 2025.

Leerink Partners

Stifel

Guggenheim Securities

The date of this prospectus supplement is October 23, 2025.

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Prospectus

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ABOUT THIS PROSPECTUS SUPPLEMENT

This prospectus supplement is part of a registration statement that we have filed with the SEC utilizing a “shelf” registration process. Under the shelf registration statement, we may offer shares of our common stock, preferred stock, debt securities and warrants, including common stock or preferred stock upon conversion of debt securities, common stock upon conversion of preferred stock, or common stock, preferred stock or debt securities upon the exercise of warrants, having an aggregate offering price of up to \$300,000,000.

We provide information to you about this offering of securities in two separate documents that are bound together: (1) this prospectus supplement, which describes the specific details regarding this offering; and (2) the accompanying prospectus, which provides general information, some of which may not apply to this offering. Generally, when we refer to this “prospectus,” we are referring to both documents combined, including all documents incorporated by reference into this prospectus supplement and the accompanying prospectus. If information in this prospectus supplement is inconsistent with the accompanying prospectus, you should rely on this prospectus supplement. However, if any statement in one of these documents is inconsistent with a statement in another document having a later date—for example, a document incorporated by reference in this prospectus supplement—the statement in the document having the later date modifies or supersedes the earlier statement as our business, financial condition, results of operations and prospects may have changed since the earlier dates.

We have not, and the underwriters have not, authorized any other person to provide you with any information or to make any representations other than those contained in or incorporated by reference in this prospectus supplement, the accompanying prospectus and any free writing prospectus prepared by or on behalf of us or to which we have referred you. We and the underwriters take no responsibility for, and can provide no assurance as to the reliability of, any other information that others may give you. We and the underwriters are not making an offer to sell or soliciting an offer to buy our securities in any jurisdiction in which an offer or solicitation is not authorized or in which the person making that offer or solicitation is not qualified to do so or to anyone to whom it is unlawful to make an offer or solicitation. You should assume that the information appearing in this prospectus supplement, the accompanying prospectus, the documents incorporated by reference into this prospectus supplement and in any free writing prospectus that we may authorize for use in connection with this offering, is accurate only as of the date of those respective documents. Our business, financial condition, results of operations and prospects may have changed since those dates. You should read this prospectus supplement, the accompanying prospectus, the documents incorporated by reference into this prospectus supplement and any free writing prospectus that we may authorize for use in connection with this offering, in their entirety before making an investment decision. You should also read and consider the information in the documents to which we have referred you in the sections of this prospectus supplement captioned “Where You Can Find More Information” and “Incorporation of Certain Information by Reference.”

We are offering to sell, and seeking offers to buy, our securities only in jurisdictions where offers and sales are permitted. The distribution of this prospectus supplement and the accompanying prospectus and the offering of our securities in certain jurisdictions may be restricted by law. Persons outside the United States who come into possession of this prospectus supplement and the accompanying prospectus must inform themselves about, and observe any restrictions relating to, the offering of our securities and the distribution of this prospectus supplement and the accompanying prospectus supplement outside the United States. This prospectus supplement and the accompanying prospectus do not constitute, and may not be used in connection with, an offer to sell, or a solicitation of an offer to buy, any securities offered by this prospectus supplement and the accompanying prospectus by any person in any jurisdiction in which it is unlawful for such person to make such an offer or solicitation.

We obtained the industry, market and competitive position data used throughout this prospectus supplement and in the documents incorporated by reference herein from our own internal estimates and research, as well as from industry and general publications, and research, surveys and studies conducted by third parties. Internal estimates are derived from publicly available information released by industry analysts and third-party sources, our internal research and our industry experience, and are based on assumptions made by us based on such data and our knowledge of the industry and market, which we believe to be reasonable. In addition, while we believe the industry, market and competitive position data included in this prospectus supplement and in the documents incorporated by reference herein is reliable and based on reasonable assumptions, we have not independently verified any third-party information, and all such data involve risks and uncertainties and are subject to change based on various factors,

including those discussed in the section titled “Risk Factors” in this prospectus supplement and in the section titled “Risk Factors” in our Annual Report on Form 10-K for the year ended December 31, 2024 and subsequent Quarterly Reports on Form 10-Q, which are incorporated by reference herein. These and other factors could cause results to differ materially from those expressed in the estimates made by the independent parties and by us.

This prospectus supplement, including the information incorporated by reference into this prospectus supplement, include trademarks, service marks and trade names owned by us or others. All trademarks, service marks and trade names included or incorporated by reference in this prospectus supplement or any related free writing prospectus are the property of their respective owners.

PROSPECTUS SUPPLEMENT SUMMARY

This summary highlights selected information contained elsewhere in this prospectus supplement or incorporated by reference in this prospectus supplement. This summary does not contain all of the information that you should consider before deciding to invest in our securities. You should read the entire prospectus supplement, including the information incorporated by reference herein, the accompanying prospectus and any related free writing prospectus, carefully, including the section titled “Risk Factors” contained in this prospectus supplement, the accompanying prospectus and any related free writing prospectus, and under similar headings in the other documents that are incorporated by reference into this prospectus supplement, and our financial statements and notes thereto included in our Annual Report on Form 10-K for the year ended December 31, 2024, and in our subsequent Quarterly Reports on Form 10-Q, which are incorporated by reference herein, before making an investment decision. Some of the statements in this summary constitute forward-looking statements, see “Special Note Regarding Forward-Looking Statements.” In this prospectus supplement, unless the context requires otherwise, references to “we,” “us,” “our,” “X4” or the “company” refer to X4 Pharmaceuticals, Inc., in each case together with its consolidated subsidiaries.

Overview

We are a biopharmaceutical company developing and commercializing novel therapeutics for the treatment of rare hematology diseases. We have one commercially approved product, XOLREMDI® (mavorixafor), which has received accelerated approval in the United States from the U.S. Food and Drug Administration (“FDA”) for use as an oral, once-daily therapy in patients aged 12 years of age and older with WHIM (warts, hypogammaglobulinemia, infections, and myelokathexis) syndrome, to increase the number of circulating mature neutrophils and lymphocytes. WHIM syndrome is a rare combined primary immunodeficiency and chronic neutropenic disorder.

We continue to progress our global, pivotal Phase 3 clinical trial, (the “4WARD” trial) to evaluate the efficacy, safety, and tolerability of oral, once-daily mavorixafor (with or without stable doses of G-CSF) in people with congenital, acquired primary autoimmune, or idiopathic chronic neutropenia who are experiencing recurrent and/or serious infections. The 52-week trial is a randomized, double-blind, placebo-controlled, multicenter study aiming to enroll up to 176 patients, with full enrollment expected in Q3 2026. The FDA has granted Fast Track designation to mavorixafor for the treatment of chronic neutropenia. Chronic neutropenia is defined as periods lasting more than three months persistently or intermittently where there are abnormally low levels of neutrophils circulating in the blood, and may be idiopathic (of unknown origin), cyclic (episodes typically occurring every three weeks), or congenital (of genetic causation). Chronic neutropenia disorders are rare blood conditions similarly characterized by increased risks of infections and cancer due to abnormally low levels of neutrophils in the body. In all cases, the CXCL12/CXCR4 pathway is the key regulator of neutrophil release from the bone marrow.

Corporate Information

We were incorporated in August 2010 in the State of Delaware under the name Arsanis, Inc. On March 13, 2019, we completed the business combination with X4 Therapeutics, Inc. (formerly X4 Pharmaceuticals, Inc.) and we completed our corporate rebranding, changing our name to X4 Pharmaceuticals, Inc.

On April 28, 2025, we effected a 1-for-30 reverse stock split of our common stock (the “Reverse Stock Split”). All references to common stock share and per share amounts in this prospectus supplement are presented on a post-Reverse Stock Split basis.

Our principal executive offices are located at 61 North Beacon Street, 4th Floor, Boston, MA 02134, and our telephone number is (857) 529-8300. Our website is located at <http://www.x4pharma.com>. The information on, or that can be accessed through, our website is not part of this prospectus supplement and is not incorporated by reference herein.

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Smaller Reporting Company Status

We are a “smaller reporting company” as defined in the Securities Exchange Act of 1934, as amended (the “Exchange Act”). We may take advantage of certain of the scaled disclosures available to smaller reporting companies and will be able to take advantage of these scaled disclosures for so long as our common stock held by non-affiliates is less than \$250.0 million measured on the last business day of our second fiscal quarter, or our annual revenue is less than \$100.0 million during the most recently completed fiscal year and our common stock held by non-affiliates is less than \$700.0 million measured on the last business day of our second fiscal quarter.

THE OFFERING

Common Stock Offered By Us	45,860,000 shares of common stock.
Pre-Funded Warrants Offered By Us	We are also offering, in lieu of common stock to certain investors that so choose, pre-funded warrants to purchase 700,000 shares of our common stock. The purchase price of each pre-funded warrant equals the price per share at which the shares of our common stock are being sold to the public in this offering, minus \$0.001 per share of common stock, which is the exercise price of each pre-funded warrant. Each pre-funded warrant will be exercisable at any time after the date of issuance of such pre-funded warrant, subject to an ownership limitation, and will not expire. See the section titled “Description of Securities We Are Offering” for additional information. This prospectus supplement also relates to the offering of the shares of our common stock issuable upon exercise of the pre-funded warrants.
Option to Purchase Additional Shares of Common Stock	The underwriters have a 30-day option to purchase up to 6,984,000 additional shares of our common stock at the public offering price, less underwriting discounts.
Common Stock to be Outstanding after this Offering	53,819,947 shares of common stock (or 60,803,947 shares of common stock if the underwriters exercise their option to purchase additional shares of our common stock in full), assuming no exercise of the pre-funded warrants offered and sold in this offering.
Use of Proceeds	We currently intend to use the net proceeds from this offering, together with our existing cash and cash equivalents and cash flows from operations, to fund the pivotal Phase 3 development of mavorixafor in certain chronic neutropenic disorders, as well as for general and administrative expenses, capital expenditures, working capital and other general corporate purposes. See “Use of Proceeds” on page S-10 of this prospectus supplement.
Risk Factors	You should read the “Risk Factors” section of this prospectus supplement and the accompanying prospectus and in the documents incorporated by reference into this prospectus supplement for a discussion of factors you should carefully consider before deciding to purchase our securities.
Indications of Interest	Certain of our officers have indicated an interest in purchasing shares of our common stock in this offering at the public offering price. However, because indications of interest are not binding agreements or commitments to purchase, the underwriter could determine to sell more, less or no shares to any of these potential investors and any of these potential investors could determine to purchase more, less or no shares in this offering. The underwriting discount for any shares sold to these potential investors in the offering will be the same as the underwriting discount for the shares sold to the public.
Nasdaq Symbol	“XFOR”. There is no established public trading market for the pre-funded warrants, and we do not expect a market to develop. We do not intend to apply for listing of the pre-funded warrants on Nasdaq or any securities exchange or nationally recognized trading system. Without an active trading market, the liquidity of the pre-funded warrants will be limited.

The number of shares of our common stock to be outstanding after this offering is based on 7,959,947 shares of our common stock outstanding as of June 30, 2025 and excludes:

- 21,034 shares of our common stock issuable upon the exercise of options outstanding as of June 30, 2025 under the 2015 Employee, Director and Consultant Equity Incentive Plan, as amended (the “2015 Plan”), having a weighted average exercise price of \$268.72 per share;

- 30,547 shares of our common stock issuable upon the exercise of options outstanding as of June 30, 2025 under the Amended and Restated 2017 Equity Incentive Plan (the “2017 Plan”), having a weighted average exercise price of \$127.08 per share;
- 255,959 shares of our common stock issuable upon the exercise of options outstanding as of June 30, 2025 under the 2019 Inducement Equity Incentive Plan (the “2019 Plan”), having a weighted average exercise price of \$36.72 per share;
- 12,759,626 shares of our common stock issuable upon the exercise of options issued subsequent to June 30, 2025, having a weighted average exercise price of \$1.61 per share;
- 333,264 shares of our common stock issuable upon the vesting and settlement of outstanding restricted stock unit awards, outstanding as of June 30, 2025 under our 2017 Plan and 2019 Plan;
- 1,080,462 shares of common stock issuable upon the exercise of pre-funded warrants outstanding as of June 30, 2025, with 94,154 having an exercise price of \$0.30 per share and 986,308 having an exercise price of \$0.03 per share;
- 2,545,948 shares of common stock issuable upon the exercise of warrants outstanding as of June 30, 2025, having a weighted average exercise price of \$39.10 per share;
- 321,789 shares of common stock reserved for future issuance under our 2017 Plan, Amended and Restated 2017 Employee Stock Purchase Plan (the “2017 ESPP”) and 2019 Plan as of June 30, 2025;
- 11,040,776 shares of common stock issued and sold subsequent to June 30, 2025 in a private placement;
- 48,852,772 shares of common stock issuable upon the exercise of pre-funded warrants having an exercise price of \$0.001 per share issued and sold subsequent to June 30, 2025 in a private placement;
- Up to \$75.0 million of our shares of common stock that may be sold from time to time under an “at the market” equity offering program that we entered into on August 7, 2020 with B. Riley Securities, Inc., Cantor Fitzgerald & Co. and Stifel, Nicolaus & Company, Incorporated (the “ATM”), of which 7,762,998 shares have been sold through the business day immediately preceding the date hereof for approximate gross proceeds of \$24.2 million.

Except as otherwise indicated, all information in this prospectus supplement assumes no exercise of the outstanding options or warrants referred to above, no vesting and settlement of the outstanding restricted stock units referred to above, no exercise of the underwriters’ option to purchase additional shares of our common stock and no exercise of the pre-funded warrants offered and sold in this offering.

RISK FACTORS

Investing in our securities involves a high degree of risk. Before deciding whether to invest in our securities, you should consider carefully the risks and uncertainties described below and discussed under the heading “Risk Factors” contained in our most recent Annual Report on Form 10-K, and in our subsequent Quarterly Reports on Form 10-Q, as well as any amendments thereto reflected in subsequent filings with the SEC, which are incorporated by reference into this prospectus supplement in their entirety, together with other information in this prospectus supplement, the accompanying prospectus, the documents incorporated by reference and any free writing prospectus that we may authorize for use in connection with this offering. The risks described in these documents are not the only ones we face, but those that we consider to be material. There may be other unknown or unpredictable economic, business, competitive, regulatory or other factors that could have material adverse effects on our future results. Past financial performance may not be a reliable indicator of future performance, and historical trends should not be used to anticipate results or trends in future periods. If any of these risks actually occurs, our business, financial condition, results of operations or cash flow could be seriously harmed. This could cause the trading price of our common stock to decline, resulting in a loss of all or part of your investment. Please also read carefully the section below entitled “Special Note Regarding Forward-Looking Statements.”

Additional Risks Related to This Offering

The price of our stock may be volatile, and you could lose all or part of your investment.

The trading price of our common stock has fluctuated, and is likely to continue to fluctuate substantially in response to various factors, some of which are beyond our control, including the factors discussed in this “Risk Factors” section and elsewhere in this prospectus supplement, the accompanying prospectus and the documents incorporated by reference herein. The realization of any of these factors could have a dramatic and adverse impact on the market price of our common stock.

In addition, the stock market in general, and the market for biotechnology and biopharmaceutical companies in particular, have historically been particularly volatile and experienced extreme price and volume fluctuations that have often been unrelated or disproportionate to the operating performance of these companies. Broad market and industry factors may negatively affect the market price of our common stock, regardless of our actual operating performance. If the market price of our common stock does not exceed the price at which you purchase your shares, you may not realize any return on your investment in us and may lose some or all of your investment. In the past, securities class action litigation has often been instituted against companies following periods of volatility in the market price of a company’s securities. This type of litigation, if instituted, could result in substantial costs and a diversion of management’s attention and resources, which would materially adversely affect our business, financial condition and results of operation.

If you purchase shares of our common stock in this offering, or pre-funded warrants in lieu thereof, you will incur immediate and substantial dilution and may experience additional dilution in the future.

You will suffer immediate and substantial dilution with respect to the common stock or the shares of common stock underlying the pre-funded warrants you purchase in this offering. If you purchase common stock (or pre-funded warrants in lieu thereof) in this offering at the public offering price of \$2.90 per share (or \$2.899 per pre-funded warrant in lieu thereof), and assuming that the underwriters do not exercise their option to purchase additional shares of common stock in this offering, you will incur immediate and substantial dilution of \$1.02 per share, representing the difference between the public offering price of \$2.90 per share and our as adjusted net tangible book value per share as of June 30, 2025. See the section titled “Dilution” for a more detailed description of the dilution to new investors in this offering. In addition, to the extent that restricted stock units vest and settle or we raise additional funds by issuing equity securities, you will experience further dilution.

There is no public market for the pre-funded warrants being offered in this offering.

There is no established public trading market for the pre-funded warrants being offered in this offering, and we do not expect a market to develop. In addition, we do not intend to apply to list these pre-funded warrants on any securities exchange or nationally recognized trading system, including Nasdaq. Without an active market, the liquidity of these pre-funded warrants will be limited.

Holders of pre-funded warrants purchased in this offering will have no rights as common stockholders until such holders exercise their pre-funded warrants and acquire our common stock.

Until holders of the pre-funded warrants acquire shares of our common stock upon exercise of such pre-funded warrants, the holders will have no rights with respect to the shares of our common stock underlying such pre-funded warrants, such as voting rights or the rights to receive dividends. Upon exercise of the pre-funded warrants, the holders will be entitled to exercise the rights of a common stockholder only as to matters for which the record date occurs after the exercise.

We will not receive significant additional funds upon the exercise of the pre-funded warrants being offered.

In certain limited circumstances, each pre-funded warrant may be exercised by way of a cashless exercise, meaning that the holder may not pay a cash purchase price upon exercise, but instead would receive upon such exercise the net number of shares of our common stock determined according to the formula set forth in the pre-funded warrant. Accordingly, we may not receive any additional funds upon the cashless exercise of the pre-funded warrants or if the pre-funded warrants altogether are not exercised at all. In addition, the pre-funded warrants have an exercise price of \$0.001 per share of common stock, and as a result we will not receive significant additional funds upon their exercise even if not a cashless exercise.

Significant holders or beneficial owners of our common stock may not be permitted to exercise pre-funded warrants that they hold.

Holders of the pre-funded warrants will not be entitled to exercise any portion of any pre-funded warrant which, upon giving effect to such exercise, would cause the aggregate number of shares of our common stock beneficially owned by the holder (together with its affiliates) to exceed a specified percentage of the number of shares of our common stock outstanding immediately after giving effect to the exercise, as such percentage ownership is determined in accordance with the terms of the pre-funded warrants. As a result, you may not be able to exercise your pre-funded warrants for shares of our common stock at a time when it would be financially beneficial for you to do so. In such circumstance you could seek to sell your pre-funded warrants to realize value, but you may be unable to do so in the absence of an established trading market for the pre-funded warrants.

If we do not maintain a current and effective registration statement relating to the shares of common stock issuable upon exercise of the pre-funded warrants, holders will only be able to exercise such pre-funded warrants on a "cashless basis."

If we do not maintain a current and effective registration statement relating to the shares of common stock issuable upon exercise of the pre-funded warrants at the time that holders wish to exercise such pre-funded warrants, they will only be able to exercise them on a "cashless basis," provided that an exemption from registration is available. As a result, the number of shares of common stock that holders will receive upon exercise of the pre-funded warrants will be fewer than it would have been had such holder exercised his or her warrant for cash, and holders may be limited in their ability to immediately sell shares upon exercise, subject to volume or other securities law limitations. Further, if an exemption from registration is not available, holders would not be able to exercise on a cashless basis and would only be able to exercise their pre-funded warrants for cash if a current and effective registration statement relating to the shares of common stock issuable upon exercise of the pre-funded warrants is available.

A sale of a substantial number of shares of our common stock, including any shares issuable upon exercise of any pre-funded warrants, may cause the price of our common stock to decline.

We cannot predict what effect, if any, future sales of our shares in the public market or the availability of shares for sale will have on the market price of our common stock. However, future sales of substantial amounts of our common stock in the public market, including shares issued upon exercise of any pre-funded warrants issued in this offering or option awards or upon settlement of restricted stock units or shares sold pursuant to our ATM, or the perception that such sales may occur, could adversely affect the market price of our common stock. We also expect that significant additional capital will be needed in the future to continue our planned operations. To raise capital, we may sell common stock, convertible securities, or other equity securities in one or more transactions at prices and in a manner we determine from time to time. These sales, or the perception in the market that the holders of a large number of shares intend to sell shares, could reduce the market price of our common stock.

We have broad discretion in the use of the net proceeds from this offering and may not use them effectively.

Our management will have broad discretion in the application of the net proceeds from this offering, including for the purposes described in the section titled “Use of Proceeds,” and you will be relying on the judgment of our management regarding the application of these proceeds. You will not have the opportunity, as part of your investment decision, to assess whether the proceeds are being used appropriately. Our management might not apply the proceeds in ways that ultimately increase or maintain the value of your investment. If we do not invest or apply the proceeds from this offering in ways that enhance stockholder value, we may fail to achieve expected financial results, which could cause our stock price to decline.

SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS

This prospectus supplement contains “forward-looking statements” within the meaning of the federal securities laws, which statements involve substantial risks and uncertainties. In some cases, you can identify forward-looking statements by terms such as “may,” “might,” “will,” “objective,” “intend,” “should,” “could,” “can,” “would,” “expect,” “believe,” “design,” “estimate,” “predict,” “potential,” “plan,” “anticipate,” “target,” “forecast” or the negative of these terms, and similar expressions intended to identify forward-looking statements.

Forward-looking statements involve known and unknown risks, uncertainties and other factors that could cause our actual results to differ materially from the forward-looking statements expressed or implied in this prospectus supplement. Such risks, uncertainties and other factors include, among others, the factors disclosed in the section titled “Risk Factors” in this prospectus supplement and the sections titled “Risk Factors” and “Management’s Discussion and Analysis of Financial Condition and Results of Operations” in our Annual Report on Form 10-K for the year ended December 31, 2024 and Quarterly Report on Form 10-Q for the quarter ended June 30, 2025, which are incorporated by reference herein, and the following risks, uncertainties and factors:

- our ability to raise additional capital or achieve sufficient revenue to properly fund our business and operating plan as well as our ability to continue as a going concern;
- our expectations and goals for commercialization of XOLREMDI®, which has been approved for use as an oral, once-daily therapy to increase the number of circulating mature neutrophils and lymphocytes in patients 12 years of age and older with WHIM (warts, hypogammaglobulinemia, infections, and myelokathexis) syndrome in the United States and that XOLREMDI, our one product approved for commercial sale, upon which we depend almost entirely on to produce revenue faces an unknown market size and growth potential and we have not generated significant revenue from product sales to date, and we may never achieve profitability;
- our expectations that the reverse stock split will have its intended effects and that we will be able to maintain compliance with Nasdaq’s listing requirements and this will positively impact our ability to raise capital;
- the initiation, timing, progress and results of our current and future preclinical studies and clinical trials and related preparatory work and the period during which the results of the trials will become available, as well as our research and development programs;
- the timing of enrollment in, and our ability to successfully enroll, our clinical trials, including our Phase 3 4WARD clinical trial;
- the potential benefits, including clinical utility, that may be derived from XOLREMDI or any of our product candidates;
- the timing of and our ability to obtain and maintain regulatory approval of our existing product XOLREMDI (mavorixafor) or any product candidates that we may develop in the future, and any related restrictions, limitations, or warnings in the label of any approved product candidates;
- our plans to research, develop, manufacture and commercialize XOLREMDI or our product candidates;
- the timing of our regulatory filings for our product candidates, along with regulatory developments in the United States and other foreign countries;
- the size and growth potential of the markets for XOLREMDI and our product candidates, if approved, and the rate and degree of market acceptance of XOLREMDI and our product candidates, including reimbursement that may be received from payors;
- the benefits of U.S. Food and Drug Administration and European Commission designations, including, without limitation, Fast Track, Orphan and Breakthrough Therapy;
- our commercialization, marketing and manufacturing capabilities and strategy;
- our ability to attract and retain qualified employees and key personnel;
- our competitive position and the development of and projections relating to our competitors or our industry;
- our expectations regarding our ability to obtain and maintain intellectual property protection;

- the success of competing therapies that are or may become available;
- our estimates and expectations regarding future operations, financial position, revenues, costs, expenses, uses of cash, capital requirements, including the proceeds from this offering, or our need for additional financing;
- our plans to in-license, acquire, develop and commercialize additional product candidates;
- the impact of laws and regulations;
- our plans to identify additional product candidates with significant commercial potential that are consistent with our commercial objectives;
- our strategies, prospects, plans, expectations or objectives; and
- other risks and uncertainties, including those listed or incorporated by reference in “Risk Factors.”

We caution you that the risks, uncertainties and other factors referred to above, elsewhere in this prospectus supplement and in the documents incorporated by reference herein may not contain all of the risks, uncertainties and other factors that may affect our future results and operations. Moreover, new risks will emerge from time to time. It is not possible for our management to predict all risks. In addition, we cannot assure you that we will realize the results, benefits or developments that we expect or anticipate or, even if substantially realized, that they will result in the consequences or affect us or our business in the way expected. Forward-looking statements are not historical facts, and reflect our current views with respect to future events. Given the significant uncertainties, you should evaluate all forward-looking statements made in this prospectus supplement in the context of these risks and uncertainties and not place undue reliance on these forward-looking statements as predictions of future events.

In addition, statements that “we believe” and similar statements reflect our beliefs and opinions on the relevant subject. These statements are based upon information available to us as of the date of this prospectus supplement, and while we believe we have a reasonable basis for such statements, such information may be limited or incomplete, and our statements should not be read to indicate that we have conducted an exhaustive inquiry into, or review of, all potentially available relevant information. These statements are inherently uncertain and you are cautioned not to unduly rely upon these statements.

All forward-looking statements in this prospectus supplement apply only as of the date made and are expressly qualified in their entirety by the cautionary statements included in this prospectus supplement. We disclaim any intent to publicly update or revise any forward-looking statements to reflect subsequent events or circumstances, except as required by law.

USE OF PROCEEDS

We estimate that the net proceeds from this offering will be approximately \$126.6 million (or approximately \$145.6 million if the underwriters' option to purchase additional shares is exercised in full) from the sale of the shares of common stock and pre-funded warrants offered by us in this offering, based on the public offering price of \$2.90 per share of common stock and \$2.899 per pre-funded warrant (which equals the price per share at which the shares of our common stock are being sold to the public in this offering, minus \$0.001 per share of common stock), after deducting the underwriting discounts and commissions and the estimated offering expenses payable by us.

We currently intend to use the net proceeds of this offering, together with our existing cash and cash equivalents and cash flows from operations, to fund the pivotal Phase 3 development of mavorixafor in certain chronic neutropenic disorders, as well as for general and administrative expenses, capital expenditures, working capital and other general corporate purposes. We may also use a portion of the proceeds to license, acquire or invest in new programs or for drug development activities related to such programs, however, we have no current commitments to do so.

As of the date of this prospectus supplement, we cannot specify with certainty all of the particular uses for the net proceeds to us from the sale of the shares of our securities offered by us hereunder. Accordingly, our management will have broad discretion in the timing and application of these proceeds. Pending application of the net proceeds as described above, we intend to temporarily invest the proceeds in short-term, interest-bearing instruments.

DILUTION

If you purchase shares of common stock in this offering (or pre-funded warrants in lieu thereof), your ownership interest will be diluted to the extent of the difference between the purchase price per share of our common stock (or pre-funded warrant in lieu thereof) and the as adjusted net tangible book value per share after giving effect to this offering.

The net tangible book value (deficit) of our common stock on June 30, 2025 was approximately \$(25.7) million, or \$(3.22) per share of common stock. We calculate net tangible book value per share by dividing the net tangible book value, which is tangible assets less total liabilities, by the number of outstanding shares of our common stock. Dilution with respect to net tangible book value per share represents the difference between the amount per share paid by purchasers of shares of common stock in this offering and the net tangible book value per share of our common stock immediately after this offering.

After giving effect to the issuance and sale of 45,860,000 shares of our common stock and 700,000 pre-funded warrants (as we finalize the accounting treatment of the pre-funded warrants, we have assumed equity classification) in this offering by us at the public offering price of \$2.90 per share and \$2.899 per pre-funded warrant (which equals the price per share at which the shares of our common stock are being sold to the public in this offering, minus \$0.001 per share of common stock), and after deducting the underwriting discounts and commissions and estimated aggregate offering expenses payable by us, our as adjusted net tangible book value as of June 30, 2025 would have been approximately \$100.9 million, or \$1.88 per share of common stock. This represents an immediate increase in net tangible book value per share of \$5.10 to our existing stockholders and an immediate dilution in net tangible book value of \$1.02 per share to new investors purchasing shares of common stock and pre-funded warrants in this offering. The following table illustrates this per share dilution:

Public offering price per share	\$	2.90
Net tangible book value (deficit) per share as of June 30, 2025	\$	(3.22)
Increase in net tangible book value per share attributable to new investors in this offering	\$	5.10
As adjusted net tangible book value per share after giving effect to the offering	\$	1.88
Dilution per share to new investors in this offering	\$	1.02

The dilution information discussed above assumes no exercise of the pre-funded warrants sold in this offering and is illustrative only. Investors who receive shares of common stock upon the exercise of the pre-funded warrants offered hereby may experience additional dilution depending on our net tangible book value at the time of exercise.

If the underwriters exercise their option in full to purchase an additional 6,984,000 shares of common stock, our as adjusted net tangible book value per share after this offering would be approximately \$1.97 per share, representing an immediate increase in as adjusted net tangible book value of \$5.20 per share to our existing stockholders and an immediate dilution of approximately \$0.93 per share to investors participating in this offering, after deducting the estimated underwriting discounts and commissions and estimated offering expenses payable by us.

The above table is based on 7,959,947 shares of our common stock outstanding as of June 30, 2025 and excludes:

- 21,034 shares of our common stock issuable upon the exercise of options outstanding as of June 30, 2025 under the 2015 Plan, having a weighted average exercise price of \$268.72 per share;
- 30,547 shares of our common stock issuable upon the exercise of options outstanding as of June 30, 2025 under the 2017 Plan having a weighted average exercise price of \$127.08 per share;
- 255,959 shares of our common stock issuable upon the exercise of options outstanding as of June 30, 2025 under the 2019 Plan, having a weighted average exercise price of \$36.72 per share;
- 12,759,626 shares of our common stock issuable upon the exercise of options issued subsequent to June 30, 2025, having a weighted average exercise price of \$1.61 per share;

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- 333,264 shares of our common stock issuable upon the vesting and settlement of outstanding restricted stock unit awards outstanding as of June 30, 2025 under our 2017 Plan and 2019 Plan;
- 2,545,948 shares of common stock issuable upon the exercise of warrants outstanding as of June 30, 2025, having a weighted average exercise price of \$39.10 per share;
- 1,080,462 shares of common stock issuable upon the exercise of pre-funded warrants outstanding as of June 30, 2025, with 94,154 having an exercise price of \$0.30 per share and 986,308 having an exercise price of \$0.03 per share;
- 321,789 shares of common stock reserved for future issuance under our 2017 Plan, 2017 ESPP and 2019 Plan as of June 30, 2025;
- 11,040,776 shares of common stock issued and sold subsequent to June 30, 2025 in a private placement;
- 48,852,772 shares of common stock issuable upon the exercise of pre-funded warrants having an exercise price of \$0.001 per share issued and sold subsequent to June 30, 2025 in a private placement; and
- Up to \$75.0 million of our shares of common stock that may be sold from time to time under our ATM, of which 7,762,998 shares have been sold through the business day immediately preceding the date hereof for approximate gross proceeds of \$24.2 million.

To the extent that options or warrants outstanding as of June 30, 2025 have been or are exercised, any restricted stock units vest, or other shares are issued, investors purchasing shares in this offering could experience further dilution. In addition, we may choose to raise additional capital, including pursuant to the ATM, due to market conditions or strategic considerations, even if we believe we have sufficient funds for our current or future operating plans. To the extent that additional capital is raised through the sale of equity or convertible debt securities, the issuance of these securities could result in further dilution to our stockholders.

DESCRIPTION OF SECURITIES WE ARE OFFERING

Common Stock

We are offering shares of our common stock in this offering. See the section titled “Description of Capital Stock” in the accompanying prospectus for more information regarding our shares of common stock.

Pre-funded Warrants

The following is a summary of the material attributes and characteristics of the pre-funded warrants. The form of pre-funded warrant will be provided to the pre-funded warrant purchasers in this offering and will be filed as an exhibit to a Current Report on Form 8-K filed in connection with this offering and incorporated by reference into the registration statement of which this prospectus supplement forms a part. The following summary is subject in all respects to the provisions contained in the pre-funded warrants.

Pre-funded warrants will be issued in certificated form only.

Duration and Exercise Price. Each pre-funded warrant entitles the holder thereof to purchase shares of our common stock at an exercise price equal to \$0.001 per share. Each pre-funded warrant will be exercisable at any time beginning on the date of issuance and will not expire. The number of shares of our common stock issuable upon exercise of each pre-funded warrant is subject to adjustment in the event of stock dividends, stock splits, reorganizations or similar events affecting our common stock and the exercise price.

Exercisability. The holder of the pre-funded warrant may exercise the pre-funded warrant by delivering an exercise notice, completed and duly signed, and payment in cash of the exercise price for the number of shares of our common stock for which the pre-funded warrant is being exercised. The holder of the pre-funded warrant may also satisfy its obligation to pay the exercise price through a “cashless exercise,” in which the holder receives the net value of the pre-funded warrant in shares of common stock determined according to the formula set forth in the pre-funded warrant.

Upon a holder’s exercise of the pre-funded warrant, we will issue the shares of common stock to which the holder is entitled pursuant to such exercise within the Standard Settlement Period (as defined in the form of pre-funded warrant) after the exercise date.

A holder of the pre-funded warrant will not be entitled to exercise any portion of such pre-funded warrant that, upon giving effect to such exercise, would cause the aggregate number of shares of our common stock beneficially owned by such holder (together with its affiliates and any other persons whose beneficial ownership of common stock would be aggregated with the holder for purposes of Section 13(d) of the Exchange Act of 1934, as amended (the Exchange Act)) to exceed 9.99% (or 4.99% at the election of the holder) of the total number of then issued and outstanding shares of common stock, as such percentage ownership is determined in accordance with the terms of the pre-funded warrant and subject to such holder’s rights under the pre-funded warrant to increase or decrease such percentage to any other percentage not in excess of 19.99% upon at least 61 days’ prior notice from such holder to us.

Fundamental Transaction. In the event of any fundamental transaction, as described in the pre-funded warrants and generally including any merger with or into another entity, sale of all or substantially all of our assets, tender offer or exchange offer, or reclassification of our shares of common stock, then upon any subsequent exercise of a pre-funded warrant, the holder will have the right to receive as alternative consideration, for each share of common stock that would have been issuable upon such exercise immediately prior to the occurrence of such fundamental transaction, the number of shares of common stock of the successor or acquiring corporation of our company, if it is the surviving corporation, and any additional consideration receivable upon or as a result of such transaction by a holder of the number of shares of common stock for which the warrant is exercisable immediately prior to such event.

Transferability. Subject to applicable laws, a pre-funded warrant may be transferred at the option of the holder upon surrender of the pre-funded warrant to us together with the appropriate instruments of transfer and payment of funds sufficient to pay any transfer taxes (if applicable).

Exchange Listing. There is no trading market available for the pre-funded warrants on any securities exchange or nationally recognized trading system. We do not intend to list the pre-funded warrants on Nasdaq or any securities exchange or nationally recognized trading system.

We will initially serve as the warrant agent under the pre-funded warrants.

Rights as a Stockholder. Except as otherwise provided in the pre-funded warrants or by virtue of such holder's ownership of shares of our common stock, the holders of the pre-funded warrants do not have the rights or privileges of holders of our common stock, including any voting rights, until they exercise their pre-funded warrants.

U.S. FEDERAL INCOME TAX CONSIDERATIONS

The following discussion is a summary of U.S. federal income tax considerations to U.S. Holders and Non-U.S. Holders (each as defined below) of the ownership and disposition of the common stock and pre-funded warrants issued pursuant to this offering. The discussion does not purport to be a complete analysis of all potential tax considerations. The considerations of other U.S. federal tax laws, such as estate and gift tax laws, and any applicable state, local or non-U.S. tax laws, are not discussed. This discussion is based on the U.S. Internal Revenue Code of 1986, as amended (the Code), Treasury Regulations promulgated under the Code, judicial decisions and published rulings and administrative pronouncements of the U.S. Internal Revenue Service (the IRS), in each case in effect as of the date hereof. These authorities may change or be subject to differing interpretations. Any such change or differing interpretation may be applied retroactively in a manner that could adversely affect a holder of our common stock or pre-funded warrants. We have not sought and will not seek any rulings from the IRS regarding the matters discussed below. There can be no assurance the IRS or a court will not take a contrary position to that discussed below regarding the tax considerations of the ownership and disposition of our common stock or pre-funded warrants.

This discussion is limited to holders that hold our common stock or pre-funded warrants as a “capital asset” within the meaning of Section 1221 of the Code (generally, property held for investment). This discussion does not address all U.S. federal income tax considerations relevant to such holder’s particular circumstances, including without limitation the alternative minimum tax and the effect of the Medicare contribution tax on net investment income. In addition, it does not address considerations relevant to holders who are subject to special rules, including, without limitation:

- U.S. expatriates and former citizens or long-term residents of the United States;
- persons holding our common stock or pre-funded warrants as part of a hedge, straddle or other risk-reduction strategy or as part of a conversion transaction or other integrated investment;
- banks, insurance companies, or other financial institutions;
- real estate investment trusts or regulated investment companies;
- brokers, dealers or traders in currencies or securities, or other persons that elect to use a mark-to-market method of accounting for their holdings in our common stock or pre-funded warrants;
- “controlled foreign corporations,” “passive foreign investment companies” and corporations that accumulate earnings to avoid U.S. federal income tax;
- partnerships or other entities or arrangements classified as partnerships or disregarded entities for U.S. federal income tax purposes (and investors therein), S corporations or other passthrough entities (including hybrid entities);
- tax-exempt organizations or governmental organizations;
- persons deemed to sell our common stock or pre-funded warrants under the constructive sale provisions of the Code;
- persons who hold or receive our common stock or pre-funded warrants pursuant to the exercise of any employee stock option or otherwise as compensation;
- tax-qualified retirement plans;
- persons that acquire our common stock or pre-funded warrants as compensation for services;
- persons that own, or have owned, actually or constructively, more than 5% of our common stock and/or pre-funded warrants; and
- pension plans or funds, or an entity that is wholly owned by a pension plan or fund, including “qualified foreign pension funds” as defined in Section 897(l)(2) of the Code and entities all of the interests of which are held by qualified foreign pension funds.

If an entity or arrangement classified as a partnership for U.S. federal income tax purposes holds our common stock or pre-funded warrants, the tax treatment of a partner in the partnership will depend on the status of the partner, the

activities of the partnership and certain determinations made at the partner level. Accordingly, each partnership and each partner in such partnership holding our common stock or pre-funded warrants is urged to consult its tax advisor regarding the U.S. federal income tax considerations to it of the ownership and disposition of our common stock or pre-funded warrants.

For purposes of this discussion, a “U.S. Holder” is any beneficial owner of common stock or pre-funded warrants that, for U.S. federal income tax purposes, is or is treated as any of the following:

- an individual who is a citizen or resident of the United States;
- a corporation or other entity treated as a corporation for U.S. federal income tax purposes, created in, or organized under the laws of the United States or any state thereof or the District of Columbia;
- an estate, the income of which is subject to U.S. federal income tax regardless of its source; or
- a trust that (i) is subject to the primary supervision of a U.S. court and the control of one or more “United States persons” (within the meaning of Section 7701(a)(30) of the Code), or (ii) has a valid election in effect to be treated as a U.S. person for U.S. federal income tax purposes.

For purposes of this discussion, a “Non-U.S. Holder” is any beneficial owner of our common stock or pre-funded warrants that is neither a U.S. Holder nor an entity or arrangement treated as a partnership or other entity or arrangement treated as a pass-through entity for U.S. federal income tax purposes.

THIS DISCUSSION IS FOR INFORMATIONAL PURPOSES ONLY AND IS NOT TAX ADVICE. EACH INVESTOR IS URGED TO CONSULT ITS TAX ADVISOR WITH RESPECT TO THE APPLICATION OF U.S. FEDERAL INCOME TAX LAWS TO ITS PARTICULAR SITUATION AS WELL AS ANY TAX CONSIDERATIONS OF THE OWNERSHIP AND DISPOSITION OF OUR COMMON STOCK OR PRE-FUNDED WARRANTS ARISING UNDER THE U.S. FEDERAL ESTATE OR GIFT TAX LAWS OR UNDER THE LAWS OF ANY STATE, LOCAL OR NON-U.S. TAXING JURISDICTION OR UNDER ANY APPLICABLE INCOME TAX TREATY.

Treatment of Pre-Funded Warrants

Although it is not entirely free from doubt, because the exercise price of the pre-funded warrants is a nominal amount, the pre-funded warrants are generally expected to be treated as shares of our common stock for U.S. federal income tax purposes (and a holder is expected to be subject to the same tax considerations as if the holder held shares of our common stock as discussed below). Accordingly, no gain or loss should be recognized upon exercise of a pre-funded warrant, and the holding period of the shares of our common stock received upon exercise of a pre-funded warrant should include the holding period of the pre-funded warrant. Similarly, the tax basis of the pre-funded warrant should carry over to the shares of common stock received upon exercise, increased by the exercise price. Each U.S. Holder and Non-U.S. Holder is urged to consult its tax advisor regarding the U.S. federal income tax considerations to it of the ownership and disposition of the pre-funded warrants. The following discussion generally assumes that the characterization described above is respected for U.S. federal income tax purposes.

U.S. Holders

Distributions on Common Stock

We have no present intention to pay cash dividends on our common stock. However, if we do make distributions of cash or other property on our common stock (other than certain distributions of our common stock), those distributions will generally constitute dividends for U.S. federal income tax purposes to the extent paid from our current or accumulated earnings and profits, as determined under U.S. federal income tax principles. If the amount of such distributions exceeds our current and accumulated earnings and profits, such excess will generally constitute a non-taxable return of capital and will first be applied against and reduce, but not below zero, a U.S. Holder’s adjusted tax basis in our common stock. Any excess will be treated as capital gain and will be treated as described below under the subsection titled “Sale or Other Taxable Disposition of Common Stock or Pre-Funded Warrants.”

Dividends paid to a U.S. Holder of our common stock that is a taxable corporation will generally qualify for the dividends received deduction if the requirements relating to the requisite holding period are satisfied. With certain

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exceptions, and provided certain holding period requirements are met, dividends we pay to a non-corporate U.S. Holder will generally constitute “qualified dividends” that currently are subject to tax at preferential long-term capital gains rates.

Constructive Distributions on Pre-Funded Warrants

Under Section 305 of the Code, an adjustment to (or failure to adjust) the number of shares that will be issued on the exercise of the pre-funded warrants may be treated as a constructive distribution to a U.S. Holder of pre-funded warrants if, and to the extent that, such adjustment (or failure to adjust) has the effect of increasing such U.S. Holder’s proportionate interest in our assets or earnings and profits as determined under U.S. federal income tax law, depending on the circumstances of such adjustment. U.S. Holders should consult their tax advisors on the circumstances in which a constructive distribution may be realized, and the tax consequences of any such constructive distribution.

Sale or Other Taxable Disposition of Common Stock or Pre-Funded Warrants

Upon a sale, exchange or other taxable disposition of our common stock or pre-funded warrants, a U.S. Holder will generally recognize capital gain or loss in an amount equal to the difference between (1) the amount realized upon such sale, exchange or disposition and (2) the U.S. Holder’s tax basis in the common stock or pre-funded warrant. Such gain or loss will generally be treated as long-term capital gain or loss if the common stock or pre-funded warrant is held by the U.S. Holder for more than one year at the time of such sale, exchange or other taxable disposition. Long-term capital gains recognized by certain non-corporate U.S. Holders, including individuals, generally will be subject to reduced rates of U.S. federal income tax. The deductibility of capital losses is subject to certain limitations.

Information Reporting and Backup Withholding

Information reporting requirements may apply to dividends paid to a U.S. Holder and to the proceeds of the sale, exchange or other taxable disposition of our common stock, unless the U.S. Holder is an exempt recipient (provided that, in the case of dividends paid to such exempt recipient, the exempt recipient is not subject to backup withholding under Section 3406 of the Code). Backup withholding may apply to such payments if the U.S. Holder fails to provide a taxpayer identification number or a certification of exempt status or has been notified by the IRS that it is subject to backup withholding (and such notification has not been withdrawn).

Backup withholding is not an additional tax. Any amounts withheld under the backup withholding rules may be allowed as a refund or a credit against a U.S. Holder’s U.S. federal income tax liability, provided the required information is timely furnished to the IRS.

Non-U.S. Holders

Distributions (and Constructive Distributions) on Common Stock

We have no present intention to pay cash dividends on our common stock. However, if we do make distributions of cash or other property on our common stock (other than certain distributions of our common stock), those distributions will generally constitute dividends for U.S. federal income tax purposes to the extent paid from our current or accumulated earnings and profits, as determined under U.S. federal income tax principles. If the amount of such distributions exceeds our current and accumulated earnings and profits, such excess will generally constitute a non-taxable return of capital and will first be applied against and reduce, but not below zero, a Non-U.S. Holder’s adjusted tax basis in our common stock. Any excess will be treated as capital gain and will be treated as described below under the subsection titled “Sale or Other Taxable Disposition of Common Stock or Pre-funded Warrants.” Dividends paid to a Non-U.S. Holder of our common stock that is not effectively connected with such Non-U.S. Holder’s conduct of a trade or business in the United States will generally be subject to U.S. federal withholding tax at a rate of 30% of the gross amount of the dividends (or such lower rate specified by an applicable income tax treaty, provided such Non-U.S. Holder furnishes the applicable withholding agent with documentation required to claim benefits under such tax treaty (generally, a valid IRS Form W-8BEN or W-8BEN-E or a successor form)). These certifications must be provided to the applicable withholding agent prior to the payment of dividends and must be updated periodically. Each Non-U.S. Holder is urged to consult its tax advisor regarding U.S. federal withholding tax on distributions on our common stock, including such Non-U.S. Holder’s eligibility for benefits under any applicable income tax treaties and the availability of a refund on any excess U.S. federal tax withheld. If dividends paid to a Non-U.S. Holder are effectively connected with such Non-U.S. Holder’s conduct of a trade or business within the United States (and, if required by an applicable income tax treaty, such Non-U.S. Holder maintains a permanent establishment in the United States to which such dividends are attributable), such Non-U.S.

Holder will generally be exempt from the U.S. federal withholding tax described above. To claim the exemption, a Non-U.S. Holder must furnish to the applicable withholding agent a valid IRS Form W-8ECI (or a successor form) certifying that the dividends are effectively connected with such Non-U.S. Holder's conduct of a trade or business within the United States. In general, any such effectively connected dividends will be subject to U.S. federal income tax on a net income basis at the regular rates applicable to a U.S. person, unless a specific treaty exemption applies. A Non-U.S. Holder that is a corporation also may be subject to a branch profits tax at a rate of 30% (or such lower rate specified by an applicable income tax treaty) on such effectively connected dividends, as adjusted for certain items. Each Non-U.S. Holder is urged to consult its tax advisor regarding the U.S. federal income tax considerations of any distributions with respect to our common stock, including any applicable tax treaties that may provide for different rules.

As discussed above under “—Constructive Distributions on Pre-Funded Warrants,” certain adjustments to the pre-funded warrants may result in a constructive distribution to holders of such pre-funded warrants. Non-U.S. Holders should consult their tax advisors on the circumstances in which a constructive distribution may be realized, and the tax consequences of any such constructive distribution.

Sale or Other Taxable Disposition of Common Stock or Pre-Funded Warrants

A Non-U.S. Holder will generally not be subject to U.S. federal income or withholding tax on any gain realized upon the sale or other taxable disposition of our common stock or pre-funded warrants unless:

- the gain is effectively connected with such Non-U.S. Holder's conduct of a trade or business within the United States (and, if required by an applicable income tax treaty, the Non-U.S. Holder maintains a permanent establishment or fixed base in the United States to which such gain is attributable);
- such Non-U.S. Holder is a nonresident alien individual present in the United States for 183 days or more during the taxable year of the disposition and certain other requirements are met; or
- our common stock or pre-funded warrants constitute a U.S. real property interest (USRPI) by reason of our status as a U.S. real property holding corporation (USRPHC) for U.S. federal income tax purposes.

Gain described in the first bullet point above will generally be subject to U.S. federal income tax on a net income basis at the regular rates applicable to U.S. persons, unless a specific treaty exemption applies. A Non-U.S. Holder that is a corporation also may be subject to a “branch profits tax” at a rate of 30% (or such lower rate specified by an applicable income tax treaty) on such effectively connected gain, as adjusted for certain items

Gain described in the second bullet point above will generally be subject to U.S. federal income tax at a rate of 30% (or such lower rate specified by an applicable income tax treaty), which may be offset by certain U.S.-source capital losses of a Non-U.S. Holder, provided such Non-U.S. Holder has timely filed U.S. federal income tax returns with respect to such losses.

With respect to the third bullet point above, we believe we currently are not, and we do not anticipate becoming, a USRPHC. However, we cannot assure you that we will not become a USRPHC. Even if we are or were to become a USRPHC, however, our common stock will not be treated as a USRPI if our common stock is “regularly traded” on an “established securities market” (as such terms are defined by applicable Treasury Regulations) and such Non-U.S. Holder owned, actually and constructively, 5% or less of our common stock throughout the shorter of the 5-year period ending on the date of the sale or other taxable disposition or such Non-U.S. Holder's holding period. No assurance can be provided that our common stock will be regularly traded on an established securities market for purposes of the rules described above. Each Non-U.S. Holder is urged to consult its tax advisor regarding the U.S. federal income tax considerations of the sale or other taxable disposition of our common stock or pre-funded warrants, including any applicable income tax treaties that may provide for different rules.

Information Reporting and Backup Withholding

Payments of dividends on our common stock generally will not be subject to backup withholding provided the applicable withholding agent does not have actual knowledge or reason to know the Non-U.S. Holder is a U.S. person and the Non-U.S. Holder certifies its non-U.S. status by furnishing a valid IRS Form W-8BEN, W-8BEN-E, W-8ECI, W-8EXP or other applicable IRS form, or otherwise establishes an exemption. Information returns are required to be filed with the IRS in connection with any distributions on our common stock paid to the Non-U.S. Holder, regardless of whether any tax was actually withheld. Copies of these information returns may also be made

available under the provisions of an applicable treaty or agreement to the tax authorities of the country in which the Non-U.S. Holder resides or is established.

Information reporting and, depending on the circumstances, backup withholding generally will apply (at a current rate of 24%) to the proceeds of the sale or other taxable disposition of our common stock within the United States or conducted through certain U.S.-related brokers, unless the applicable withholding agent receives the certification described above and does not have actual knowledge or reason to know that the Non-U.S. Holder is a U.S. person, or the holder otherwise establishes an exemption. Proceeds of a disposition of our common stock conducted through a non-U.S. office of a non-U.S. broker that does not have certain enumerated relationships with the United States generally will not be subject to backup withholding or information reporting.

Backup withholding is not an additional tax. Any amounts withheld under the backup withholding rules may be allowed as a refund or a credit against a Non-U.S. Holder's U.S. federal income tax liability, provided the required information is timely furnished to the IRS.

Additional Withholding Tax on Payments Made to Foreign Accounts

Withholding taxes may be imposed under Sections 1471 to 1474 of the Code and the rules and regulations promulgated thereunder (commonly referred to as FATCA) on certain types of payments made to non-U.S. financial institutions and certain other non-U.S. entities. Specifically, a 30% withholding tax may be imposed on dividends on our common stock paid to a "foreign financial institution" or a "non-financial foreign entity" (each as defined in the Code), unless: (i) the foreign financial institution undertakes certain diligence, reporting and withholding obligations; (ii) the non-financial foreign entity either certifies it does not have any "substantial U.S. owners" (as defined in the Code) or furnishes identifying information regarding each substantial U.S. owner; or (iii) the foreign financial institution or non-financial foreign entity otherwise qualifies for an exemption from these rules. If the payee is a foreign financial institution and is subject to the diligence, reporting and withholding requirements in (i) above, it must enter into an agreement with the U.S. Department of the Treasury requiring, among other things, that it undertake to identify accounts held by certain "specified U.S. persons" or "United States-owned foreign entities" (each as defined in the Code), annually report certain information about such accounts, and withhold 30% on certain payments to noncompliant foreign financial institutions and certain other account holders. Foreign financial institutions located in jurisdictions that have an intergovernmental agreement with the United States concerning FATCA may be subject to different rules. If a dividend payment is both subject to withholding under FATCA and subject to the withholding tax discussed above under the section titled "Non-U.S. Holders-Distributions of Common Stock," the withholding under FATCA may be credited against, and therefore reduce, such other withholding tax.

Prospective investors should consult their tax advisors regarding the potential application of withholding under FATCA to their investment in our common stock.

UNDERWRITING

Leerink Partners LLC, Stifel, Nicolaus & Company, Incorporated and Guggenheim Securities, LLC are acting as representatives of each of the underwriters named below and as joint bookrunning managers for this offering. Subject to the terms and conditions set forth in the underwriting agreement among us and the underwriters, we have agreed to sell to the underwriters, and each of the underwriters has agreed, severally and not jointly, to purchase from us, the number of shares of common stock and pre-funded warrants set forth opposite its name below.

<u>Underwriter</u>	<u>Number of Shares of Common Stock</u>	<u>Number of Pre- Funded Warrants</u>
Leerink Partners LLC	22,930,000	350,000
Stifel, Nicolaus & Company, Incorporated	11,923,600	182,000
Guggenheim Securities, LLC	11,006,400	168,000
Total	45,860,000	700,000

Subject to the terms and conditions set forth in the underwriting agreement, the underwriters have agreed, severally and not jointly, to purchase all of the shares of common stock and pre-funded warrants sold under the underwriting agreement if any of the shares of common stock and pre-funded warrants are purchased. If an underwriter defaults, the underwriting agreement provides that the purchase commitments of the non-defaulting underwriters may be increased proportionally or the underwriting agreement may be terminated.

We have agreed to indemnify the underwriters against certain liabilities, including liabilities under the Securities Act, or to contribute to payments the underwriters may be required to make in respect of those liabilities.

The underwriters are offering the shares of common stock and pre-funded warrants, subject to prior sale, when, as and if issued to and accepted by them, subject to approval of legal matters by their counsel, including the validity of the shares of common stock and pre-funded warrants, and subject to other conditions contained in the underwriting agreement, such as the receipt by the underwriters of officers' certificates and legal opinions. The underwriters reserve the right to withdraw, cancel or modify offers to the public and to reject orders in whole or in part.

Discounts and Commissions

The representatives have advised us that the underwriters propose to initially offer the shares of common stock and pre-funded warrants to the public at the initial public offering price set forth on the cover page of this prospectus supplement and to dealers at that price less a concession not in excess of \$0.1044 per share. After the initial offering of the shares of common stock and pre-funded warrants, the public offering price, concession or any other term of the offering may be changed by the representatives.

The following table shows the initial public offering price, underwriting discounts and commissions and proceeds, before expenses, to us. The information assumes either no exercise or full exercise by the underwriters of their option to purchase additional shares of common stock.

	<u>Per Share</u>	<u>Per Pre-Funded Warrant</u>	<u>Total</u>	
			<u>Without Option</u>	<u>With Option</u>
Initial public offering price	\$ 2.900	\$ 2.899	\$ 135,023,300	\$ 155,276,900
Underwriting discounts and commissions	\$ 0.174	\$ 0.174	\$ 8,101,440	\$ 9,316,656
Proceeds, before expenses, to us	\$ 2.726	\$ 2.725	\$ 126,921,860	\$ 145,960,244

We estimate expenses payable by us in connection with this offering, other than the underwriting discounts and commissions referred to above, will be approximately \$331,000. We also have agreed to reimburse the underwriters for reasonable fees and disbursements of counsel in connection with FINRA review. In accordance with FINRA Rule 5110, this reimbursed fee is deemed underwriting compensation for this offering.

Option to Purchase Additional Shares of Common Stock

We have granted an option to the underwriters, exercisable for 30 days after the date of this prospectus supplement, to purchase up to 6,984,000 additional shares of common stock at the initial public offering price, less underwriting discounts and commissions. If the underwriters exercise this option, each underwriter will be obligated, subject to the conditions contained in the underwriting agreement, to purchase a number of additional shares of common stock proportionate to that underwriter's initial amount reflected in the above table.

No Sales of Similar Securities

We, our executive officers and directors have agreed not to sell or transfer any shares of common stock or securities convertible into or exchangeable or exercisable for shares of common stock, for 90 days after the date of this prospectus supplement, without first obtaining the written consent of Leerink Partners LLC on behalf of the underwriters. Specifically, we and these other persons have agreed, with certain limited exceptions, not to directly or indirectly, (i) offer, sell, assign, transfer, pledge, contract to sell, or otherwise dispose of, or announce the intention to otherwise dispose of, any shares of common stock (including, without limitation, common stock which may be deemed to be beneficially owned by the undersigned in accordance with the rules and regulations promulgated under the Securities Act), (ii) enter into any swap, hedge or similar agreement or arrangement that transfers in whole or in part, the economic risk of ownership of the shares of common stock, or (iii) engage in any short selling of the shares of common stock.

The lock-up provisions apply to shares of common stock and to securities convertible into or exchangeable or exercisable for shares of common stock. They also apply to shares of common stock owned now or acquired later by the person executing the lock-up agreement or for which the person executing the lock-up agreement later acquires the power of disposition.

The foregoing restrictions do not apply to, among other things and subject to restrictions: transfers made by any natural person (a) to any member of the immediate family or to a trust, (b) by will or intestate succession upon death, (c) as a bona fide gift or gifts, including to a charity or educational institution, or (d) by operation of law, such as pursuant to a domestic order, negotiated divorce settlement, divorce decree or separation agreement; transfers made by a corporation, partnership, limited liability company or other business entity to any stockholder, partner or member of, or owner of a similar equity interest, as the case may be, if, in any such case, such transfer is not for value; transfers by a trust to any beneficiaries of such trust if such transfer is not for value; transfers by a corporation, partnership, limited liability company or other business entity (a) in connection with the sale or other bona fide transfer in a single transaction of all or substantially all of the entity's capital stock, partnership interests, membership interests or other similar equity interests, as the case may be, or all or substantially all of the entity's assets, in any such case not undertaken for the purpose of avoiding lockup restrictions or (b) to another corporation, partnership, limited liability company or other business entity so long as the transferee is an affiliate of the entity and such transfer is not for value; transactions related to securities acquired in this offering and open market transactions following completion of the offering; the entry into or amendment of a Rule 10b5-1(c) program under the Exchange Act, provided that such plan does not permit the sale of shares of common stock during the lockup period and no public announcement or filing is voluntarily made or required regarding such plan during the lockup period; transfers to us pursuant to agreements in effect on the date of the offering under which we have the option to repurchase such securities upon termination of the service with the Company; transfers made to us to satisfy tax withholding obligations pursuant to our equity incentive plans or arrangements disclosed herein (including in the documents incorporated by reference); transfers made pursuant to a change of control of the company, provided that in the event that such transaction is not completed, such securities shall remain subject to the lockup restrictions; transfers in transactions pursuant to any Rule 10b5-1 plan entered into prior to the date of the offering; transfers to a partnership, limited liability company or other entity of which the transferor or immediate family of the transferor are the legal and beneficial owner of all of the outstanding equity securities or similar interests; transfers to us from an employee upon death, disability or termination of employment of such employee; and transfers to a nominee or custodian of a person or entity to whom a disposition or transfer would be permissible pursuant to the foregoing.

Nasdaq Capital Market Listing

Our shares of common stock are listed on Nasdaq and trade under the symbol “XFOR.”

Price Stabilization, Short Positions and Penalty Bids

Until the distribution of the securities is completed, SEC rules may limit underwriters and selling group members from bidding for and purchasing our shares of common stock. However, the representatives may engage in transactions that stabilize the price of the shares of common stock, such as bids or purchases to peg, fix or maintain that price.

In connection with this offering, the underwriters may purchase and sell our shares of common stock in the open market. These transactions may include short sales, purchases on the open market to cover positions created by short sales and stabilizing transactions. Short sales involve the sale by the underwriters of a greater number of shares than they are required to purchase in this offering. “Covered” short sales are sales made in an amount not greater than the underwriters’ option to purchase additional shares described above. The underwriters may close out any covered short position by either exercising their option to purchase additional shares or purchasing shares in the open market. In determining the source of shares to close out the covered short position, the underwriters will consider, among other things, the price of shares available for purchase in the open market as compared to the price at which they may purchase shares through the option to purchase additional shares granted to them under the underwriting agreement described above. “Naked” short sales are sales in excess of such option. The underwriters must close out any naked short position by purchasing shares in the open market. A naked short position is more likely to be created if the underwriters are concerned that there may be downward pressure on the price of our shares of common stock in the open market after pricing that could adversely affect investors who purchase in this offering. Stabilizing transactions consist of various bids for or purchases of shares of common stock made by the underwriters in the open market prior to the closing of this offering.

The underwriters may also impose a penalty bid. This occurs when a particular underwriter repays to the underwriters a portion of the underwriting discount received by it because the representatives have repurchased shares sold by or for the account of such underwriter in stabilizing or short covering transactions.

Similar to other purchase transactions, the underwriters’ purchases to cover the syndicate short sales may have the effect of raising or maintaining the market price of our shares of common stock or preventing or retarding a decline in the market price of our shares of common stock. As a result, the price of our shares of common stock may be higher than the price that might otherwise exist in the open market. The underwriters may conduct these transactions on Nasdaq, in the over-the-counter market or otherwise.

Neither we nor any of the underwriters make any representation or prediction as to the direction or magnitude of any effect that the transactions described above may have on the price of our shares of common stock. In addition, neither we nor any of the underwriters make any representation that the representatives will engage in these transactions or that these transactions, once commenced, will not be discontinued without notice.

Electronic Distribution

In connection with this offering, certain of the underwriters or securities dealers may distribute prospectuses by electronic means, such as e-mail.

Other Relationships

The underwriters and certain of their affiliates are full service financial institutions engaged in various activities, which may include securities trading, commercial and investment banking, financial advisory, investment management, investment research, principal investment, hedging, financing and brokerage activities. Some of the underwriters and certain of their affiliates may in the future engage in investment banking and other commercial dealings in the ordinary course of business with us and our affiliates, for which they may in the future receive customary fees, commissions and expenses. Stifel, Nicolaus & Company, Incorporated is an agent under our ATM and is entitled to receive, together with the other agents, compensation of up to 3.0% of the gross sales price per share sold pursuant to the ATM. Additionally, Stifel, Nicolaus & Company, Incorporated received compensation in connection with its service as placement agent for our August 2025 private placement transaction.

In addition, in the ordinary course of their business activities, the underwriters and their affiliates may make or hold a broad array of investments and actively trade debt and equity securities (or related derivative securities) and financial instruments (including bank loans) for their own account and for the accounts of their customers. Such investments and securities activities may involve securities and/or instruments of ours or our affiliates. The underwriters and their affiliates may also make investment recommendations and/or publish or express independent

research views in respect of such securities or financial instruments and may hold, or recommend to clients that they acquire, long and/or short positions in such securities and instruments.

Selling Restrictions

Notice to Prospective Investors in the European Economic Area

In relation to each Member State of the European Economic Area (each a “Relevant State”), no securities have been offered or will be offered pursuant to the offering to the public in that Relevant State prior to the publication of a prospectus in relation to the securities which has been approved by the competent authority in that Relevant State or, where appropriate, approved in another Relevant State and notified to the competent authority in that Relevant State, all in accordance with the Prospectus Regulation, except that securities may be offered to the public in that Relevant State at any time:

- 1) to any legal entity which is a qualified investor as defined under Article 2 of the Prospectus Regulation;
- 2) to fewer than 150 natural or legal persons (other than qualified investors as defined under Article 2 of the Prospectus Regulation), subject to obtaining the prior consent of the representatives for any such offer; or
- 3) in any other circumstances falling within Article 1(4) of the Prospectus Regulation, *provided* that no such offer of securities shall require us or any of the representatives to publish a prospectus pursuant to Article 3 of the Prospectus Regulation or supplement a prospectus pursuant to Article 23 of the Prospectus Regulation.

For the purposes of this provision, the expression an “offer to the public” in relation to any securities in any Relevant State means the communication in any form and by any means of sufficient information on the terms of the offer and any securities to be offered so as to enable an investor to decide to purchase or subscribe for any securities, and the expression “Prospectus Regulation” means Regulation (EU) 2017/1129, as amended.

Notice to Prospective Investors in the United Kingdom

No securities have been offered or will be offered pursuant to the offering to the public in the United Kingdom prior to the publication of a prospectus in relation to the securities which has been approved by the Financial Conduct Authority, except that the securities may be offered to the public in the United Kingdom at any time:

- 1) to any legal entity which is a qualified investor as defined under Article 2 of the UK Prospectus Regulation;
- 2) to fewer than 150 natural or legal persons (other than qualified investors as defined under Article 2 of the UK Prospectus Regulation), subject to obtaining the prior consent of the representatives for any such offer; or
- 3) in any other circumstances falling within Section 86 of the Financial Services and Markets Act 2000, or the FMSA, *provided* that no such offer of the securities shall require us or any representative to publish a prospectus pursuant to Section 85 of the FSMA or supplement a prospectus pursuant to Article 23 of the UK Prospectus Regulation. For the purposes of this provision, the expression an “offer to the public” in relation to the securities in the United Kingdom means the communication in any form and by any means of sufficient information on the terms of the offer and any securities to be offered so as to enable an investor to decide to purchase or subscribe for any securities and the expression “UK Prospectus Regulation” means Regulation (EU) 2017/1129 as it forms part of domestic law by virtue of the European Union (Withdrawal) Act 2018.

Notice to Prospective Investors in Canada

The securities may be sold only to purchasers purchasing, or deemed to be purchasing, as principal that are accredited investors, as defined in National Instrument 45-106 Prospectus Exemptions or subsection 73.3(1) of the Securities Act (Ontario), and are permitted clients, as defined in National Instrument 31-103 Registration Requirements, Exemptions and Ongoing Registrant Obligations. Any resale of the securities must be made in accordance with an exemption from, or in a transaction not subject to, the prospectus requirements of applicable securities laws.

Securities legislation in certain provinces or territories of Canada may provide a purchaser with remedies for rescission or damages if this prospectus supplement (including any amendment thereto) contains a misrepresentation, provided that the remedies for rescission or damages are exercised by the purchaser within the time limit prescribed by the securities legislation of the purchaser’s province or territory. The purchaser should refer to any applicable provisions of the securities legislation of the purchaser’s province or territory for particulars of these rights or consult with a legal advisor.

Pursuant to section 3A.3 of National Instrument 33-105 Underwriting Conflicts (NI 33-105), the underwriters are not required to comply with the disclosure requirements of NI 33-105 regarding underwriter conflicts of interest in connection with this offering.

Notice to Prospective Investors in Switzerland

The shares of common stock may not be publicly offered, directly or indirectly, in Switzerland within the meaning of the Swiss Financial Services Act (“FinSA”), and no application has or will be made to admit the shares of common stock to trading on any trading venue (exchange or multilateral trading facility) in Switzerland. Neither this prospectus supplement, the accompanying prospectus nor any other offering or marketing material relating to the shares of common stock constitute a prospectus pursuant to the FinSA, and neither this prospectus supplement, the accompanying prospectus nor any other offering or marketing material relating to the shares of common stock may be publicly distributed or otherwise made publicly available in Switzerland.

Notice to Prospective Investors in Israel

In the State of Israel this prospectus supplement or the accompanying prospectus shall not be regarded as an offer to the public to purchase securities under the Israeli Securities Law, 5728-1968, which requires a prospectus to be published and authorized by the Israel Securities Authority, if it complies with certain provisions of Section 15 of the Israeli Securities Law, 5728-1968, including, inter alia, if: (i) the offer is made, distributed or directed to not more than 35 investors (the “Addressed Investors”), subject to certain conditions; or (ii) the offer is made, distributed or directed to certain qualified investors defined in the First Addendum of the Israeli Securities Law, 5728-1968 (the “Qualified Investors”), subject to certain conditions. The Qualified Investors shall not be taken into account in the count of the Addressed Investors and may be offered to purchase securities in addition to the 35 Addressed Investors. The company has not and will not take any action that would require it to publish a prospectus in accordance with and subject to the Israeli Securities Law, 5728-1968. We have not and will not distribute this prospectus supplement or the accompanying prospectus or make, distribute or direct an offer to subscribe for our securities to any person within the State of Israel, other than to Qualified Investors and up to 35 Addressed Investors.

Qualified Investors may have to submit written evidence that they meet the definitions set out in of the First Addendum to the Israeli Securities Law, 5728-1968. In particular, we may request, as a condition to be offered our securities, that Qualified Investors will each represent, warrant and certify to us and/or to anyone acting on our behalf: (i) that it is an investor falling within one of the categories listed in the First Addendum to the Israeli Securities Law, 5728-1968; (ii) which of the categories listed in the First Addendum to the Israeli Securities Law, 5728-1968 regarding Qualified Investors is applicable to it; (iii) that it will abide by all provisions set forth in the Israeli Securities Law, 5728-1968 and the regulations promulgated thereunder in connection with the offer to be issued the securities; (iv) that the securities that it will be issued are, subject to exemptions available under the Israeli Securities Law, 5728-1968: (a) for its own account; (b) for investment purposes only; and (c) not issued with a view to resale within the State of Israel, other than in accordance with the provisions of the Israeli Securities Law, 5728-1968; and (v) that it is willing to provide further evidence of its Qualified Investor status. Addressed Investors may have to submit written evidence in respect of their identity and may have to sign and submit a declaration containing, inter alia, the Addressed Investor’s name, address and passport number or Israeli identification number.

LEGAL MATTERS

The validity of the securities offered hereby will be passed upon for us by Gibson, Dunn & Crutcher LLP, San Francisco, California. The underwriters are being represented in this offering by Freshfields US LLP, San Francisco, California.

EXPERTS

The financial statements incorporated in this prospectus supplement by reference to the Annual Report on Form 10-K for the year ended December 31, 2024 have been so incorporated in reliance on the report (which contains an explanatory paragraph relating to the Company's ability to continue as a going concern as described in Note 1 to the financial statements) of PricewaterhouseCoopers LLP, an independent registered public accounting firm, given on the authority of said firm as experts in auditing and accounting.

WHERE YOU CAN FIND MORE INFORMATION

This prospectus supplement and accompanying prospectus are part of the registration statement on Form S-3 we filed with the SEC. This prospectus supplement and the accompanying prospectus do not contain all of the information set forth in the registration statement and the exhibits to the registration statement. For further information with respect to us and the securities we are offering under this prospectus supplement and the accompanying prospectus, we refer you to the registration statement and the exhibits and schedules filed as a part of the registration statement. You should rely only on the information contained in this prospectus supplement, the accompanying prospectus and incorporated by reference herein or therein. We have not authorized anyone else to provide you with different information. We are not making an offer of these securities in any state where the offer is not permitted. You should not assume that the information in this prospectus supplement or accompanying prospectus is accurate as of any date other than the date on the front page of this prospectus supplement or the date on the front page of the accompanying prospectus, respectively, regardless of the time of delivery of this prospectus supplement and accompanying prospectus or any sale of the securities offered by this prospectus supplement and the accompanying prospectus.

We file annual, quarterly and current reports, proxy statements and other information with the SEC. Our SEC filings are available to the public over the Internet at the SEC's website at <http://www.sec.gov>.

Copies of certain information filed by us with the SEC are also available on our website at <http://www.x4pharma.com>. Information contained in or accessible through our website does not constitute a part of this prospectus supplement and is not incorporated by reference in this prospectus supplement.

INCORPORATION OF CERTAIN INFORMATION BY REFERENCE

The SEC allows us to “incorporate by reference” information that we file with it, which means that we can disclose important information to you by referring you to those documents. The information incorporated by reference is an important part of this prospectus supplement. Information in this prospectus supplement supersedes information incorporated by reference that we filed with the SEC prior to the date of this prospectus, while information that we file later with the SEC will automatically update and supersede the information in this prospectus. We also incorporate by reference into this prospectus supplement the documents listed below and any future filings made by us with the SEC (other than Current Reports or portions thereof furnished under Item 2.02 or Item 7.01 of Form 8-K and exhibits filed on such form that are related to such items and other portions of documents that are furnished, but not filed, pursuant to applicable rules promulgated by the SEC) that are filed by us with the SEC pursuant to Sections 13(a), 13(c), 14 or 15(d) of the Exchange Act prior to the termination of this offering, including all such reports and documents filed with the SEC after the date of the initial filing of the registration statement of which this prospectus supplement forms a part but prior to the effectiveness of such registration statement:

- Our Annual Report on Form 10-K for the fiscal year ended December 31, 2024, filed with the SEC on [March 26, 2025](#), (including the portions of our Definitive Proxy Statement on Schedule 14A filed on [April 25, 2025](#) incorporated by reference therein);
- Our Quarterly Reports on Form 10-Q for the fiscal quarters ended March 31, 2025 and June 30, 2025, filed with the SEC on [May 1, 2025](#) and [August 8, 2025](#), respectively;
- Our Current Reports on Form 8-K filed with the SEC on [January 13, 2025](#) (excluding Items 7.01 and 9.01), [February 6, 2025](#) (excluding Items 7.01 and 9.01), [March 3, 2025](#), [April 18, 2025](#), [April 24, 2025](#), [June 11, 2025](#), [June 23, 2025](#), [August 12, 2025](#), [August 13, 2025](#), [August 25, 2025](#) and [September 17, 2025](#) (excluding Items 7.01 and 9.01); and
- The description of our common stock set forth in the registration statement on Form 8-A filed with the SEC on [November 15, 2017](#), including any amendments or reports filed for purposes of updating such description.

We will provide to each person, including any beneficial owner, to whom a prospectus is delivered, without charge upon written or oral request, a copy of any or all of the documents that are incorporated by reference into this prospectus supplement but not delivered with the prospectus, including exhibits that are specifically incorporated by reference into such documents. You should direct any requests for documents to X4 Pharmaceuticals, Inc., Attn: Investor Relations, 61 North Beacon Street, 4th Floor, Boston, Massachusetts 02134.

PROSPECTUS**\$300,000,000****Common Stock
Preferred Stock
Debt Securities
Warrants**

From time to time, we may offer up to \$300,000,000 of any combination of the securities described in this prospectus in one or more offerings. We may also offer securities as may be issuable upon conversion, redemption, repurchase, exchange or exercise of any securities registered hereunder, including any applicable anti-dilution provisions.

This prospectus provides a general description of the securities we may offer. Each time we offer securities, we will provide specific terms of the securities offered in a supplement to this prospectus. We may also authorize one or more free writing prospectuses to be provided to you in connection with these offerings. The prospectus supplement and any related free writing prospectus may also add, update or change information contained in this prospectus. You should carefully read this prospectus, the applicable prospectus supplement and any related free writing prospectus, as well as any documents incorporated by reference, before you invest in any of the securities being offered.

This prospectus may not be used to consummate a sale of any securities unless accompanied by a prospectus supplement.

Our common stock is traded on the Nasdaq Capital Market under the symbol “XFOR.” On August 8, 2023, the closing sale price of our common stock was \$1.69 per share. The applicable prospectus supplement will contain information, where applicable, as to any other listing on the Nasdaq Capital Market or any securities market or other exchange of the securities, if any, covered by the applicable prospectus supplement.

We will sell these securities directly to investors, through agents designated from time to time or to or through underwriters or dealers, on a continuous or delayed basis. For additional information on the methods of sale, you should refer to the section titled “Plan of Distribution” in this prospectus. If any agents or underwriters are involved in the sale of any securities with respect to which this prospectus is being delivered, the names of such agents or underwriters and any applicable fees, commissions, discounts or options to purchase additional securities will be set forth in a prospectus supplement. The price to the public of such securities and the net proceeds we expect to receive from such sale will also be set forth in a prospectus supplement.

Investing in our securities involves a high degree of risk. You should review carefully the risks and uncertainties described under the heading “[Risk Factors](#)” contained in this prospectus beginning on page 5 and any applicable prospectus supplement and in any related free writing prospectus we have authorized for use in connection with a specific offering, and under similar headings in the other documents that are incorporated by reference into this prospectus.

NEITHER THE SECURITIES AND EXCHANGE COMMISSION NOR ANY STATE SECURITIES COMMISSION HAS APPROVED OR DISAPPROVED OF THESE SECURITIES OR DETERMINED IF THIS PROSPECTUS IS TRUTHFUL OR COMPLETE. ANY REPRESENTATION TO THE CONTRARY IS A CRIMINAL OFFENSE.

The date of this prospectus is August 24, 2023.

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ABOUT THIS PROSPECTUS

This prospectus is a part of a registration statement on Form S-3 that we filed with the SEC utilizing a “shelf” registration process. Under this shelf registration process, we may sell any combination of the securities described in this prospectus in one or more offerings up to a total aggregate offering price of \$300,000,000. This prospectus provides you with a general description of the securities we may offer.

Each time we sell securities under this prospectus, we will provide a prospectus supplement that will contain specific information about the terms of that offering. We may also authorize one or more free writing prospectuses to be provided to you that may contain material information relating to these offerings. The prospectus supplement and any related free writing prospectus that we may authorize to be provided to you may also add, update or change information contained in this prospectus or in any documents that we have incorporated by reference into this prospectus. You should read this prospectus, any applicable prospectus supplement and any related free writing prospectus, together with the information incorporated herein by reference as described under the heading “Incorporation of Certain Information by Reference,” before investing in any of the securities offered.

THIS PROSPECTUS MAY NOT BE USED TO CONSUMMATE A SALE OF SECURITIES UNLESS IT IS ACCOMPANIED BY A PROSPECTUS SUPPLEMENT.

Neither we, nor any agent, underwriter or dealer has authorized any person to give any information or to make any representation other than those contained or incorporated by reference in this prospectus, any applicable prospectus supplement or any related free writing prospectus prepared by or on behalf of us or to which we have referred you. This prospectus, any applicable supplement to this prospectus or any related free writing prospectus do not constitute an offer to sell or the solicitation of an offer to buy any securities other than the registered securities to which they relate, nor do this prospectus, any applicable supplement to this prospectus or any related free writing prospectus constitute an offer to sell or the solicitation of an offer to buy securities in any jurisdiction to any person to whom it is unlawful to make such offer or solicitation in such jurisdiction.

You should not assume that the information contained in this prospectus, any applicable prospectus supplement or any related free writing prospectus is accurate on any date subsequent to the date set forth on the front of the document or that any information we have incorporated by reference is correct on any date subsequent to the date of the document incorporated by reference, even though this prospectus, any applicable prospectus supplement or any related free writing prospectus is delivered, or securities are sold, on a later date.

This prospectus and the information incorporated herein by reference contain summaries of certain provisions contained in some of the documents described herein, but reference is made to the actual documents for complete information. All of the summaries are qualified in their entirety by the actual documents. Copies of some of the documents referred to herein have been filed, will be filed or will be incorporated by reference as exhibits to the registration statement of which this prospectus is a part, and you may obtain copies of those documents as described below under the heading “Where You Can Find More Information.”

This prospectus and the information incorporated by reference herein include trademarks, service marks and trade names owned by us or other companies. All trademarks, service marks and trade names included or incorporated by reference into this prospectus are the property of their respective owners. Solely for convenience, the trademarks and trade names in this prospectus are referred to without the symbols ® and ™, but such references should not be construed as any indication that their respective owners will not assert, to the fullest extent under applicable law, their rights thereto.

PROSPECTUS SUMMARY

This summary highlights selected information contained elsewhere in this prospectus. This summary is not complete and does not contain all of the information that you need to consider in making your investment decision. You should carefully read the entire prospectus, the applicable prospectus supplement and any related free writing prospectus, including the risks of investing in our securities discussed under the heading “Risk Factors” contained in the applicable prospectus supplement and any related free writing prospectus, and under similar headings in the other documents that are incorporated by reference into this prospectus. You should also carefully read the information incorporated by reference into this prospectus, including our financial statements, and the exhibits to the registration statement of which this prospectus is a part.

Unless otherwise indicated or the context otherwise requires, the terms “Company,” “X4 Pharmaceuticals,” “X4,” “Registrant,” “we,” “us” and “our” refer to X4 Pharmaceuticals, Inc., formerly Arsanis, Inc., and its subsidiaries.

Company Overview

We are a late clinical-stage biopharmaceutical company discovering and developing novel therapeutics for the treatment of rare diseases and those with limited treatment options, with a focus on conditions resulting from dysfunction of the immune system.

Our lead clinical candidate is mavorixafor, a small molecule antagonist of chemokine receptor CXCR4 that is being developed as an oral, once-daily therapy. Due to its ability to increase the mobilization of mature, functional white blood cells from the bone marrow into the bloodstream, we believe that mavorixafor has the potential to provide therapeutic benefit across a variety of chronic neutropenic disorders, including WHIM (Warts, Hypogammaglobulinemia, Infections, and Myelokathexis) syndrome, a rare, primary immunodeficiency. We are also currently advancing mavorixafor in clinical trial in people with certain chronic neutropenic disorders.

To date, we have not generated revenue from product sales and do not expect to generate significant revenue from the sale of our products in the foreseeable future. If our development efforts for our product candidates are successful and result in regulatory approval, we may generate revenue in the future from product sales. We cannot predict if, when, or to what extent we will generate revenue from the commercialization and sale of our product candidates. We may never succeed in obtaining regulatory approval for any of our product candidates.

Corporate Information

Prior to March 13, 2019, we were a clinical-stage biopharmaceutical company known as Arsanis, Inc. that had historically been focused on applying monoclonal antibody immunotherapies to address serious infectious diseases. Arsanis, Inc. was originally incorporated in the State of Delaware in August 2010.

On March 13, 2019, we completed our business combination with X4 Therapeutics, Inc. (formerly X4 Pharmaceuticals, Inc.) in accordance with the terms of an Agreement and Plan of Merger, dated as of November 26, 2018, as amended on December 20, 2018 and March 8, 2019 (the “Merger Agreement”), that we entered into with X4 Therapeutics, Inc. and Artemis AC Corp., a Delaware corporation and our wholly owned subsidiary, or the Merger Sub. Pursuant to the terms of the Merger Agreement, Merger Sub merged with and into X4 Therapeutics, Inc., with X4 Therapeutics, Inc. continuing as our wholly owned subsidiary and the surviving corporation of the merger, which transaction we refer to as the Merger. At the closing of the Merger, we issued shares of our common stock to X4 Therapeutics, Inc. stockholders based on an agreed upon exchange ratio, and each option or warrant to purchase X4 Therapeutics, Inc. capital stock became an option or warrant, respectively, to purchase our common stock, subject to adjustment in accordance with the agreed upon exchange ratio. Following the closing of the Merger, we effected a 1-for-6 reverse stock split of our common stock, our name was changed to X4 Pharmaceuticals, Inc., the business of X4 Therapeutics, Inc. became our business, and we became a clinical-stage biopharmaceutical company focused on the discovery, development and commercialization of novel therapeutics for the treatment of rare diseases. In connection with the closing of the Merger, our stock began trading on the Nasdaq Capital Market under the symbol “XFOR” on March 14, 2019.

Our principal executive offices are located at 61 North Beacon Street, 4th Floor, Boston, Massachusetts 02134, and our telephone number is (857) 529-8300. Our website is located at <http://www.x4pharma.com>. We do not

incorporate by reference into this prospectus the information on, or accessible through, our website, and you should not consider it as part of this prospectus.

The Securities We May Offer

We may offer shares of our common stock, shares of our preferred stock, various series of debt securities and warrants to purchase any of such securities, up to a total aggregate offering price of \$300,000,000 from time to time in one or more offerings under this prospectus, together with any applicable prospectus supplement and any related free writing prospectus, at prices and on terms to be determined by market conditions at the time of the relevant offering. This prospectus provides you with a general description of the securities we may offer. Each time we offer a type or series of securities under this prospectus, we will provide a prospectus supplement that will describe the specific amounts, prices and other important terms of the securities, including, to the extent applicable:

- designation or classification;
- aggregate principal amount or aggregate offering price;
- maturity;
- original issue discount, if any;
- rates and times of payment of interest or dividends, if any;
- redemption, conversion, exchange or sinking fund terms, if any;
- conversion or exchange prices or rates, if any, and, if applicable, any provisions for changes to or adjustments in the conversion or exchange prices or rates and in the securities or other property receivable upon conversion or exchange;
- ranking;
- restrictive covenants, if any;
- voting or other rights, if any; and
- important U.S. federal income tax considerations.

The prospectus supplement and any related free writing prospectus that we may authorize to be provided to you may also add, update or change information contained in this prospectus or in documents we have incorporated by reference. However, no prospectus supplement or free writing prospectus will offer a security that is not registered and described in this prospectus at the time of the effectiveness of the registration statement of which this prospectus is a part.

We may sell the securities directly to investors or through underwriters, dealers or agents. We, and our underwriters or agents, reserve the right to accept or reject all or part of any proposed purchase of securities. If we do offer securities through underwriters or agents, we will include in the applicable prospectus supplement:

- the names of those underwriters or agents;
- applicable fees, discounts and commissions to be paid to them;
- details regarding options to purchase additional securities, if any; and
- the estimated net proceeds to us.

THIS PROSPECTUS MAY NOT BE USED TO CONSUMMATE A SALE OF ANY SECURITIES UNLESS IT IS ACCOMPANIED BY A PROSPECTUS SUPPLEMENT.

Common Stock. We may issue shares of our common stock from time to time. Holders of our common stock are entitled to one vote for each share held on all matters submitted to a vote of stockholders and do not have cumulative voting rights. An election of directors by our stockholders shall be determined by a plurality of the votes cast by the stockholders entitled to vote on the election. Holders of common stock are entitled to receive proportionately any dividends as may be declared by our board of directors, subject to any preferential dividend rights of any series of preferred stock that we may designate and issue in the future.

In the event of our liquidation or dissolution, the holders of common stock are entitled to receive proportionately our net assets available for distribution to stockholders after the payment of all debts and other liabilities and subject to the prior rights of any outstanding preferred stock. Holders of common stock have no preemptive, subscription, redemption or conversion rights. There are no redemption or sinking fund provisions

applicable to the common stock. The rights, preferences and privileges of holders of common stock are subject to and may be adversely

affected by the rights of the holders of shares of any series of preferred stock that we may designate and issue in the future.

Preferred Stock. We may issue shares of our preferred stock from time to time, in one or more series. Under our restated certificate of incorporation, as amended, or restated certificate, our board of directors has the authority, without further action by the stockholders, to issue up to 10,000,000 shares of preferred stock, par value \$0.001 per share. As of the date of this prospectus, no shares of our preferred stock were outstanding or designated. You should refer to our restated certificate and our amended and restated by-laws, or restated by-laws, both of which are included as exhibits to the registration statement of which this prospectus is a part.

Our board of directors may, without further action by our stockholders, from time to time, direct the issuance of shares of preferred stock in series and may, at the time of issuance, determine the rights, preferences and limitations of each series, including voting rights, dividend rights and redemption and liquidation preferences. Satisfaction of any dividend preferences of outstanding shares of preferred stock would reduce the amount of funds available for the payment of dividends on shares of our common stock. Holders of shares of preferred stock may be entitled to receive a preference payment in the event of any liquidation, dissolution or winding-up of our company before any payment is made to the holders of shares of our common stock. In some circumstances, the issuance of shares of preferred stock may render more difficult or tend to discourage a merger, tender offer or proxy contest, the assumption of control by a holder of a large block of our securities or the removal of incumbent management. Upon the affirmative vote of our board of directors, without stockholder approval, we may issue shares of preferred stock with voting and conversion rights which could adversely affect the holders of shares of our common stock.

If we offer a specific series of preferred stock under this prospectus, we will describe the terms of the preferred stock in the prospectus supplement for such offering and will file a copy of the restated certificate establishing the terms of the preferred stock with the SEC. We urge you to read the applicable prospectus supplement (and any free writing prospectus that we may authorize to be provided to you) related to the series of preferred stock being offered, as well as the complete certificate of designation that contains the terms of the applicable series of preferred stock.

Debt Securities. We may issue debt securities from time to time, in one or more series, as either senior or subordinated debt or as senior or subordinated convertible debt. The senior debt securities will rank equally with any other unsecured and unsubordinated debt. The subordinated debt securities will be subordinate and junior in right of payment, to the extent and in the manner described in the instrument governing the debt, to all of our senior indebtedness. Convertible debt securities will be convertible into or exchangeable for our common stock or other securities. Conversion may be mandatory or at the holder's option and would be at prescribed conversion rates.

The debt securities will be issued under one or more documents called indentures, which are contracts between us and a national banking association or other eligible party, as trustee. In this prospectus, we have summarized certain general features of the debt securities. We urge you, however, to read the applicable prospectus supplement (and any free writing prospectus that we may authorize to be provided to you) related to the series of debt securities being offered, as well as the complete indentures that contain the terms of the debt securities. A form of indenture has been filed as an exhibit to the registration statement of which this prospectus is a part, and supplemental indentures and forms of debt securities containing the terms of the debt securities being offered will be filed as exhibits to the registration statement of which this prospectus is a part or will be incorporated by reference from reports that we file with the SEC.

Warrants. We may issue warrants for the purchase of common stock, preferred stock and/or debt securities, in one or more series, from time to time. We may issue warrants independently or together with common stock, preferred stock and/or debt securities, and the warrants may be attached to or separate from these securities. In this prospectus, we have summarized certain general features of the warrants. We urge you, however, to read the applicable prospectus supplement (and any free writing prospectus that we may authorize to be provided to you) related to the particular series of warrants being offered, as well as the complete warrant agreements and warrant certificates that contain the terms of the warrants. Forms of the warrant agreements and forms of warrant certificates containing the terms of the warrants being offered have been filed as exhibits to the registration statement of which this prospectus is a part, and supplemental warrant agreements and forms of

warrant certificates will be filed as exhibits to the registration statement of which this prospectus is a part or will be incorporated by reference from reports that we file with the SEC.

We will evidence each series of warrants by warrant certificates that we will issue. Warrants may be issued under an applicable warrant agreement that we enter into with a warrant agent. We will indicate the name and address of the warrant agent, if applicable, in the prospectus supplement relating to the particular series of warrants being offered.

RISK FACTORS

Investing in our securities involves a high degree of risk. You should carefully review the risks and uncertainties described under the heading “Risk Factors” contained in the applicable prospectus supplement and any related free writing prospectus, and under similar headings in our Annual Report on Form 10-K for the year ended December 31, 2022, as updated by any subsequently filed periodic reports and other documents that are incorporated by reference into this prospectus, before deciding whether to purchase any of the securities being registered pursuant to the registration statement of which this prospectus is a part. Each of the risk factors described in the documents referenced above could adversely affect our business, operating results and financial condition, as well as adversely affect the value of an investment in our securities, and the occurrence of any of these risks might cause you to lose all or part of your investment. Additional risks not presently known to us or that we currently believe are immaterial may also significantly impair our business operations.

SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS

This prospectus, each prospectus supplement and the information incorporated by reference in this prospectus and each prospectus supplement contain forward-looking statements. These are based on our management's current beliefs, expectations and assumptions about future events, conditions and results and on information currently available to us. Discussions containing these forward-looking statements may be found, among other places, in the sections titled "Business," "Risk Factors" and "Management's Discussion and Analysis of Financial Condition and Results of Operations" contained in the documents incorporated by reference herein.

Any statements in this prospectus, or incorporated herein by reference, about our expectations, beliefs, plans, objectives, assumptions or future events or performance are not historical facts and are forward-looking statements. Within the meaning of Section 27A of the Securities Act of 1933, as amended, or the Securities Act, and Section 21E of the Securities Exchange Act of 1934, as amended, or the Exchange Act, these forward-looking statements include statements regarding:

- the initiation, timing, progress and results of our current and future preclinical studies and clinical trials and related preparatory work and the period during which the results of the trials will become available, as well as our research and development programs;
- the potential benefits, including clinical utility, that may be derived from any of our product candidates;
- the timing of and our ability to obtain and maintain regulatory approval of our existing product candidates or any product candidates that we may develop in the future, and any related restrictions, limitations, or warnings in the label of any approved product candidates;
- our plans to research, develop, manufacture and commercialize our product candidates;
- the timing of our regulatory filings for our product candidates, along with regulatory developments in the United States and other foreign countries;
- the size and growth potential of the markets for our product candidates, if approved, and the rate and degree of market acceptance of our product candidates, including reimbursement that may be received from payors;
- the benefits of U.S. Food and Drug Administration and European Commission designations, including, without limitation, Fast Track, Orphan Drug and Breakthrough Therapy;
- our commercialization, marketing and manufacturing capabilities and strategy;
- our ability to attract and retain qualified employees and key personnel;
- our competitive position and the development of and projections relating to our competitors or our industry;
- our expectations regarding our ability to obtain and maintain intellectual property protection;
- the success of competing therapies that are or may become available;
- our estimates and expectations regarding future operations, financial position, revenues, costs, expenses, uses of cash, capital requirements or our need for additional financing;
- our ability to continue as a going concern;
- our plans to in-license, acquire, develop and commercialize additional product candidates;
- the impact of laws and regulations;
- our plans to identify additional product candidates with significant commercial potential that are consistent with our commercial objectives;
- our ability to raise additional capital;
- our strategies, prospects, plans, expectations or objectives; and
- other risks and uncertainties, including those listed under the caption "Risk Factors" in our most recent Annual Report on Form 10-K, our most recent Quarterly Report on Form 10-Q, and other filings we make with the SEC.

In some cases, you can identify forward-looking statements by the words “may,” “might,” “can,” “will,” “to be,” “could,” “would,” “should,” “expect,” “intend,” “plan,” “objective,” “anticipate,” “believe,” “estimate,” “predict,” “project,” “potential,” “likely,” “continue” and “ongoing,” or the negative of these terms, or other comparable terminology intended to identify statements about the future, although not all forward-looking statements contain these words. These statements involve known and unknown risks, uncertainties and other factors that may cause our actual results, levels of activity, performance or achievements to be materially different from the information expressed or implied by these forward-looking statements.

You should refer to the “Risk Factors” section contained in the applicable prospectus supplement and any related free writing prospectus, and under similar headings in the other documents that are incorporated by reference into this prospectus, for a discussion of important factors that may cause our actual results to differ materially from those expressed or implied by our forward-looking statements. Given these risks, uncertainties and other factors, many of which are beyond our control, we cannot assure you that the forward-looking statements in this prospectus will prove to be accurate, and you should not place undue reliance on these forward-looking statements. Furthermore, if our forward-looking statements prove to be inaccurate, the inaccuracy may be material. In light of the significant uncertainties in these forward-looking statements, you should not regard these statements as a representation or warranty by us or any other person that we will achieve our objectives and plans in any specified time frame, or at all.

Except as required by law, we assume no obligation to update these forward-looking statements publicly, or to revise any forward-looking statements to reflect events or developments occurring after the date of this prospectus, even if new information becomes available in the future.

USE OF PROCEEDS

We will retain broad discretion over the use of the net proceeds from the sale of the securities offered hereby. Except as described in any applicable prospectus supplement or in any free writing prospectuses that we may authorize to be provided to you in connection with a specific offering, we currently intend to use the net proceeds from the sale of the securities offered hereby, if any, for working capital and general corporate purposes, including research and development expenses and capital expenditures, which may include costs of funding future acquisitions or for any other purpose we describe in the applicable prospectus supplement. We will set forth in the applicable prospectus supplement or free writing prospectus our intended use for the net proceeds received from the sale of any securities sold pursuant to the prospectus supplement or free writing prospectus. Pending the use of net proceeds, we plan to invest the net proceeds in short-term interest-bearing investment-grade securities, certificates of deposit or government securities.

DESCRIPTION OF CAPITAL STOCK

The following description of our capital stock and certain provisions of our restated certificate of incorporation, as amended, or restated certificate, and amended and restated by-laws are summaries. You should also refer to the restated certificate and the amended and restated by-laws, which are filed as exhibits to the registration statement of which this prospectus is part, and to the applicable provisions of Delaware law.

General

Our restated certificate authorizes us to issue up to 500,000,000 shares of common stock, \$0.001 par value per share, and 10,000,000 shares of preferred stock, \$0.001 par value per share, all of which shares of preferred stock are undesignated. Our board of directors may establish the rights and preferences of the preferred stock from time to time. As of August 8, 2023, we had outstanding 164,424,897 shares of common stock and no shares of preferred stock outstanding.

Common Stock

Holders of our common stock are entitled to one vote for each share held on all matters submitted to a vote of stockholders and do not have cumulative voting rights. An election of directors by our stockholders shall be determined by a plurality of the votes cast by the stockholders entitled to vote on the election. Holders of common stock are entitled to receive proportionately any dividends as may be declared by our board of directors, subject to any preferential dividend rights of any series of preferred stock that we may designate and issue in the future.

In the event of our liquidation or dissolution, the holders of common stock are entitled to receive proportionately our net assets available for distribution to stockholders after the payment of all debts and other liabilities and subject to the prior rights of any outstanding preferred stock. Holders of common stock have no preemptive, subscription, redemption or conversion rights. There are no redemption or sinking fund provisions applicable to the common stock. The rights, preferences and privileges of holders of common stock are subject to and may be adversely affected by the rights of the holders of shares of any series of preferred stock that we may designate and issue in the future.

Preferred Stock

Our board of directors may, without further action by our stockholders, from time to time, direct the issuance of shares of up to 10,000,000 shares of preferred stock in series and may, at the time of issuance, determine the rights, preferences and limitations of each series, including voting rights, dividend rights and redemption and liquidation preferences. Satisfaction of any dividend preferences of outstanding shares of preferred stock would reduce the amount of funds available for the payment of dividends on shares of our common stock. Holders of shares of preferred stock may be entitled to receive a preference payment in the event of any liquidation, dissolution or winding-up of our company before any payment is made to the holders of shares of our common stock. In some circumstances, the issuance of shares of preferred stock may render more difficult or tend to discourage a merger, tender offer or proxy contest, the assumption of control by a holder of a large block of our securities or the removal of incumbent management. Upon the affirmative vote of our board of directors, without stockholder approval, we may issue shares of preferred stock with voting and conversion rights which could adversely affect the holders of shares of our common stock.

Our board of directors will fix the designations, voting powers, preferences and rights of each series, as well as the qualifications, limitations or restrictions thereof, of the preferred stock of each series that we offer under this prospectus and applicable prospectus supplements in the certificate of designation relating to that series. We will file as an exhibit to the registration statement of which this prospectus is a part, or will incorporate by reference from reports that we file with the SEC, the form of any certificate of designation that describes the terms of the series of preferred stock we are offering before the issuance of that series of preferred stock. This description will include:

- the title and stated value;
- the number of shares we are offering;
- the liquidation preference per share;

- the purchase price per share;
- the dividend rate per share, dividend period and payment dates and method of calculation for dividends;
- whether dividends will be cumulative or non-cumulative and, if cumulative, the date from which dividends will accumulate;
- our right, if any, to defer payment of dividends and the maximum length of any such deferral period;
- the procedures for any auction and remarketing, if any;
- the provisions for a sinking fund, if any;
- the provisions for redemption or repurchase, if applicable, and any restrictions on our ability to exercise those redemption and repurchase rights;
- any listing of the preferred stock on any securities exchange or market;
- whether the preferred stock will be convertible into our common stock or other securities of ours, including depositary shares and warrants, and, if applicable, the conversion period, the conversion price, or how it will be calculated, and under what circumstances it may be adjusted;
- whether the preferred stock will be exchangeable into debt securities, and, if applicable, the exchange period, the exchange price, or how it will be calculated, and under what circumstances it may be adjusted;
- voting rights, if any, of the preferred stock;
- preemption rights, if any;
- restrictions on transfer, sale or other assignment, if any;
- whether interests in the preferred stock will be represented by depositary shares;
- a discussion of any material or special U.S. federal income tax considerations applicable to the preferred stock;
- the relative ranking and preferences of the preferred stock as to dividend rights and rights if we liquidate, dissolve or wind up our affairs;
- any limitations on issuances of any class or series of preferred stock ranking senior to or on a parity with the series of preferred stock being issued as to dividend rights and rights if we liquidate, dissolve or wind up our affairs; and
- any other specific terms, rights, preferences, privileges, qualifications or restrictions of the preferred stock.

The General Corporation Law of the State of Delaware, or DGCL, the state of our incorporation, provides that the holders of preferred stock will have the right to vote separately as a class (or, in some cases, as a series) on an amendment to our certificate of incorporation if the amendment would change the par value or, unless the certificate of incorporation provided otherwise, the number of authorized shares of the class or change the powers, preferences or special rights of the class or series so as to adversely affect the class or series, as the case may be. This right is in addition to any voting rights that may be provided for in the applicable certificate of designation.

Anti-Takeover Provisions

Section 203 of the Delaware General Corporation Law

We are subject to Section 203 of the DGCL, which prohibits a Delaware corporation from engaging in any business combination with any interested stockholder for a period of three years after the date that such stockholder became an interested stockholder, with the following exceptions:

- before such date, the board of directors of the corporation approved either the business combination or the transaction that resulted in the stockholder becoming an interested stockholder;
- upon completion of the transaction that resulted in the stockholder becoming an interested stockholder, the interested stockholder owned at least 85% of the voting stock of the corporation outstanding at the time the transaction began, excluding for purposes of determining the voting stock outstanding, but not the outstanding voting stock owned by the interested stockholder, those shares owned (i) by persons who are directors and also officers and (ii) employee stock plans in which employee participants do not have the right to determine confidentially whether shares held subject to the plan will be tendered in a tender or exchange offer; or
- on or after such date, the business combination is approved by the board of directors and authorized at an annual or special meeting of the stockholders, and not by written consent, by the affirmative vote of at least 66 2/3% of the outstanding voting stock that is not owned by the interested stockholder.

In general, Section 203 defines a “business combination” to include the following:

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

In general, Section 203 defines an “interested stockholder” as an entity or person who, together with such person’s affiliates and associates, beneficially owns, or within three years prior to the time of determination of interested stockholder status did own, 15% or more of the outstanding voting stock of the corporation.

Section 203 could prohibit or delay mergers or other takeover or change in control attempts and, accordingly, may discourage attempts to acquire us even though such a transaction may offer our stockholders the opportunity to sell their stock at a price above the prevailing market price.

Staggered Board

Our restated certificate and by-laws divide our board of directors into three classes with staggered three-year terms. In addition, our restated certificate and by-laws provide that directors may be removed only for cause and only by the affirmative vote of the holders of 75% of our shares of capital stock present in person or by proxy and entitled to vote. Under our restated certificate and by-laws, any vacancy on our board of directors, including a vacancy resulting from an enlargement of our board of directors, may be filled only by vote of a majority of our directors then in office. Furthermore, our restated certificate provides that the authorized number of directors may be changed only by the resolution of our board of directors, subject to the rights of any holders of preferred stock to elect directors. The classification of our board of directors and the limitations on the ability of our stockholders to remove directors, change the authorized number of directors and fill vacancies could make it more difficult for a third party to acquire, or discourage a third party from seeking to acquire, control of us.

Authorized but Unissued Shares

The authorized but unissued shares of common stock and preferred stock are available for future issuance without stockholder approval, subject to any limitations imposed by the listing standards of any exchange on which our shares are listed. These additional shares may be used for a variety of corporate finance transactions, acquisitions and employee benefit plans. The existence of authorized but unissued and unreserved common stock and preferred stock could make more difficult or discourage an attempt to obtain control of us by means of a proxy contest, tender offer, merger or otherwise.

Special Meeting of Stockholders; Advance Notice Requirements for Stockholder Proposals and Director Nominations; Stockholder Action

Our restated certificate and restated by-laws provide that any action required or permitted to be taken by our stockholders at an annual meeting or special meeting of stockholders may only be taken if it is properly brought before such meeting and may not be taken by written action in lieu of a meeting. Our restated certificate and our restated by-laws also provide that, except as otherwise required by law, special meetings of the stockholders can only be called by the chairman of our board of directors, our chief executive officer or our board of directors. In addition, our restated by-laws establish an advance notice procedure for stockholder proposals to be brought before an annual meeting of stockholders, including proposed nominations of candidates for election to our board of directors. Stockholders at an annual meeting may only consider proposals or nominations specified in the notice of meeting or brought before the meeting by or at the direction of our board of directors, or by a stockholder of record on the record date for the meeting who is entitled to vote at the meeting and who has delivered timely written notice in proper form to our secretary of the stockholder's intention to bring such business before the meeting. These provisions could have the effect of delaying until the next stockholder meeting stockholder actions that are favored by the holders of a majority of our outstanding voting securities. These provisions also could discourage a third party from making a tender offer for our common stock because even if the third party acquired a majority of our outstanding voting stock, it would be able to take action as a stockholder, such as electing new directors or approving a merger, only at a duly called stockholders meeting and not by written consent.

Super Majority Voting

The DGCL provides generally that the affirmative vote of a majority of the shares entitled to vote on any matter is required to amend a corporation's certificate of incorporation or by-laws, unless a corporation's certificate of incorporation or by-laws, as the case may be, require a greater percentage. Our amended and restated by-laws may be amended or repealed by a majority vote of our board of directors or the affirmative vote of the holders of at least 75% of the votes that all of our stockholders would be entitled to cast in any election of directors. In addition, the affirmative vote of the holders of at least 75% of the votes that all of our stockholders would be entitled to cast in any election of directors is required to amend or repeal or to adopt any provisions inconsistent with certain of the provisions of our restated certificate.

Exclusive Forum Selection

Our restated certificate of incorporation provides that, unless we consent in writing to the selection of an alternative forum, the Court of Chancery of the State of Delaware shall be the sole and exclusive forum for (1) any derivative action or proceeding brought on behalf of our company, (2) any action asserting a claim of breach of a fiduciary duty owed by any of our directors, officers, employees or stockholders to our company or our stockholders, (3) any action asserting a claim arising pursuant to any provision of the General Corporation Law of the State of Delaware or as to which the General Corporation Law of the State of Delaware confers jurisdiction on the Court of Chancery of the State of Delaware, or (4) any action asserting a claim arising pursuant to any provision of our restated certificate or restated by-laws (in each case, as they may be amended from time to time) or governed by the internal affairs doctrine. This exclusive forum provision would not apply to suits brought to enforce any liability or duty created by the Securities Act or the Exchange Act or any other claim for which the federal courts have exclusive jurisdiction. To the extent that any such claims may be based upon federal law claims, Section 27 of the Exchange Act creates exclusive federal jurisdiction over all suits brought to enforce any duty or liability created by the Exchange Act or the rules and regulations thereunder. Furthermore, Section 22 of the Securities Act creates concurrent jurisdiction for federal and state courts over all suits brought to enforce any duty or liability created by the Securities Act or the rules and regulations thereunder. Although our restated certificate contains the choice of forum provision described above, it is possible that a court could rule that such a provision is inapplicable for a particular claim or action or that such provision is unenforceable.

Transfer Agent and Registrar

The transfer agent and registrar for our common stock is Computershare Trust Company, N.A., with offices at 150 Royall Street, Canton, Massachusetts 02021. The transfer agent for any series of preferred stock that we may offer under this prospectus will be named and described in the prospectus supplement for that series.

Listing on Nasdaq

Our common stock is listed on the Nasdaq Capital Market under the symbol “XFOR.”

DESCRIPTION OF DEBT SECURITIES

We may issue debt securities from time to time, in one or more series, as either senior or subordinated debt or as senior or subordinated convertible debt. While the terms we have summarized below will apply generally to any debt securities that we may offer under this prospectus, we will describe the particular terms of any debt securities that we may offer in more detail in the applicable prospectus supplement. The terms of any debt securities offered under a prospectus supplement may differ from the terms described below. Unless the context requires otherwise, whenever we refer to the indenture, we also are referring to any supplemental indentures that specify the terms of a particular series of debt securities.

We will issue the debt securities under the indenture that we will enter into with the trustee named in the indenture. The indenture will be qualified under the Trust Indenture Act of 1939, as amended, or the Trust Indenture Act. We have filed the form of indenture as an exhibit to the registration statement of which this prospectus is a part, and supplemental indentures and forms of debt securities containing the terms of the debt securities being offered will be filed as exhibits to the registration statement of which this prospectus is a part or will be incorporated by reference from reports that we file with the SEC.

The following summary of material provisions of the debt securities and the indenture is subject to, and qualified in its entirety by reference to, all of the provisions of the indenture applicable to a particular series of debt securities. We urge you to read the applicable prospectus supplements and any related free writing prospectuses related to the debt securities that we may offer under this prospectus, as well as the complete indenture that contains the terms of the debt securities.

General

The indenture does not limit the amount of debt securities that we may issue. It provides that we may issue debt securities up to the principal amount that we may authorize and may be in any currency or currency unit that we may designate. Except for the limitations on consolidation, merger and sale of all or substantially all of our assets contained in the indenture, the terms of the indenture do not contain any covenants or other provisions designed to give holders of any debt securities protection against changes in our operations, financial condition or transactions involving us.

We may issue the debt securities issued under the indenture as “discount securities,” which means they may be sold at a discount below their stated principal amount. These debt securities, as well as other debt securities that are not issued at a discount, may be issued with “original issue discount,” or OID, for U.S. federal income tax purposes because of interest payment and other characteristics or terms of the debt securities. Material U.S. federal income tax considerations applicable to debt securities issued with OID will be described in more detail in any applicable prospectus supplement.

We will describe in the applicable prospectus supplement the terms of the series of debt securities being offered, including:

- the title of the series of debt securities;
- any limit upon the aggregate principal amount that may be issued;
- the maturity date or dates;
- the form of the debt securities of the series;
- the applicability of any guarantees;
- whether or not the debt securities will be secured or unsecured, and the terms of any secured debt;

- whether the debt securities rank as senior debt, senior subordinated debt, subordinated debt or any combination thereof, and the terms of any subordination;
- if the price (expressed as a percentage of the aggregate principal amount thereof) at which such debt securities will be issued is a price other than the principal amount thereof, the portion of the principal amount thereof payable upon declaration of acceleration of the maturity thereof, or if applicable, the portion of the principal amount of such debt securities that is convertible into another security or the method by which any such portion shall be determined;
- the interest rate or rates, which may be fixed or variable, or the method for determining the rate and the date interest will begin to accrue, the dates interest will be payable and the regular record dates for interest payment dates or the method for determining such dates;
- our right, if any, to defer payment of interest and the maximum length of any such deferral period;
- if applicable, the date or dates after which, or the period or periods during which, and the price or prices at which, we may, at our option, redeem the series of debt securities pursuant to any optional or provisional redemption provisions and the terms of those redemption provisions;
- the date or dates, if any, on which, and the price or prices at which we are obligated, pursuant to any mandatory sinking fund or analogous fund provisions or otherwise, to redeem, or at the holder's option to purchase, the series of debt securities and the currency or currency unit in which the debt securities are payable;
- the denominations in which we will issue the series of debt securities, if other than denominations of \$1,000 and any integral multiple thereof;
- any and all terms, if applicable, relating to any auction or remarketing of the debt securities of that series and any security for our obligations with respect to such debt securities and any other terms which may be advisable in connection with the marketing of debt securities of that series;
- whether the debt securities of the series shall be issued in whole or in part in the form of a global security or securities;
- the terms and conditions, if any, upon which such global security or securities may be exchanged in whole or in part for other individual securities;
- the depositary for such global security or securities;
- if applicable, the provisions relating to conversion or exchange of any debt securities of the series and the terms and conditions upon which such debt securities will be so convertible or exchangeable, including the conversion or exchange price, as applicable, or how it will be calculated and may be adjusted, any mandatory or optional (at our option or the holders' option) conversion or exchange features, the applicable conversion or exchange period and the manner of settlement for any conversion or exchange;
- if other than the full principal amount thereof, the portion of the principal amount of debt securities of the series which shall be payable upon declaration of acceleration of the maturity thereof;
- additions to or changes in the covenants applicable to the particular debt securities being issued, including, among others, the consolidation, merger or sale covenant;
- additions to or changes in the events of default with respect to the securities and any change in the right of the trustee or the holders to declare the principal, premium, if any, and interest, if any, with respect to such securities to be due and payable;

- additions to or changes in or deletions of the provisions relating to covenant defeasance and legal defeasance;
- additions to or changes in the provisions relating to satisfaction and discharge of the indenture;
- additions to or changes in the provisions relating to the modification of the indenture both with and without the consent of holders of debt securities issued under the indenture;
- the currency of payment of debt securities if other than U.S. dollars and the manner of determining the equivalent amount in U.S. dollars;
- whether interest will be payable in cash or additional debt securities at our or the holders' option and the terms and conditions upon which the election may be made;
- the terms and conditions, if any, upon which we will pay amounts in addition to the stated interest, premium, if any and principal amounts of the debt securities of the series to any holder that is not a "United States person" for federal tax purposes;
- any restrictions on transfer, sale or assignment of the debt securities of the series; and
- any other specific terms, preferences, rights or limitations of, or restrictions on, the debt securities, any other additions or changes in the provisions of the indenture, and any terms that may be required by us or advisable under applicable laws or regulations.

Conversion or Exchange Rights

We will set forth in the applicable prospectus supplement the terms on which a series of debt securities may be convertible into or exchangeable for our common stock or our other securities. We will include provisions as to settlement upon conversion or exchange and whether conversion or exchange is mandatory, at the option of the holder or at our option. We may include provisions pursuant to which the number of shares of our common stock or our other securities that the holders of the series of debt securities receive would be subject to adjustment.

Consolidation, Merger or Sale

Unless we provide otherwise in the prospectus supplement applicable to a particular series of debt securities, the indenture will not contain any covenant that restricts our ability to merge or consolidate, or sell, convey, transfer or otherwise dispose of our assets as an entirety or substantially as an entirety. However, any successor to or acquirer of such assets (other than a subsidiary of ours) must assume all of our obligations under the indenture or the debt securities, as appropriate.

Events of Default under the Indenture

Unless we provide otherwise in the prospectus supplement applicable to a particular series of debt securities, the following are events of default under the indenture with respect to any series of debt securities that we may issue:

- if we fail to pay any installment of interest on any series of debt securities, as and when the same shall become due and payable, and such default continues for a period of 90 days; provided, however, that a valid extension of an interest payment period by us in accordance with the terms of any indenture supplemental thereto shall not constitute a default in the payment of interest for this purpose;
- if we fail to pay the principal of, or premium, if any, on any series of debt securities as and when the same shall become due and payable whether at maturity, upon redemption, by declaration or otherwise, or in any payment required by any sinking or analogous fund established with respect to such series; provided, however, that a valid extension of the maturity of such debt securities in accordance with the terms of any indenture supplemental thereto shall not constitute a default in the payment of principal or premium, if any;

- if we fail to observe or perform any other covenant or agreement contained in the debt securities or the indenture, other than a covenant specifically relating to another series of debt securities, and our failure continues for 90 days after we receive written notice of such failure, requiring the same to be remedied and stating that such is a notice of default thereunder, from the trustee or holders of at least 25% in aggregate principal amount of the outstanding debt securities of the applicable series; and
- if specified events of bankruptcy, insolvency or reorganization occur.

If an event of default with respect to debt securities of any series occurs and is continuing, other than an event of default specified in the last bullet point above, the trustee or the holders of at least 25% in aggregate principal amount of the outstanding debt securities of that series, by notice to us in writing, and to the trustee if notice is given by such holders, may declare the unpaid principal of, premium, if any, and accrued interest, if any, due and payable immediately. If an event of default specified in the last bullet point above occurs with respect to us, the principal amount of and accrued interest, if any, of each issue of debt securities then outstanding shall be due and payable without any notice or other action on the part of the trustee or any holder.

The holders of a majority in principal amount of the outstanding debt securities of an affected series may waive any default or event of default with respect to the series and its consequences, except defaults or events of default regarding payment of principal, premium, if any, or interest, unless we have cured the default or event of default in accordance with the indenture. Any waiver shall cure the default or event of default.

Subject to the terms of the indenture, if an event of default under an indenture shall occur and be continuing, the trustee will be under no obligation to exercise any of its rights or powers under such indenture at the request or direction of any of the holders of the applicable series of debt securities, unless such holders have offered the trustee reasonable indemnity. The holders of a majority in principal amount of the outstanding debt securities of any series will have the right to direct the time, method and place of conducting any proceeding for any remedy available to the trustee, or exercising any trust or power conferred on the trustee, with respect to the debt securities of that series, provided that:

- the direction so given by the holder is not in conflict with any law or the applicable indenture; and
- subject to its duties under the Trust Indenture Act, the trustee need not take any action that might involve it in personal liability or might be unduly prejudicial to the holders not involved in the proceeding.

A holder of the debt securities of any series will have the right to institute a proceeding under the indenture or to appoint a receiver or trustee, or to seek other remedies only if:

- the holder has given written notice to the trustee of a continuing event of default with respect to that series;
- the holders of at least 25% in aggregate principal amount of the outstanding debt securities of that series have made written request,
- such holders have offered to the trustee indemnity satisfactory to it against the costs, expenses and liabilities to be incurred by the trustee in compliance with the request; and
- the trustee does not institute the proceeding, and does not receive from the holders of a majority in aggregate principal amount of the outstanding debt securities of that series other conflicting directions within 90 days after the notice, request and offer.

These limitations do not apply to a suit instituted by a holder of debt securities if we default in the payment of the principal, premium, if any, or interest on, the debt securities.

We will periodically file statements with the trustee regarding our compliance with specified covenants in the indenture.

Modification of Indenture; Waiver

We and the trustee may change an indenture without the consent of any holders with respect to specific matters:

- to cure any ambiguity, defect or inconsistency in the indenture or in the debt securities of any series;
- to comply with the provisions described above under “Description of Debt Securities-Consolidation, Merger or Sale;”
- to provide for uncertificated debt securities in addition to or in place of certificated debt securities;
- to add to our covenants, restrictions, conditions or provisions such new covenants, restrictions, conditions or provisions for the benefit of the holders of all or any series of debt securities, to make the occurrence, or the occurrence and the continuance, of a default in any such additional covenants, restrictions, conditions or provisions an event of default or to surrender any right or power conferred upon us in the indenture;
- to add to, delete from or revise the conditions, limitations, and restrictions on the authorized amount, terms, or purposes of issue, authentication and delivery of debt securities, as set forth in the indenture;
- to make any change that does not adversely affect the interests of any holder of debt securities of any series in any material respect;
- to provide for the issuance of and establish the form and terms and conditions of the debt securities of any series as provided above under “Description of Debt Securities-General” to establish the form of any certifications required to be furnished pursuant to the terms of the indenture or any series of debt securities, or to add to the rights of the holders of any series of debt securities;
- to evidence and provide for the acceptance of appointment under any indenture by a successor trustee; or
- to comply with any requirements of the SEC in connection with the qualification of any indenture under the Trust Indenture Act.

In addition, under the indenture, the rights of holders of a series of debt securities may be changed by us and the trustee with the written consent of the holders of at least a majority in aggregate principal amount of the outstanding debt securities of each series that is affected. However, unless we provide otherwise in the prospectus supplement applicable to a particular series of debt securities, we and the trustee may make the following changes only with the consent of each holder of any outstanding debt securities affected:

- extending the fixed maturity of any debt securities of any series;
- reducing the principal amount, reducing the rate of or extending the time of payment of interest, or reducing any premium payable upon the redemption of any series of any debt securities; or
- reducing the percentage of debt securities, the holders of which are required to consent to any amendment, supplement, modification or waiver.

Discharge

Each indenture provides that we can elect to be discharged from our obligations with respect to one or more series of debt securities, except for specified obligations, including obligations to:

- provide for payment;
- register the transfer or exchange of debt securities of the series;

- replace stolen, lost or mutilated debt securities of the series;
- pay principal of and premium and interest on any debt securities of the series;
- maintain paying agencies;
- hold monies for payment in trust;
- recover excess money held by the trustee;
- compensate and indemnify the trustee; and
- appoint any successor trustee.

In order to exercise our rights to be discharged, we must deposit with the trustee money or government obligations sufficient to pay all the principal of, any premium, if any, and interest on, the debt securities of the series on the dates payments are due.

Form, Exchange and Transfer

We will issue the debt securities of each series only in fully registered form without coupons and, unless we provide otherwise in the applicable prospectus supplement, in denominations of \$1,000 and any integral multiple thereof. The indenture provides that we may issue debt securities of a series in temporary or permanent global form and as book-entry securities that will be deposited with, or on behalf of, The Depository Trust Company, or DTC, or another depository named by us and identified in the applicable prospectus supplement with respect to that series. To the extent the debt securities of a series are issued in global form and as book-entry, a description of terms relating to any book-entry securities will be set forth in the applicable prospectus supplement.

At the option of the holder, subject to the terms of the indenture and the limitations applicable to global securities described in the applicable prospectus supplement, the holder of the debt securities of any series can exchange the debt securities for other debt securities of the same series, in any authorized denomination and of like tenor and aggregate principal amount.

Subject to the terms of the indenture and the limitations applicable to global securities set forth in the applicable prospectus supplement, holders of the debt securities may present the debt securities for exchange or for registration of transfer, duly endorsed or with the form of transfer endorsed thereon duly executed if so required by us or the security registrar, at the office of the security registrar or at the office of any transfer agent designated by us for this purpose. Unless otherwise provided in the debt securities that the holder presents for transfer or exchange, we will impose no service charge for any registration of transfer or exchange, but we may require payment of any taxes or other governmental charges.

We will name in the applicable prospectus supplement the security registrar, and any transfer agent in addition to the security registrar, that we initially designate for any debt securities. We may at any time designate additional transfer agents or rescind the designation of any transfer agent or approve a change in the office through which any transfer agent acts, except that we will be required to maintain a transfer agent in each place of payment for the debt securities of each series.

If we elect to redeem the debt securities of any series, we will not be required to:

- issue, register the transfer of, or exchange any debt securities of that series during a period beginning at the opening of business 15 days before the day of mailing of a notice of redemption of any debt securities that may be selected for redemption and ending at the close of business on the day of the mailing; or
- register the transfer of or exchange any debt securities so selected for redemption, in whole or in part, except the unredeemed portion of any debt securities we are redeeming in part.

Information Concerning the Trustee

The trustee, other than during the occurrence and continuance of an event of default under an indenture, undertakes to perform only those duties as are specifically set forth in the applicable indenture. Upon an event of default under an indenture, the trustee must use the same degree of care as a prudent person would exercise or use in the conduct of his or her own affairs. Subject to this provision, the trustee is under no obligation to exercise any of the powers given it by the indenture at the request of any holder of debt securities unless it is offered reasonable security and indemnity against the costs, expenses and liabilities that it might incur.

Payment and Paying Agents

Unless we otherwise indicate in the applicable prospectus supplement, we will make payment of the interest on any debt securities on any interest payment date to the person in whose name the debt securities, or one or more predecessor securities, are registered at the close of business on the regular record date for the interest.

We will pay principal of and any premium and interest on the debt securities of a particular series at the office of the paying agents designated by us, except that unless we otherwise indicate in the applicable prospectus supplement, we will make interest payments by check that we will mail to the holder or by wire transfer to certain holders.

Unless we otherwise indicate in the applicable prospectus supplement, we will designate the corporate trust office of the trustee as our sole paying agent for payments with respect to debt securities of each series. We will name in the applicable prospectus supplement any other paying agents that we initially designate for the debt securities of a particular series. We will maintain a paying agent in each place of payment for the debt securities of a particular series.

All money we pay to a paying agent or the trustee for the payment of the principal of or any premium or interest on any debt securities that remains unclaimed at the end of two years after such principal, premium or interest has become due and payable will be repaid to us, and the holder of the debt security thereafter may look only to us for payment thereof.

Governing Law

The indenture and the debt securities will be governed by and construed in accordance with the internal laws of the State of New York, except to the extent that the Trust Indenture Act is applicable.

DESCRIPTION OF WARRANTS

The following description, together with the additional information we may include in any applicable prospectus supplements and free writing prospectuses, summarizes the material terms and provisions of the warrants that we may offer under this prospectus, which may consist of warrants to purchase common stock, preferred stock or debt securities and may be issued in one or more series. Warrants may be issued independently or together with common stock, preferred stock or debt securities offered by any prospectus supplement, and may be attached to or separate from those securities. While the terms we have summarized below will apply generally to any warrants that we may offer under this prospectus, we will describe the particular terms of any series of warrants that we may offer in more detail in the applicable prospectus supplement and any applicable free writing prospectus. The terms of any warrants offered under a prospectus supplement may differ from the terms described below. However, no prospectus supplement will offer a security that is not registered and described in this prospectus at the time of its effectiveness.

We have filed forms of the warrant agreements and forms of warrant certificates containing the terms of the warrants being offered as exhibits to the registration statement of which this prospectus is a part. We will file as exhibits to the registration statement of which this prospectus is a part, or will incorporate by reference from reports that we file with the SEC, the form of warrant agreement, if any, including a form of warrant certificate, that describes the terms of the particular series of warrants we are offering. The following summaries of material provisions of the warrants and the warrant agreements are subject to, and qualified in their entirety by reference to, all the provisions of the warrant agreement and warrant certificate applicable to the particular series of warrants that we may offer under this prospectus. We urge you to read the applicable prospectus supplements related to the particular series of warrants that we may offer under this prospectus, as well as any related free writing prospectuses, and the complete warrant agreements and warrant certificates that contain the terms of the warrants.

General

We will describe in the applicable prospectus supplement the terms relating to a series of warrants being offered, including:

- the title of such securities;
- the offering price or prices and aggregate number of warrants offered;
- the currency or currencies for which the warrants may be purchased;
- if applicable, the designation and terms of the securities with which the warrants are issued and the number of warrants issued with each such security or each principal amount of such security;
- if applicable, the date on and after which the warrants and the related securities will be separately transferable;
- if applicable, the minimum or maximum amount of such warrants which may be exercised at any one time;
- in the case of warrants to purchase common stock, the number of shares of common stock purchasable upon the exercise of one warrant and the price at which, and the currency in which, these shares may be purchased upon such exercise;
- in the case of warrants to purchase preferred stock, the number of shares of preferred stock purchasable upon the exercise of one warrant and the price at which, and the currency in which, these shares may be purchased upon such exercise;

- in the case of warrants to purchase debt securities, the principal amount of debt securities purchasable upon exercise of one warrant and the price at which, and currency in which, this principal amount of debt securities may be purchased upon such exercise;
- the effect of any merger, consolidation, sale or other disposition of our business on the warrant agreements and the warrants;
- the terms of any rights to redeem or call the warrants;
- the terms of any rights to force the exercise of the warrants;
- any provisions for changes to or adjustments in the exercise price or number of securities issuable upon exercise of the warrants;
- the dates on which the right to exercise the warrants will commence and expire;
- the manner in which the warrant agreements and warrants may be modified;
- a discussion of any material or special U.S. federal income tax consequences of holding or exercising the warrants;
- the terms of the securities issuable upon exercise of the warrants; and
- any other specific terms, preferences, rights or limitations of or restrictions on the warrants.

Before exercising their warrants, holders of warrants will not have any of the rights of holders of the securities purchasable upon such exercise, including:

- in the case of warrants to purchase common stock, the right to receive dividends, if any, or, payments upon our liquidation, dissolution or winding up or to exercise voting rights, if any;
- in the case of warrants to purchase preferred stock, the right to receive dividends, if any, or, payments upon our liquidation, dissolution or winding up or to exercise voting rights, if any; or
- in the case of warrants to purchase debt securities, the right to receive payments of principal of, or premium, if any, or interest on, the debt securities purchasable upon exercise or to enforce covenants in the applicable indenture.

Exercise of Warrants

Each warrant will entitle the holder to purchase the securities that we specify in the applicable prospectus supplement at the exercise price that we describe in the applicable prospectus supplement. Unless we otherwise specify in the applicable prospectus supplement, holders of the warrants may exercise the warrants at any time up to the specified time on the expiration date that we set forth in the applicable prospectus supplement. After the close of business on the expiration date, unexercised warrants will become void.

Unless we otherwise specify in the applicable prospectus supplement, holders of the warrants may exercise the warrants by delivering the warrant certificate representing the warrants to be exercised together with specified information, and paying the required amount to the warrant agent in immediately available funds, as provided in the applicable prospectus supplement. We will set forth on the reverse side of the warrant certificate and in the applicable prospectus supplement the information that the holder of the warrant will be required to deliver to the warrant agent in connection with the exercise of the warrant.

Upon receipt of the required payment and the warrant certificate properly completed and duly executed at the corporate trust office of the warrant agent or any other office indicated in the applicable prospectus supplement, we will issue and deliver the securities purchasable upon such exercise. If fewer than all of the warrants represented by the warrant certificate are exercised, then we will issue a new warrant certificate for the remaining amount of warrants. If we so indicate in the applicable prospectus supplement, holders of the warrants may surrender securities as all or part of the exercise price for warrants.

Governing Law

Unless we provide otherwise in the applicable prospectus supplement, the warrants and warrant agreements, and any claim, controversy or dispute arising under or related to the warrants or warrant agreements, will be governed by and construed in accordance with the laws of the State of New York.

Enforceability of Rights by Holders of Warrants

Each warrant agent will act solely as our agent under the applicable warrant agreement and will not assume any obligation or relationship of agency or trust with any holder of any warrant. A single bank or trust company may act as warrant agent for more than one issue of warrants. A warrant agent will have no duty or responsibility in case of any default by us under the applicable warrant agreement or warrant, including any duty or responsibility to initiate any proceedings at law or otherwise, or to make any demand upon us. Any holder of a warrant may, without the consent of the related warrant agent or the holder of any other warrant, enforce by appropriate legal action its right to exercise, and receive the securities purchasable upon exercise of, its warrants.

LEGAL OWNERSHIP OF SECURITIES

We can issue securities in registered form or in the form of one or more global securities. We describe global securities in greater detail below. We refer to those persons who have securities registered in their own names on the books that we or any applicable trustee or depositary maintain for this purpose as the “holders” of those securities. These persons are the legal holders of the securities. We refer to those persons who, indirectly through others, own beneficial interests in securities that are not registered in their own names, as “indirect holders” of those securities. As we discuss below, indirect holders are not legal holders, and investors in securities issued in book-entry form or in street name will be indirect holders.

Book-Entry Holders

We may issue securities in book-entry form only, as we will specify in the applicable prospectus supplement. This means securities may be represented by one or more global securities registered in the name of a financial institution that holds them as depositary on behalf of other financial institutions that participate in the depositary’s book-entry system. These participating institutions, which are referred to as participants, in turn, hold beneficial interests in the securities on behalf of themselves or their customers.

Only the person in whose name a security is registered is recognized as the holder of that security. Global securities will be registered in the name of the depositary or its participants. Consequently, for global securities, we will recognize only the depositary as the holder of the securities, and we will make all payments on the securities to the depositary. The depositary passes along the payments it receives to its participants, which in turn pass the payments along to their customers who are the beneficial owners. The depositary and its participants do so under agreements they have made with one another or with their customers; they are not obligated to do so under the terms of the securities.

As a result, investors in a global security will not own securities directly. Instead, they will own beneficial interests in a global security, through a bank, broker or other financial institution that participates in the depositary’s book-entry system or holds an interest through a participant. As long as the securities are issued in global form, investors will be indirect holders, and not legal holders, of the securities.

Street Name Holders

We may terminate a global security or issue securities in non-global form. In these cases, investors may choose to hold their securities in their own names or in “street name.” Securities held by an investor in street name would be registered in the name of a bank, broker or other financial institution that the investor chooses, and the investor would hold only a beneficial interest in those securities through an account he or she maintains at that institution.

For securities held in street name, we or any applicable trustee or depositary will recognize only the intermediary banks, brokers and other financial institutions in whose names the securities are registered as the holders of those securities, and we or any such trustee or depositary will make all payments on those securities to them. These institutions pass along the payments they receive to their customers who are the beneficial owners, but only because they agree to do so in their customer agreements or because they are legally required to do so. Investors who hold securities in street name will be indirect holders, not holders, of those securities.

Legal Holders

Our obligations, as well as the obligations of any applicable trustee or third party employed by us or a trustee, run only to the legal holders of the securities. We do not have obligations to investors who hold beneficial interests in global securities, in street name or by any other indirect means. This will be the case whether an investor chooses to be an indirect holder of a security or has no choice because we are issuing the securities only in global form.

For example, once we make a payment or give a notice to the legal holder, we have no further responsibility for the payment or notice even if that legal holder is required, under agreements with its participants or customers or by law, to pass it along to the indirect holders but does not do so. Similarly, we may want to obtain the approval of the holders to amend an indenture, to relieve us of the consequences of a default or of our obligation to comply with a particular provision of an indenture, or for other purposes. In such an event, we would seek approval only from the legal holders, and not the indirect holders, of the securities. Whether and how the legal holders contact the indirect holders is up to the legal holders.

Special Considerations for Indirect Holders

If you hold securities through a bank, broker or other financial institution, either in book-entry form because the securities are represented by one or more global securities or in street name, you should check with your own institution to find out:

- how it handles securities payments and notices;
- whether it imposes fees or charges;
- how it would handle a request for the holders' consent, if ever required;
- whether and how you can instruct it to send you securities registered in your own name so you can be a holder, if that is permitted in the future;
- how it would exercise rights under the securities if there were a default or other event triggering the need for holders to act to protect their interests; and
- if the securities are in book-entry form, how the depositary's rules and procedures will affect these matters.

Global Securities

A global security is a security that represents one or any other number of individual securities held by a depositary. Generally, all securities represented by the same global securities will have the same terms.

Each security issued in book-entry form will be represented by a global security that we issue to, deposit with and register in the name of a financial institution or its nominee that we select. The financial institution that we select for this purpose is called the depositary. Unless we specify otherwise in the applicable prospectus supplement, DTC will be the depositary for all securities issued in book-entry form.

A global security may not be transferred to or registered in the name of anyone other than the depositary, its nominee or a successor depositary, unless special termination situations arise. We describe those situations below under “-Special Situations When a Global Security Will Be Terminated.” As a result of these arrangements, the depositary, or its nominee, will be the sole registered owner and legal holder of all securities represented by a global security, and investors will be permitted to own only beneficial interests in a global security. Beneficial interests must be held by means of an account with a broker, bank or other financial institution that in turn has an account with the depositary or with another institution that does. Thus, an investor whose security is represented by a global security will not be a legal holder of the security, but only an indirect holder of a beneficial interest in the global security.

If the prospectus supplement for a particular security indicates that the security will be issued as a global security, then the security will be represented by a global security at all times unless and until the global security is terminated. If termination occurs, we may issue the securities through another book-entry clearing system or decide that the securities may no longer be held through any book-entry clearing system.

Special Considerations for Global Securities

As an indirect holder, an investor will have rights relating to a global security governed by the account rules of the investor's financial institution and of the depositary, as well as general laws relating to securities transfers. We do not recognize an indirect holder as a holder of securities and instead deal only with the depositary that holds the global security.

If securities are issued only as global securities, an investor should be aware of the following:

- an investor cannot cause the securities to be registered in his or her name, and cannot obtain non-global certificates for his or her interest in the securities, except in the special situations we describe below;
- an investor will be an indirect holder and must look to his or her own bank or broker for payments on the securities and protection of his or her legal rights relating to the securities, as we describe above;
- an investor may not be able to sell interests in the securities to some insurance companies and to other institutions that are required by law to own their securities in non-book-entry form;
- an investor may not be able to pledge his or her interest in the global security in circumstances where certificates representing the securities must be delivered to the lender or other beneficiary of the pledge in order for the pledge to be effective;
- the depositary's policies, which may change from time to time, will govern payments, transfers, exchanges and other matters relating to an investor's interest in the global security;
- we and any applicable trustee have no responsibility for any aspect of the depositary's actions or for its records of ownership interests in the global security, nor will we or any applicable trustee supervise the depositary in any way;
- the depositary may, and we understand that DTC will, require that those who purchase and sell interests in the global security within its book-entry system use immediately available funds, and your broker or bank may require you to do so as well; and
- financial institutions that participate in the depositary's book-entry system, and through which an investor holds its interest in the global security, may also have their own policies affecting payments, notices and other matters relating to the securities.

There may be more than one financial intermediary in the chain of ownership for an investor. We do not monitor and are not responsible for the actions of any of those intermediaries.

Special Situations When a Global Security Will Be Terminated

In a few special situations described below, a global security will terminate and interests in it will be exchanged for physical certificates representing those interests. After that exchange, the choice of whether to hold securities directly or in street name will be up to the investor. Investors must consult their own banks or brokers to find out how to have their interests in securities transferred to their own names, so that they will be direct holders. We have described the rights of holders and street name investors above.

A global security will terminate when the following special situations occur:

- if the depositary notifies us that it is unwilling, unable or no longer qualified to continue as depositary for that global security and we do not appoint another institution to act as depositary within 90 days;
- if we notify any applicable trustee that we wish to terminate that global security; or

- if an event of default has occurred with regard to securities represented by that global security and has not been cured or waived.

The applicable prospectus supplement may also list additional situations for terminating a global security that would apply only to the particular series of securities covered by the applicable prospectus supplement. When a global security terminates, the depositary, and neither we nor any applicable trustee, is responsible for deciding the names of the institutions that will be the initial direct holders.

PLAN OF DISTRIBUTION

We may sell the securities covered hereby from time to time pursuant to underwritten public offerings, direct sales to the public, negotiated transactions, block trades or a combination of these methods. A distribution of these securities offered by this prospectus may also be effected through the issuance of derivative securities, including without limitation, warrants. We may sell the securities to or through underwriters or dealers, through agents, or directly to one or more purchasers. We may distribute securities from time to time in one or more transactions:

- at a fixed price or prices, which may be changed;
- at market prices prevailing at the time of sale;
- at prices related to such prevailing market prices; or
- at negotiated prices.

We may also sell equity securities covered by this registration statement in an “at the market offering” as defined in Rule 415(a)(4) under the Securities Act. Such offering may be made into an existing trading market for such securities in transactions at other than a fixed price on or through the facilities of the Nasdaq Capital Market or any other securities exchange or quotation or trading service on which such securities may be listed, quoted or traded at the time of sale.

Such at-the-market offerings, if any, may be conducted by underwriters acting as principal or agent.

A prospectus supplement or supplements (and any related free writing prospectus that we may authorize to be provided to you) will describe the terms of the offering of the securities, including, to the extent applicable:

- the name or names of any underwriters, dealers or agents, if any;
- the purchase price of the securities and the proceeds we will receive from the sale;
- any options pursuant to which underwriters may purchase additional securities from us;
- any agency fees or underwriting discounts and other items constituting agents’ or underwriters’ compensation;
- any public offering price;
- any discounts or concessions allowed or reallocated or paid to dealers; and
- any securities exchange or market on which the securities may be listed.

Only underwriters named in the prospectus supplement are underwriters of the securities offered by the prospectus supplement.

If underwriters are used in the sale, they will acquire the securities for their own account and may resell the securities from time to time in one or more transactions at a fixed public offering price or at varying prices determined at the time of sale. The obligations of the underwriters to purchase the securities will be subject to the conditions set forth in the applicable underwriting agreement. We may offer the securities to the public through underwriting syndicates represented by managing underwriters or by underwriters without a syndicate. Subject to certain conditions, the underwriters will be obligated to purchase all of the securities offered by the prospectus supplement, other than securities covered by any option to purchase additional securities. Any public offering price and any discounts or concessions allowed or reallocated or paid to dealers may change from time to time. We may

use underwriters with whom we have a material relationship. We will describe in the prospectus supplement, naming the underwriter, the nature of any such relationship.

We may sell securities directly or through agents we designate from time to time. We will name any agent involved in the offering and sale of securities, and we will describe any commissions and other compensation we will pay the agent in the prospectus supplement. Unless the prospectus supplement states otherwise, our agent will act on a best-efforts basis for the period of its appointment.

We may authorize agents or underwriters to solicit offers by certain types of institutional investors to purchase securities from us at the public offering price set forth in the prospectus supplement pursuant to delayed delivery contracts providing for payment and delivery on a specified date in the future. We will describe the conditions to these contracts and the commissions we must pay for solicitation of these contracts in the prospectus supplement.

We may provide agents and underwriters with indemnification against civil liabilities related to this offering, including liabilities under the Securities Act, or contribution with respect to payments that the agents or underwriters may make with respect to these liabilities. Agents and underwriters may engage in transactions with, or perform services for, us in the ordinary course of business.

All securities we may offer, other than common stock, will be new issues of securities with no established trading market. Any agents or underwriters may make a market in these securities, but will not be obligated to do so and may discontinue any market making at any time without notice. We cannot guarantee the liquidity of the trading markets for any securities. There is currently no market for any of the offered securities, other than our common stock which is listed on the Nasdaq Capital Market. We have no current plans for listing of the preferred stock, debt securities or warrants on any securities exchange or quotation system; any such listing with respect to any particular preferred stock, debt securities or warrants will be described in the applicable prospectus supplement or other offering materials, as the case may be.

Any underwriter may engage in overallotment, stabilizing transactions, short covering transactions and penalty bids in accordance with Rule 103 of Regulation M under the Exchange Act. Overallotment involves sales in excess of the offering size, which create a short position. Stabilizing transactions permit bids to purchase the underlying security so long as the stabilizing bids do not exceed a specified maximum. Short covering transactions involve purchases of the securities in the open market after the distribution is completed to cover short positions. Penalty bids permit the underwriters to reclaim a selling concession from a dealer when the securities originally sold by the dealer are purchased in a stabilizing or covering transaction to cover short positions. Those activities may cause the price of the securities to be higher than it would otherwise be. If commenced, the underwriters may discontinue any of the activities at any time. These transactions may be effected on any exchange or over-the-counter market or otherwise.

Any agents and underwriters who are qualified market makers on the Nasdaq Capital Market may engage in passive market making transactions in the securities on the Nasdaq Capital Market in accordance with Rule 103 of Regulation M, during the business day prior to the pricing of the offering, before the commencement of offers or sales of the securities. Passive market makers must comply with applicable volume and price limitations and must be identified as passive market makers. In general, a passive market maker must display its bid at a price not in excess of the highest independent bid for such security; if all independent bids are lowered below the passive market maker's bid, however, the passive market maker's bid must then be lowered when certain purchase limits are exceeded. Passive market making may stabilize the market price of the securities at a level above that which might otherwise prevail in the open market and, if commenced, may be discontinued at any time.

LEGAL MATTERS

Unless otherwise indicated in the applicable prospectus supplement, certain legal matters in connection with the offering and the validity of the securities offered by this prospectus, and any supplement thereto, will be passed upon by Cooley LLP, New York, New York. Additional legal matters may be passed upon for us or any underwriters, dealers or agents, by counsel that we will name in the applicable prospectus supplement.

EXPERTS

The financial statements incorporated in this prospectus by reference to the Annual Report on Form 10-K for the year ended December 31, 2022 have been so incorporated in reliance on the report (which contains an explanatory paragraph relating to the Company's ability to continue as a going concern as described in Note 1 to the financial statements) of PricewaterhouseCoopers LLP, an independent registered public accounting firm, given on the authority of said firm as experts in auditing and accounting.

WHERE YOU CAN FIND MORE INFORMATION

This prospectus is part of a registration statement we filed with the SEC. This prospectus does not contain all of the information set forth in the registration statement and the exhibits to the registration statement. For further information with respect to us and the securities we are offering under this prospectus, we refer you to the registration statement and the exhibits and schedules filed as a part of the registration statement. You should rely only on the information contained in this prospectus or incorporated by reference in this prospectus. Neither we nor any agent, underwriter or dealer has authorized any person to provide you with different information. We are not making an offer of these securities in any state where the offer is not permitted. You should not assume that the information in this prospectus is accurate as of any date other than the date on the front page of this prospectus, regardless of the time of delivery of this prospectus or any sale of the securities offered by this prospectus.

We file annual, quarterly and current reports, proxy statements and other information with the SEC. Our SEC filings are available to the public over the Internet at the SEC's website at <http://www.sec.gov>.

Copies of certain information filed by us with the SEC are also available on our website at www.x4pharma.com. Information contained in or accessible through our website does not constitute a part of this prospectus and is not incorporated by reference into this prospectus.

INCORPORATION OF CERTAIN INFORMATION BY REFERENCE

The SEC allows us to “incorporate by reference” information that we file with it, which means that we can disclose important information to you by referring you to those documents. The information incorporated by reference is an important part of this prospectus. Information in this prospectus supersedes information incorporated by reference that we filed with the SEC prior to the date of this prospectus, while information that we file later with the SEC will automatically update and supersede the information in this prospectus. We also incorporate by reference into this prospectus the documents listed below and any future filings made by us with the SEC (other than Current Reports or portions thereof furnished under Item 2.02 or Item 7.01 of Form 8-K and exhibits filed on such form that are related to such items and other portions of documents that are furnished, but not filed, pursuant to applicable rules promulgated by the SEC) that are filed by us with the SEC pursuant to Sections 13(a), 13(c), 14 or 15(d) of the Exchange Act prior to the termination of this offering, including all such reports and documents filed with the SEC after the date of the initial filing of the registration statement of which this prospectus forms a part but prior to the effectiveness of such registration statement:

- Our Annual Report on Form 10-K for the fiscal year ended December 31, 2022, filed with the SEC on [March 21, 2023](#), including the information specifically incorporated by reference in the Annual Report on Form 10-K from our definitive proxy statement for the 2023 Annual Meeting of Stockholders, filed with the SEC on [April 25, 2023](#), as supplemented on [April 27, 2023](#);
- Our Quarterly Report on Form 10-Q for the fiscal quarter ended March 31, 2023, filed with the SEC on [May 4, 2023](#) and our Quarterly Report on Form 10-Q for the fiscal quarter ended June 30, 2023, filed with the SEC on [August 10, 2023](#);
- Our Current Reports on Form 8-K filed with the SEC on [January 6, 2023](#), [March 10, 2023](#), [May 16, 2023](#), [June 15, 2023](#), and [August 3, 2023](#) (in each case, except for information contained therein which is furnished rather than filed); and
- The description of our common stock set forth in the registration statement on [Form 8-A](#) registering our common stock under Section 12 of the Exchange Act, which was filed with the SEC on November 15, 2017, including any amendments or reports filed for purposes of updating such description, including [Exhibit 4.17](#) to our Annual Report on Form 10-K for the fiscal year ended December 31, 2022.

We will provide to each person, including any beneficial owner, to whom a prospectus is delivered, without charge upon written or oral request, a copy of any or all of the documents that are incorporated by reference into this prospectus but not delivered with the prospectus, including exhibits that are specifically incorporated by reference into such documents. You should direct any requests for documents to X4 Pharmaceuticals, Inc., Attn: Investor Relations, 61 North Beacon Street, 4th Floor, Boston, Massachusetts 02134.

Any statement contained herein or in a document incorporated or deemed to be incorporated by reference into this document will be deemed to be modified or superseded for purposes of the document to the extent that a statement contained in this document or any other subsequently filed document that is deemed to be incorporated by reference into this document modifies or supersedes the statement.

45,860,000 Shares of Common Stock
Pre-Funded Warrants to Purchase 700,000 Shares of Common Stock



X4 Pharmaceuticals, Inc.

PROSPECTUS SUPPLEMENT

Leerink Partners

Stifel

Guggenheim Securities

October 23, 2025
