

PROSPECTUS SUPPLEMENT
(To Prospectus dated October 26, 2020)



52,300,000 Shares of Common Stock
Pre-Funded Warrants to Purchase 6,800,000 Shares of Common Stock
Class C Warrants to Purchase 29,550,000 Shares of Common Stock (or Pre-Funded Warrants)

We are offering (i) 59,100,000 shares of our common stock, or for certain investors that so choose, in lieu of shares of common stock, pre-funded warrants to purchase shares of our common stock, each a Pre-Funded Warrant and collectively, the Pre-Funded Warrants, accompanied by (ii) Class C warrants to purchase an aggregate 29,550,000 shares of our common stock (or, for those investors who so choose, Pre-funded Warrants), each a Class C Warrant and collectively, the Class C Warrants, and together with the Pre-Funded Warrants, the Warrants, pursuant to this prospectus supplement and the accompanying prospectus. The common stock (and Pre-Funded Warrants sold in lieu of common stock) will be sold in fixed combinations with the Class C Warrants, with each one share of common stock (and for investors that purchase, in lieu of one share of common stock, a Pre-Funded Warrant to purchase one share of common stock) that we sell in this offering being accompanied by a Class C Warrant to purchase one-half of a share of common stock. For the investors that purchase Pre-Funded Warrants in lieu of common stock, the purchase price of each Pre-Funded Warrant and accompanying Class C Warrant will equal the price per share at which shares of common stock and accompanying Class C Warrants are sold to the public in this offering, or the public offering price, minus \$0.001. The shares of common stock (and Pre-Funded Warrants sold in lieu of common stock) and Class C Warrants are immediately separable and will be issued separately. The Pre-Funded Warrants and Class C Warrants will be exercisable immediately. The Pre-Funded Warrants will not have an expiration date and the Class C Warrants will expire 60 months from the date of issuance. The Pre-Funded Warrants will have an exercise price per share of common stock equal to \$0.001. Each Class C Warrant will be exercisable for one-half of a share of common stock with an exercise price equal to \$1.50 per whole share of common stock (or, for those investors who so choose, Pre-Funded Warrant). This prospectus supplement also relates to the offering of the shares of our common stock issuable upon the exercise of the Warrants.

Our common stock is listed on the Nasdaq Capital Market under the symbol “XFOR.” The last reported sale price of our common stock on the Nasdaq Capital Market on December 6, 2022 was \$1.20 per share. There is no established public trading market for the Warrants and we do not expect a market to develop. In addition, we do not intend to apply for listing of the Warrants on any securities exchange or recognized trading system.

We are an “emerging growth company” under applicable Securities and Exchange Commission rules and, as such, we have elected to comply with reduced public company reporting requirements. See “Prospectus Supplement Summary—Implications of Being an Emerging Growth Company and a Smaller Reporting Company.”

Investing in our securities involves a high degree of risk. Please read “[Risk Factors](#)” beginning on page S-10 of this prospectus supplement and in the documents that are 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 passed upon the adequacy or accuracy of this prospectus supplement or the accompanying prospectus. Any representation to the contrary is a criminal offense.

	Per Share	Per Pre-Funded Warrant	Per Class C Warrant	Total
Public offering price	\$ 1.09	\$ 1.089	\$ 0.01	\$65,003,200
Underwriting discounts and commissions ⁽¹⁾	\$0.0654	\$ 0.06534	\$ 0.0006	\$ 3,900,192
Proceeds, before expenses, to us	\$1.0246	\$ 1.02366	\$ 0.0094	\$61,103,008

(1) We refer you to “Underwriting” beginning on page S-30 of this prospectus supplement for additional information regarding total underwriting compensation.

We have granted the underwriters an option for a period of 30 days to purchase up to 8,865,000 additional shares of our common stock and/or Class C Warrants to purchase up to 4,432,500 additional shares of our common stock, at the public offering price less underwriting discounts and commissions. If the underwriters exercise their option in full, the total underwriting discounts and commissions payable by us will be approximately \$4.5 million and the total proceeds, before expenses, to us will be approximately \$70.3 million, excluding the proceeds, if any, for the exercise of the Class C Warrants issued pursuant to this offering.

Delivery of the shares of common stock and Warrants is expected to be made on or about December 9, 2022.

Piper Sandler

Stifel

Cantor

December 7, 2022.

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ABOUT THIS PROSPECTUS SUPPLEMENT

This prospectus supplement and the accompanying prospectus are part of a “shelf” registration statement on Form S-3 (File No. 333-249544) that we initially filed with the Securities and Exchange Commission (“SEC”) on October 19, 2020, and that was declared effective by the SEC on October 26, 2020. This document is in two parts. The first part is this prospectus supplement, which describes the specific terms of this offering and also adds to and updates information contained in the accompanying prospectus and the documents incorporated by reference herein. The second part, the accompanying prospectus, including the documents incorporated by reference therein, provides more general information. Generally, when we refer to this prospectus, we are referring to both parts of this document combined. To the extent there is a conflict between the information contained in this prospectus supplement and the information contained in the accompanying prospectus or any document incorporated by reference therein filed prior to the date of this prospectus supplement, you should rely on the information in this prospectus supplement; provided that 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 the accompanying prospectus—the statement in the document having the later date modifies or supersedes the earlier statement.

We further note that the representations, warranties and covenants made by us in any agreement that is filed as an exhibit to any document that is incorporated by reference herein were made solely for the benefit of the parties to such agreement, including, in some cases, for the purpose of allocating risk among the parties to such agreements, and should not be deemed to be a representation, warranty or covenant to you. Moreover, such representations, warranties or covenants were accurate only as of the date when made. Accordingly, such representations, warranties and covenants should not be relied on as accurately representing the current state of our affairs.

We have not authorized, and the underwriters have not authorized, anyone to provide any information other than that contained or incorporated by reference in this prospectus supplement, the accompanying prospectus or in any free writing prospectus that we have authorized for use in connection with this offering. 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. This prospectus supplement and the accompanying prospectus do not constitute an offer to sell, or a solicitation of an offer to purchase, the securities offered by this prospectus supplement and the accompanying prospectus in any jurisdiction to or from any person to whom or from whom it is unlawful to make such offer or solicitation of an offer in such jurisdiction. The information contained in this prospectus supplement, the accompanying prospectus, any free writing prospectus that we have authorized for use in connection with this offering, including the documents incorporated by reference herein or therein, is accurate only as of the respective dates thereof, regardless of the time of delivery of this prospectus supplement and the accompanying prospectus or of any sale of our securities. It is important for you to read and consider all information contained in this prospectus supplement, the accompanying prospectus and any free writing prospectus that we have authorized for use in connection with this offering, including the documents incorporated by reference herein and therein, in making your investment decision. You should also read and consider the information in the documents to which we have referred you in the sections entitled “Where You Can Find More Information” and “Incorporation of Documents by Reference” in this prospectus supplement and in the sections entitled “Where You Can Find More Information” and “Incorporation of Certain Information by Reference” in the accompanying prospectus, respectively.

We are offering to sell, and seeking offers to buy, shares of our common stock (or Pre-Funded Warrants) and accompanying Class C Warrants only in jurisdictions where offers and sales are permitted. The distribution of this prospectus supplement and the accompanying prospectus and the offering of the 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 the shares of common stock (or Pre-Funded Warrants) and accompanying Class C Warrants and the distribution of this prospectus supplement and the accompanying prospectus outside

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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.

Unless the context otherwise requires, all references in this prospectus supplement and the accompanying prospectus to the “Company,” “X4,” “we,” “us,” “our” and similar terms refer to X4 Pharmaceuticals, Inc. and its direct and indirect subsidiaries.

PROSPECTUS SUPPLEMENT SUMMARY

This summary highlights information contained elsewhere or incorporated by reference in this prospectus supplement and the accompanying prospectus. This summary does not contain all of the information that you should consider before deciding to invest in our common stock (or Pre-Funded Warrants) and accompanying Class C Warrants. You should read this entire prospectus supplement and the accompanying prospectus carefully, including the “Risk Factors” section contained in this prospectus supplement, our consolidated financial statements and the related notes thereto and the other documents and information incorporated by reference in this prospectus supplement and the accompanying prospectus.

Overview

We are a late-stage clinical biopharmaceutical company discovering and developing novel therapies for the treatment of diseases of the immune system, with a focus on rare diseases and those with limited treatment options. Our lead clinical candidate, mavorixafor, is a first-in-class, small molecule antagonist of chemokine receptor CXCR4, and is being developed as a once-daily oral therapy. We believe that inhibition of the CXCR4 pathway creates the potential to provide therapeutic benefit across a wide variety of immune system-related diseases, including chronic neutropenic disorders and certain types of cancer.

In November 2022, we announced positive top-line results from a 52-week, global Phase 3 clinical trial, which we refer to as the 4WHIM trial, for the treatment of patients with WHIM (Warts, Hypogammaglobulinemia, Infections, and Myelokathexis) syndrome, a rare, inherited, primary immunodeficiency disease typically caused by genetic mutations in the CXCR4 receptor gene. The top-line results showed that the 4WHIM trial met primary endpoint and first key secondary endpoint, with mavorixafor achieving statistically significant and clinically relevant longer times above threshold levels for both absolute neutrophil ($P < 0.0001$) and absolute lymphocyte counts ($P < 0.0001$) versus placebo. We have begun building our commercial team in anticipation of a possible New Drug Application (“NDA”) submission to the U.S. Food and Drug Administration (the “FDA”) early in the second half of 2023, with the goal of obtaining approval for mavorixafor for the treatment of people in the U.S. aged 12 and older with WHIM syndrome, should the final Phase 3 data support the NDA submission.

We are also studying mavorixafor in two Phase 1b clinical trials—one in patients with chronic neutropenic disorders, including congenital, idiopathic, and cyclic neutropenia, and one in combination with the Bruton tyrosine kinase inhibitor (“BTKi”) ibrutinib in patients with a rare B-cell lymphoma called Waldenström’s macroglobulinemia and confirmed mutations to both the CXCR4 and MYD88 genes.

We reported positive results from the Phase 1b chronic neutropenia trial in September 2022 and we are currently amending the clinical trial protocol to extend and expand the study into a Phase 1b/2 trial. Additional clinical data are expected from this expanded trial in the first half of 2023, which we expect will inform the likely regulatory path forward for mavorixafor in the treatment of chronic neutropenia. We reported positive interim results from the Waldenström’s trial in August 2022; we expect this study to conclude in December 2022.

In July 2022, we announced a strategic re-prioritization of our resources towards advancing mavorixafor solely in chronic neutropenic disorder indications, including WHIM syndrome, while pausing our pre-clinical immunodeficiency program and only progressing our oncology programs upon completion of strategic partnership(s). As a result, any further development of mavorixafor for any oncology indication, including Waldenström’s macroglobulinemia, will be subject to completion of a strategic partnership. Similarly, we are currently completing pre-clinical toxicology studies on our candidate X4P-002, a novel, small-molecule CXCR4 antagonist that has demonstrated potential in a number of oncology indications; any regulatory filings to begin clinical development of XP4-002 will now be subject to completing a strategic partnership. In addition, we have paused pre-clinical development of X4P-003, a novel, small-molecule CXCR4 antagonist on which patent

applications have been filed; further advancement of X4P-003 for any immunodeficiency indication will be dependent on the potential first approval of mavorixafor and our lifecycle management strategy for the company's product portfolio.

Mavorixafor has received multiple special designations from global regulatory authorities: in WHIM syndrome, mavorixafor has been granted Breakthrough Therapy Designation, Fast Track Designation, and Rare Pediatric Designation in the U.S., and Orphan Drug Status in both the U.S. and European Union; mavorixafor has also been granted Orphan Drug Designation in the U.S. in Waldenström's macroglobulinemia, regardless of CXCR4 mutation status. In addition, we are eligible to receive a Priority Review Voucher (PRV) as a result of mavorixafor's Rare Pediatric Designation in WHIM syndrome in the U.S.

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.

Recent Developments

On November 29, 2022, we announced positive top-line results from the 4WHIM trial of our lead clinical candidate, mavorixafor, in people with WHIM syndrome.

The top-line results showed that the 4WHIM trial met its primary endpoint, with mavorixafor achieving clinical and statistical superiority over placebo when measuring TAT_{anc}, or the length of time that participants' absolute neutrophil counts (ANC) remained above a clinically meaningful threshold of 500 cells per microliter (severe neutropenia), over 24-hour periods at 4 time points throughout the 52-week trial. Mean TAT_{anc} was 15.04 hours in the treatment group versus 2.75 hours in the placebo group (p<0.0001).

The top-line results also showed that the 4WHIM trial met a key secondary endpoint, with mavorixafor achieving clinical and statistical superiority over placebo when measuring TAT_{alc}, or the length of time that participants' absolute lymphocyte counts (ALC) remained above a clinically meaningful threshold of 1,000 cells per microliter (lymphopenia), over 24-hour periods at 4 time points throughout the 52-week trial. Mean TAT_{alc} was 15.80 hours in the treatment group versus 4.55 hours in the placebo group (p<0.0001).

Increases in both TAT_{anc} and TAT_{alc} were maintained versus placebo and baseline across 52 weeks, demonstrating durability of treatment effect during the trial. Additional 4WHIM trial data to establish clinical benefit of mavorixafor treatment for people with WHIM syndrome will be used to support a planned NDA submission.

Mavorixafor was generally well tolerated in the trial, with no treatment-related serious adverse events reported and no discontinuations for safety events. Following completion of the placebo-controlled portion of the trial, more than 90% of the eligible participants opted to receive treatment with mavorixafor in the open-label trial extension. Additional data review and analysis of the secondary and exploratory endpoints of the 4WHIM trial are ongoing, with plans to present detailed results at a future medical meeting.

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 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, or the Reverse Stock Split, 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 supplement or the accompanying prospectus the information on, or accessible through, our website, and you should not consider it as part of this prospectus supplement or the accompanying prospectus.

For a further discussion of our business, we urge you to read the documents incorporated by reference herein, including our most recent Annual Report on Form 10-K and our other periodic reports filed with the SEC and incorporated by reference herein. See “Incorporation of Certain Information by Reference” in this prospectus supplement. Please also see the section titled “Recent Developments” below.

Risks Associated with our Business

Our business is subject to numerous risks, as described under the heading “Risk Factors” contained in this prospectus supplement, the accompanying prospectus and in any free writing prospectuses that we have authorized for use in connection with this offering, and under similar headings in the documents that are incorporated by reference herein.

Implications of Being an Emerging Growth Company and a Smaller Reporting Company

We are an “emerging growth company” as defined in the Jumpstart Our Business Startups Act of 2012, and will remain an emerging growth company until December 31, 2022. An emerging growth company may take advantage of specified reduced reporting and reduced other burdens that are otherwise applicable generally to public companies. These provisions include:

- an exemption from the auditor attestation requirement in the assessment of our internal control over financial reporting pursuant to the Sarbanes-Oxley Act of 2002;
- reduced disclosure about the emerging growth company’s executive compensation arrangements; and
- no requirement to seek nonbinding advisory votes on executive compensation or golden parachute arrangements.

We may take advantage of some or all of these provisions until we are no longer an emerging growth company. We will remain an emerging growth company until the earliest of (1) December 31, 2022, (2) the last

day of the fiscal year in which we have total annual gross revenue of at least \$1.235 billion, (3) the last day of the fiscal year in which we are deemed to be a large accelerated filer, which means the market value of our equity securities that is held by non-affiliates exceeds \$700 million as of the prior June 30th and (4) the date on which we have issued more than \$1 billion in non-convertible debt during the prior three-year period.

We are also currently a “smaller reporting company” as defined in Rule 12b-2 of the Securities Exchange Act of 1934, as amended (the “Exchange Act”). In the event we are still a smaller reporting company when we cease being an emerging growth company, we will be able to continue to take advantage of certain reduced or scaled disclosure requirements, for as long as we continue to have smaller reporting company status. We may continue to be a smaller reporting company if either (1) the market value of our stock held by non-affiliates is less than \$250 million measured on the last business day of our second fiscal quarter or (2) our annual revenue was less than \$100 million during the most recently completed fiscal year and the market value of our stock held by non-affiliates is less than \$700 million measured on the last business day of our second fiscal quarter. We will cease to be an “emerging growth company” on December 31, 2022.

We have taken advantage of some reduced reporting requirements in our public filings. Accordingly, the information that we provide stockholders may be different than the information you receive from other public companies in which you hold securities. In addition, it is possible that some investors will find our securities less attractive as a result of these elections, which may result in a less active trading market for our securities and higher volatility in our share price.

THE OFFERING

Common stock offered by us pursuant to this prospectus supplement

52,300,000 shares of common stock. This prospectus supplement also relates to the offering of the shares of our common stock issuable upon exercise of the Warrants, as discussed below.

Pre-Funded Warrants offered by us pursuant to this prospectus supplement

Pre-Funded Warrants to purchase 6,800,000 shares of common stock. Each Pre-Funded Warrant will have an exercise price per share of common stock equal to \$0.001 per share. The Pre-Funded Warrants are exercisable at any time after their original issuance and will not expire. Under the Pre-Funded Warrants, we may not effect the exercise of any Pre-Funded Warrant, and a holder will not be entitled to exercise any portion of any Pre-Funded Warrant, which, upon giving effect to such exercise, would cause (i) the aggregate number of shares of our common stock beneficially owned by the holder (together with its affiliates) to exceed 9.99% of the number of shares of our common stock outstanding immediately after giving effect to the exercise, or (ii) the combined voting power of our securities beneficially owned by the holder (together with its affiliates) to exceed 9.99% of the combined voting power of all of our securities then outstanding immediately after giving effect to the exercise, as such percentage ownership is determined in accordance with the terms of the Pre-Funded Warrants. However, any holder may increase or decrease such percentage to any other percentage not in excess of 19.99% (if exceeding such percentage would result in a change of control under Nasdaq Listing Rule 5636(b) or any successor rule) upon at least 61 days' prior notice from the holder to us subject to the terms of the Pre-Funded Warrants. This prospectus supplement also relates to the offering of the shares of our common stock issuable upon exercise of the Pre-Funded Warrants.

Class C Warrants offered by us pursuant to this prospectus supplement

Class C Warrants to purchase shares of common stock (or, for those investors who so choose, Pre-Funded Warrants). Each Class C Warrant will be exercisable for one half of a share of common stock with an exercise price of \$1.50 per whole share of common stock (or, for those investors who so choose, Pre-Funded Warrant) and will expire 60 months from the date of issuance. Each Class C Warrant will be immediately exercisable, provided that the holder will be prohibited, subject to certain exceptions, from exercising the Class C Warrant for shares of our common stock to the extent that immediately after giving effect to such exercise, the holder, together with its affiliates and other attribution parties, would own more than 4.99% of the total number of shares of our common stock then issued and outstanding, which percentage may be changed at the holders' election to a higher or lower percentage not in excess of 9.99% upon 61 days' notice to us subject to the terms of the Class C Warrants.

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	<p>This prospectus supplement also relates to the offering of the shares of our common stock issuable upon exercise of the Class C Warrants.</p>
Common stock outstanding immediately after this offering	<p>121,034,553 shares of common stock (or 129,899,553 shares of common stock if the underwriters elect to exercise in full their option to purchase 8,865,000 additional shares from us), assuming no exercise of the Warrants included in this offering.</p>
Option to purchase additional common stock	<p>We have granted the underwriters an option to purchase up to 8,865,000 additional shares of our common stock and/or Class C Warrants to purchase up to 4,432,500 additional shares of our common stock from us at the public offering price less underwriting discounts and commissions. This option is exercisable, in whole or in part, for a period of 30 days following the date of this prospectus supplement.</p>
Offering price	<p>\$1.10 per share of common stock and accompanying Class C Warrant (or, for Pre-Funded Warrants in lieu of common stock, \$1.099 per Pre-Funded Warrant and accompanying Class C Warrant).</p>
Use of Proceeds	<p>We estimate that the net proceeds from this offering will be approximately \$59.8 million (or approximately \$69.0 million if the underwriters exercise their option in full), after deducting underwriting discounts and estimated offering expenses payable by us. This estimate excludes the proceeds, if any, from the exercise of the Warrants sold in this offering. We intend to use substantially all of the net proceeds from this offering to advance our corporate objectives, including but not limited to: (i) to support activities related to the preparation of NDA submission for mavorixafor for the treatment of patients with WHIM syndrome, as well as commercial market preparation activities; (ii) to complete Phase 1b/2 clinical development and fund Phase 3 development costs of mavorixafor for patients with chronic neutropenia; and (iii) for general and administrative expenses, capital expenditures, working capital and other general corporate purposes. See “Use of Proceeds” on page S-14 of this prospectus supplement for a more complete description of the intended use of proceeds from this offering.</p>
Risk Factors	<p>An investment in our securities involves a high degree of risk. See the information contained in or incorporated by reference under “Risk Factors” on page S-10 of this prospectus supplement, as well as the other information included in or incorporated by reference in this prospectus supplement and the accompanying prospectus.</p>
Nasdaq Capital Market Symbol	<p>“XFOR”. There is no established public trading market for the Warrants, and we do not expect a market to develop. We do not intend to list the Warrants on Nasdaq or any other nationally recognized securities exchange or trading system. Without an active</p>

trading market, the liquidity of the Warrants will be limited. See “Description of Securities We Are Offering” for additional information.

The number of shares of our common stock to be outstanding after this offering is based on an aggregate of 68,734,553 shares of our common stock outstanding as of September 30, 2022 and excludes:

- 1,843,673 shares of our common stock issuable upon the exercise of outstanding stock options, outstanding as of September 30, 2022, having a weighted average exercise price of \$8.11 per share;
- 415,250 shares of common stock issuable upon the exercise of outstanding stock options, granted subsequent to September 30, 2022, having a weighted average exercise price of \$1.89 per share;
- 1,397,789 shares of our common stock issuable upon the vesting and settlement of outstanding restricted stock unit awards, outstanding as of September 30, 2022, having a weighted average grant date fair value of \$3.98 per share;
- 525,000 shares of our common stock issuable upon the vesting and settlement of outstanding restricted stock unit awards, granted subsequent to September 30, 2022, having a weighted average grant date fair value of \$2.02 per share;
- 17,850,977 shares of common stock issuable upon the exercise of pre-funded warrants, outstanding as of September 30, 2022, with 15,026,279 having a remaining exercise price of \$0.001 per share and 2,824,698 having a remaining exercise price of \$0.01 per share;
- 60,374,393 shares of our common stock issuable upon the exercise of warrants, outstanding as of September 30, 2022, having a weighted average exercise price of \$1.95 per share;
- 199,744 shares of common stock reserved for future issuance under our Amended and Restated 2017 Equity Incentive Plan as of September 30, 2022;
- 64,162 shares of common stock reserved for future issuance under our 2017 Employee Stock Purchase Plan as of September 30, 2022;
- 243,450 shares of common stock reserved for future issuance under our 2019 Inducement Equity Incentive Plan as of September 30, 2022;
- 6,800,000 shares of our common stock issuable upon the exercise of the Pre-Funded Warrants being offered by us in this offering and 29,550,000 shares of our common stock issuable upon the exercise of the Class C Warrants being offered by us in this offering;
- Up to \$23.3 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, of which no shares have been sold to date; and
- Up to \$50.0 million of our shares of common stock that may be sold from time to time under an equity line of credit arrangement that we entered into on January 14, 2022 with Lincoln Park Capital Fund, LLC, of which \$3.0 million of shares have been sold to date.

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 sales under the “at the market” program and equity line of credit arrangement referred to above, and no exercise of the Warrants included in this offering or by the underwriters of their option to purchase additional shares of common stock and/or Class C Warrants to purchase additional shares of our common stock.

RISK FACTORS

Investing in our common stock involves risks. In addition to other information in this prospectus supplement, you should carefully consider the following risks, the risks described in our most recent Annual Report on Form 10-K and our other periodic reports filed with the SEC and incorporated by reference herein, as well as other information and data set forth in this prospectus supplement, the accompanying prospectus, and the documents incorporated by reference herein and therein before making an investment decision with respect to our common stock. The occurrence of any of the following risks could materially and adversely affect our business, prospects, financial condition and results of operations, which could cause you to lose all or a part of your investment in our common stock (including the common stock issuable upon exercise of the Warrants issued in this offering). Some statements in this prospectus supplement, including statements in the following risk factors, constitute forward-looking statements. See “Special Note Regarding Forward-Looking Statements.”

Risks Related to this Offering

If you purchase securities in this offering, you will suffer immediate dilution of your investment.

The public offering price per share of our common stock and the accompanying Class C Warrants (or, in the case of Pre-Funded Warrants and the accompanying Class C Warrants, the public offering price per share of our common stock and the accompanying Class C Warrant minus \$0.001) is substantially higher than the as adjusted net tangible book value per share of our common stock after giving effect to this offering. Therefore, if you purchase securities in this offering, you will pay an effective price per share of common stock that substantially exceeds our as adjusted net tangible book value per share after giving effect to this offering. If you purchase securities in this offering, assuming no exercise of the Warrants offered in this offering, you will experience immediate and substantial dilution in as adjusted net tangible book value of \$0.24 per share, representing the difference between our as adjusted net tangible book value after giving effect to this offering and the public offering price per share of common stock or Pre-Funded Warrant and the accompanying Class C Warrants. In the event the Warrants are exercised by holders, you will experience additional dilution. To the extent that any options or warrants are exercised, any restricted stock units vest and are settled, any new equity awards are issued under our equity incentive plans, or we otherwise issue additional shares of common stock in the future (including shares issued in connection with strategic and other transactions), you will experience further dilution. In addition, we may choose to raise additional capital 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. See the section entitled “Dilution” on page S-17 of this prospectus supplement for a more detailed illustration of the dilution you would incur if you participate in this offering.

There is no public market for the Warrants being offered by us in this offering.

There is no established public trading market for the 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 the Warrants on any national securities exchange or other nationally recognized trading system, including the Nasdaq Capital Market. Without an active market, the liquidity of the Warrants will be limited.

Except as otherwise provided in the Warrants, holders of each of the Warrants purchased in this offering will have no rights as common stockholders until such holders exercise their Warrants and acquire our common stock.

Until holders of Warrants acquire shares of our common stock upon exercise thereof, except as otherwise provided in each of the Warrants, such holders will have no rights with respect to the shares of our common stock underlying such Warrants. Upon exercise of the 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 date.

The Warrants are speculative in nature.

The Warrants do not confer any rights of common stock ownership on their holders, such as voting rights or the right to receive dividends, but rather merely represent the right to acquire shares of common stock at a fixed price. Specifically, commencing on the date of issuance, holders of the Pre-Funded Warrants may exercise their right to acquire the common stock and pay an exercise price per share equal to \$0.001, subject to certain adjustments, and holders of the Class C Warrants may exercise their right to acquire the common stock and pay an exercise price equal to \$1.50 per whole share of common stock (or, for those investors who so choose, Pre-Funded Warrant), subject to certain adjustments, without expiration in the case of Pre-Funded Warrants and prior to 60 months from the date of issuance in the case of Class C Warrants, after which date any unexercised Class C Warrants will expire and have no further value. Moreover, following this offering, the market value of the Warrants, if any, is uncertain and there can be no assurance that the market value of the Warrants will equal or exceed their imputed offering price. The Warrants will not be listed or quoted for trading on any market or exchange. There can be no assurance that the market price of the common stock will ever equal or exceed the respective exercise prices of the Class C Warrants, and, consequently, it may not ever be profitable for holders of the Class C Warrants to exercise the Class C Warrants.

We may not receive any additional funds upon the exercise of the Warrants.

The Warrants 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 applicable Warrants. Accordingly, we may not receive any additional funds upon the exercise of the Warrants.

Our management will have broad discretion over the use of the net proceeds from this offering, and you may not agree with how we use the proceeds and the proceeds may not be invested successfully.

Our management will have broad discretion as to the use of the net proceeds from this offering and could use them for purposes other than those contemplated at the time of this offering. Accordingly, you are relying on the judgment of our management with regard to the use of these net proceeds, and you will not have the opportunity, as part of your investment decision, to assess whether the proceeds will be used appropriately. It is possible that the proceeds will be invested in a way that does not yield a favorable, or any, return for us. For a further description of the planned use of net proceeds from this offering, see "Use of Proceeds."

Because we do not anticipate paying any cash dividends on our capital stock in the foreseeable future, capital appreciation, if any, will be your sole source of gain.

We have never paid or declared any cash dividends on our capital stock. We currently intend to retain earnings, if any, to finance the growth and development of our business and we do not anticipate paying any cash dividends in the foreseeable future. As a result, only appreciation of the price of our common stock will provide a return to our stockholders.

Sales of a significant number of shares of our common stock in the public markets, or the perception that such sales could occur, could depress the market price of our common stock.

Sales of a substantial number of shares of our common stock in the public markets could depress the market price of our common stock and impair our ability to raise capital through the sale of additional equity securities. We, our directors and our executive officers have agreed not to sell, dispose of or hedge any common stock or securities convertible into or exchangeable for shares of common stock during the period from the date of this prospectus supplement continuing through and including the date 90 days after the date of this prospectus supplement, subject to certain exceptions. The underwriters may, in their discretion, release the restrictions on any such shares at any time without notice. We cannot predict the effect that future sales of our common stock would have on the market price of our common stock.

SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS

This prospectus supplement, the accompanying prospectus and the documents incorporated by reference herein and therein 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 entitled "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 supplement, the accompanying prospectus, or incorporated herein or therein, 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 (the "Securities Act"), and Section 21E of the Exchange Act, these forward-looking statements include statements regarding:

- our plans to develop and commercialize our product candidates;
- the timing of our planned clinical trials for our product candidates;
- the timing of and our ability to obtain and maintain regulatory approvals for our product candidates;
- the clinical utility of our product candidates;
- our commercialization, marketing and manufacturing capabilities and strategy;
- the impact of the COVID-19 pandemic and other unforeseen events such as the armed conflict between Russian and Ukraine, as well as macroeconomic factors, on our business, operations, strategy, goals and anticipated timelines;
- our intellectual property position;
- our plans to in-license, acquire, develop and commercialize additional product candidates;
- our competitive position and the development of and projections relating to our competitors or our industry;
- our ability to identify, recruit and retain key personnel;
- 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 use of proceeds from this offering; and
- our estimates regarding future revenue, expenses and needs for and ability to obtain additional financing.

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 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 the accompanying prospectus, for a discussion of important factors that may cause our actual results to differ materially from those expressed or implied by our

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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 supplement and the accompanying 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 estimate that the net proceeds we will receive from the issuance and sale of shares of our common stock by us (or, in lieu of shares of common stock, Pre-Funded Warrants to purchase shares of our common stock) and the accompanying Class C Warrants in this offering will be approximately \$59.8 million, or \$69.0 million if the underwriters elect to exercise in full their option to purchase additional shares and/or Class C Warrants to purchase additional shares of our common stock from us, in each case, after deducting underwriting discounts and commissions and estimated offering expenses payable by us. This estimate excludes the proceeds, if any, from the exercise of the Warrants sold in this offering.

We currently estimate that we will use the net proceeds from this offering to advance our corporate objectives, including but not limited to:

- to support activities related to the preparation of NDA submission for mavorixafor for the treatment of patients with WHIM syndrome, as well as commercial market preparation activities;
- to complete Phase 1b/2 clinical development and fund Phase 3 development costs of mavorixafor for patients with chronic neutropenia; and
- for general and administrative expenses, capital expenditures, working capital and other general corporate purposes.

Our expected use of the net proceeds from this offering represents our current intentions based upon our present plans and business conditions. The amounts and timing of our actual use of net proceeds will vary depending on numerous factors, including the relative success and cost of our research, preclinical and clinical development programs, whether we are able to enter into future collaborations, and any unforeseen delays or cash needs. As a result, our management will have broad discretion in the application of the net proceeds, and investors will be relying on our judgment regarding the application of the net proceeds of this offering. In addition, we might decide to postpone or not pursue these planned trials and activities or other development activities if the net proceeds from this offering and the other sources of cash are less than, or do not last as long as, expected.

Pending their use, we plan to invest the net proceeds from this offering in short- and intermediate-term, interest-bearing obligations, investment-grade instruments, certificates of deposit or direct or guaranteed obligations of the U.S. government.

If all of the Pre-Funded Warrants sold in this offering were to be exercised in cash at an exercise price per share equal to \$0.001 and all of the Class C Warrants sold in this offering were to be exercised in cash at an exercise price equal to \$1.50 per whole share of common stock (or, for those investors who so choose, Pre-Funded Warrant), we would receive exercise proceeds of approximately \$44.3 million (or approximately \$51.0 million if the underwriters exercise their option in full). We cannot predict when or if the Warrants will be exercised. It is possible that the Class C Warrants may expire and that the Warrants may never be exercised.

CAPITALIZATION

The following table sets forth our cash and cash equivalents and our capitalization as of September 30, 2022:

- on an actual basis; and
- on an as adjusted basis to give effect to the issuance and sale of (i) 52,300,000 shares of our common stock and accompanying Class C Warrants to purchase 26,150,000 shares of our common stock in this offering at a public offering price of \$1.10 per share of common stock and accompanying Class C Warrant (assuming no exercise of the underwriters' option to purchase additional shares and/or Class C Warrants to purchase additional shares) and (ii) Pre-Funded Warrants to purchase 6,800,000 shares of our common stock and accompanying Class C Warrants to purchase 3,400,000 shares of our common stock at the public offering price per share minus \$0.001, in each case, after deducting underwriting discounts and commissions and estimated offering expenses payable by us and assuming no exercise of the Warrants offered hereby and that such Warrants are classified and accounted for as stockholders' equity.

We have not yet determined whether the Warrants will be classified and accounted for as liabilities or as stockholders' equity.

This table should be read together with our consolidated financial statements and related notes and the other financial information included or incorporated by reference in this prospectus supplement and the accompanying prospectus.

(in thousands, except share and per share amounts)	As of September 30, 2022	
	Actual	As Adjusted
Cash and cash equivalents	\$ 79,855	\$ 139,641
Long-term debt, net of discount and current portion	\$ 18,733	\$ 18,733
Stockholders' equity:		
Common stock, \$0.001 par value per share; 500,000,000 shares authorized, 68,734,553 shares issued and outstanding, actual; 500,000,000 shares authorized, 121,034,553 shares issued and outstanding, as adjusted	69	121
Additional paid-in capital	409,533	469,267
Accumulated other comprehensive loss	(119)	(119)
Accumulated deficit	(347,634)	(347,634)
Total stockholders' equity	61,849	121,635
Total capitalization	\$ 80,582	\$ 140,368

The number of shares of our common stock to be outstanding after this offering is based on an aggregate of 68,734,553 shares of our common stock outstanding as of September 30, 2022 and excludes:

- 1,843,673 shares of our common stock issuable upon the exercise of outstanding stock options, outstanding as of September 30, 2022, having a weighted average exercise price of \$8.11 per share;
- 415,250 shares of common stock issuable upon the exercise of outstanding stock options, granted subsequent to September 30, 2022, having a weighted average exercise price of \$1.89 per share;
- 1,397,789 shares of our common stock issuable upon the vesting and settlement of outstanding restricted stock unit awards, outstanding as of September 30, 2022, having a weighted average grant date fair value of \$3.98 per share;
- 525,000 shares of our common stock issuable upon the vesting and settlement of outstanding restricted stock unit awards, granted subsequent to September 30, 2022, having a weighted average grant date fair value of \$2.02 per share;

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- 17,850,977 shares of common stock issuable upon the exercise of pre-funded warrants, outstanding as of September 30, 2022, with 15,026,279 having a remaining exercise price of \$0.001 per share and 2,824,698 having a remaining exercise price of \$0.01 per share;
- 60,374,393 shares of our common stock issuable upon the exercise of warrants, outstanding as of September 30, 2022, having a weighted average exercise price of \$1.95 per share;
- 199,744 shares of common stock reserved for future issuance under our Amended and Restated 2017 Equity Incentive Plan as of September 30, 2022;
- 64,162 shares of common stock reserved for future issuance under our 2017 Employee Stock Purchase Plan as of September 30, 2022;
- 243,450 shares of common stock reserved for future issuance under our 2019 Inducement Equity Incentive Plan as of September 30, 2022;
- 6,800,000 shares of our common stock issuable upon the exercise of the Pre-Funded Warrants being offered by us in this offering and 29,550,000 shares of our common stock issuable upon the exercise of the Class C Warrants being offered by us in this offering;
- Up to \$23.3 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, of which no shares have been sold to date; and
- Up to \$50.0 million of our shares of common stock that may be sold from time to time under an equity line of credit arrangement that we entered into on January 14, 2022 with Lincoln Park Capital Fund, LLC, of which \$3.0 million of shares have been sold to date.

DILUTION

If you invest in our common stock (or, in lieu of common stock, Pre-Funded Warrants) and accompanying Class C Warrants, your ownership interest will be diluted immediately to the extent of the difference between the offering price per share of our common stock or Pre-Funded Warrant and accompanying Class C Warrant and the as adjusted net tangible book value per share of our common stock after this offering.

Our net tangible book value as of September 30, 2022 was \$44.5 million, or \$0.65 per share of common stock. Net tangible book value represents the amount of our total tangible assets less total liabilities. Net tangible book value per share represents net tangible book value divided by the number of outstanding shares of our common stock as of September 30, 2022.

After giving further effect to our issuance and sale of (i) 52,300,000 shares of our common stock and accompanying Class C Warrants to purchase 26,150,000 shares of our common stock in this offering in this offering at a public offering price of \$1.10 per share of common stock and accompanying Class C Warrant and (ii) Pre-Funded Warrants to purchase 6,800,000 shares of our common stock and accompanying Class C Warrants to purchase 3,400,000 shares of our common stock in this offering at the public offering price per share of common stock and accompanying Class C Warrant minus \$0.001, and in each case, after deducting underwriting discounts and commissions and estimated offering expenses payable by us, and assuming no exercise of the Warrants offered hereby and that such Warrants are classified and accounted for as stockholders' equity, our as adjusted net tangible book value as of September 30, 2022 would have been \$104.3 million, or \$0.86 per share of common stock. This represents an immediate increase in as adjusted net tangible book value of \$0.21 per share of common stock to our existing stockholders and immediate dilution in as adjusted net tangible book value of \$0.24 per share of common stock to purchasers in this offering. Dilution per share is calculated by subtracting as adjusted net tangible book value per share after this offering from the public offering price per share of common stock or Pre-Funded Warrant and accompanying Class C Warrant.

We have not yet determined whether the Warrants will be classified and accounted for as liabilities or as stockholders' equity.

The following table illustrates this dilution on a per share basis:

Public offering price per share of common stock and accompanying Class C Warrant	\$1.10
Net tangible book value per share as of September 30, 2022	\$0.65
Increase in as adjusted net tangible book value per share attributable to purchasers in this offering	<u>\$0.21</u>
As adjusted net tangible book value per share after this offering	<u>\$0.86</u>
Dilution per share to purchasers in this offering	<u>\$0.24</u>

If the underwriters exercise in full their option to purchase 8,865,000 of additional shares of our common stock and/or Class C Warrants to purchase up to 4,432,500 additional shares of our common stock from us at a public offering price of \$1.10 per share and accompanying Class C Warrant, assuming no exercise of the Warrants offered in this offering, after deducting underwriting discounts and commissions, and estimated offering expenses payable by us, the as adjusted net tangible book value after this offering would be \$0.87 per share, representing an increase in net tangible book value of \$0.22 per share to existing stockholders and immediate dilution in net tangible book value of \$0.23 per share to purchasers in this offering.

The above discussion and table are based on an aggregate of 68,734,553 shares of our common stock outstanding as of September 30, 2022 and exclude:

- 1,843,673 shares of our common stock issuable upon the exercise of outstanding stock options, outstanding as of September 30, 2022, having a weighted average exercise price of \$8.11 per share;
- 415,250 shares of common stock issuable upon the exercise of outstanding stock options, granted subsequent to September 30, 2022, having a weighted average exercise price of \$1.89 per share;

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- 1,397,789 shares of our common stock issuable upon the vesting and settlement of outstanding restricted stock unit awards, outstanding as of September 30, 2022, having a weighted average grant date fair value of \$3.98 per share;
- 525,000 shares of our common stock issuable upon the vesting and settlement of outstanding restricted stock unit awards, granted subsequent to September 30, 2022, having a weighted average grant date fair value of \$2.02 per share;
- 17,850,977 shares of common stock issuable upon the exercise of pre-funded warrants, outstanding as of September 30, 2022, with 15,026,279 having a remaining exercise price of \$0.001 per share and 2,824,698 having a remaining exercise price of \$0.01 per share;
- 60,374,393 shares of our common stock issuable upon the exercise of warrants, outstanding as of September 30, 2022, having a weighted average exercise price of \$1.95 per share;
- 199,744 shares of common stock reserved for future issuance under our Amended and Restated 2017 Equity Incentive Plan as of September 30, 2022;
- 64,162 shares of common stock reserved for future issuance under our 2017 Employee Stock Purchase Plan as of September 30, 2022;
- 243,450 shares of common stock reserved for future issuance under our 2019 Inducement Equity Incentive Plan as of September 30, 2022;
- 6,800,000 shares of our common stock issuable upon the exercise of the Pre-Funded Warrants being offered by us in this offering and 29,550,000 shares of our common stock issuable upon the exercise of the Class C Warrants being offered by us in this offering;
- Up to \$23.3 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, of which no shares have been sold to date; and
- Up to \$50.0 million of our shares of common stock that may be sold from time to time under an equity line of credit arrangement that we entered into on January 14, 2022 with Lincoln Park Capital Fund, LLC, of which \$3.0 million of shares have been sold to date.

If the holders of Warrants exercise the Warrants in full, our as adjusted net tangible book value per share after this offering would be \$0.94, representing an immediate increase in as adjusted net tangible book value per share of \$0.29 to existing stockholders and immediate dilution in as adjusted net tangible book value per share of \$0.16 to purchasers in this offering.

To the extent that any outstanding options or warrants are exercised or restricted stock units vest, the Warrants issued in this offering are accounted for as liabilities or we otherwise issue additional shares of common stock or warrants in the future, there will be further dilution to new investors. In addition, we may choose to raise additional capital 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 may result in further dilution to our stockholders.

DESCRIPTION OF SECURITIES WE ARE OFFERING

We are offering shares of our common stock, or, for certain investors that so choose, in lieu of common stock, Pre-Funded Warrants to purchase shares of our common stock, together with Class C Warrants to purchase shares of our common stock (or, for those investors who so choose, Pre-Funded Warrants). We are also registering the shares of common stock issuable from time to time upon exercise of Warrants offered hereby. The shares of common stock (or Pre-Funded Warrants) and accompanying Class C Warrants are immediately separable and will be issued separately.

Common Stock

We are offering shares of common stock in this offering. Our restated certificate of incorporation 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.

For more information regarding our common stock, see the section titled “Description of Capital Stock” starting on page 8 of the accompanying prospectus.

Pre-Funded Warrants

The following summary of certain terms and provisions of the Pre-Funded Warrants is not complete and is subject to, and qualified in its entirety by, the provisions of the Pre-Funded Warrants. Prospective investors should carefully review the terms and provisions of the form of Pre-Funded Warrant for a complete description of the terms and conditions of the Pre-Funded Warrants.

Form. The Pre-Funded Warrants will be issued as individual warrant agreements to the investors. The form of Pre-Funded Warrant will be filed as an exhibit to our Current Report on Form 8-K that we expect to file with the SEC following the completion of this offering.

Exercisability. The Pre-Funded Warrants are exercisable at any time after their original issuance. The Pre-Funded Warrants will be exercisable, at the option of each holder, in whole or in part by delivering to us a duly executed exercise notice and by payment in full in immediately available funds for the number of shares of common stock purchased upon such exercise. As an alternative to payment in immediately available funds, the holder may, in its sole discretion, elect to exercise the Pre-Funded Warrant through a cashless exercise, in which case the holder would receive upon such exercise the net number of shares of common stock determined according to the formula set forth in the Pre-Funded Warrant. No fractional shares of common stock will be issued in connection with the exercise of a Pre-Funded Warrant. In lieu of fractional shares, we will pay the holder an amount in cash equal to the fractional amount multiplied by the fair market value of any such fractional shares.

Exercise Limitations. Under the Pre-Funded Warrants, we may not effect the exercise of any Pre-Funded Warrant, and a holder will not be entitled to exercise any portion of any Pre-Funded Warrant, which, upon giving effect to such exercise, would cause (i) the aggregate number of shares of our common stock beneficially owned by the holder (together with its affiliates) to exceed 9.99% of the number of shares of our common stock outstanding immediately after giving effect to the exercise, or (ii) the combined voting power of our securities beneficially owned by the holder (together with its affiliates) to exceed 9.99% of the combined voting power of all of our securities then outstanding immediately after giving effect to the exercise, as such percentage ownership is determined in accordance with the terms of the Pre-Funded Warrants. However, any holder may increase or decrease such percentage to any other percentage not in excess of 19.99% (if exceeding such percentage would result in a change of control under Nasdaq Listing Rule 5636(b) or any successor rule) upon at least 61 days’ prior notice from the holder to us subject to the terms of the Pre-Funded Warrants.

Exercise Price. The exercise price per whole share of our common stock purchasable upon the exercise of the Pre-Funded Warrants is \$0.001 per share of common stock. The exercise price of the Pre-Funded Warrants is subject to appropriate adjustment in the event of certain stock dividends and distributions, stock splits, stock combinations, reclassifications or similar events affecting our common stock and also upon any distributions of assets, including cash, stock or other property to our stockholders.

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Transferability. Subject to applicable laws, the Pre-Funded Warrants may be offered for sale, sold, transferred or assigned without our consent.

Exchange Listing. We do not plan on applying to list the Pre-Funded Warrants on The Nasdaq Capital Market, any other national securities exchange or any other nationally recognized trading system.

Fundamental Transactions. In the event of a fundamental transaction, as described in the Pre-Funded Warrants and generally including any reorganization, recapitalization or reclassification of our common stock, the sale, transfer or other disposition of all or substantially all of our properties or assets, our consolidation or merger with or into another person, the acquisition of more than 50% of our outstanding common stock, or any person or group becoming the beneficial owner of 50% of the voting power represented by our outstanding common stock, the holders of the Pre-Funded Warrants will be entitled to receive upon exercise of the Pre-Funded Warrants the kind and amount of securities, cash or other property that the holders would have received had they exercised the Pre-Funded Warrants immediately prior to such fundamental transaction without regard to any limitations on exercise contained in the Pre-Funded Warrants.

Rights as a Stockholder. Except for the right to participate in certain dividends and distributions and 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.

Class C Warrants

The following summary of certain terms and provisions of the Class C Warrants is not complete and is subject to, and qualified in its entirety by, the provisions of the Class C Warrants. Prospective investors should carefully review the terms and provisions of the form of Class C Warrant for a complete description of the terms and conditions of the Class C Warrants.

Form. The Class C Warrants will be issued as individual warrant agreements to the investors. The form of Class C Warrant will be filed as an exhibit to our Current Report on Form 8-K that we expect to file with the SEC following the completion of this offering. The Class C Warrants will be issued in book-entry form and shall initially be represented only by one or more global warrants deposited with the warrant agent, as custodian on behalf of The Depository Trust Company ("DTC"), and registered in the name of Cede & Co., a nominee of DTC, or as otherwise directed by DTC, subject to a holder's right to elect to receive a Class C Warrant in certificated form pursuant to the terms of the Warrant Agency Agreement.

Exercisability. The Class C Warrants are exercisable immediately and at any time up to the date that is five years after their original issuance. The Class C Warrants will be exercisable, at the option of each holder, in whole or in part by delivering to us a duly executed exercise notice and, at any time a registration statement registering the issuance of the shares of common stock underlying the Class C Warrants under the Securities Act is effective and available for the issuance of such shares, or an exemption from registration under the Securities Act is available for the issuance of such shares, by payment in full in immediately available funds for the number of shares of common stock purchased upon such exercise. No fractional shares of common stock will be issued in connection with the exercise of a Class C Warrant.

Exercise Limitation. A holder will not have the right to exercise any portion of the Class C Warrant if the holder (together with its affiliates) would beneficially own in excess of 4.99% 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 Class C Warrants. However, any holder may increase or decrease such percentage to any other percentage not in excess of 9.99%, provided that any increase in such percentage shall not be effective until 61 days following notice from the holder to us. If the holder is not permitted to exercise a Class C Warrant for common stock due to the foregoing limitation, then the holder may exercise the

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Class C Warrant for an equivalent number of Pre-Funded Warrants with an exercise price of \$0.001 in substantially the same form of Pre-Funded Warrant to purchase shares of common stock described elsewhere in this prospectus supplement.

Exercise Price. Each Class C Warrant is exercisable for one-half of a share of common stock with an exercise price of \$1.50 per whole share of common stock.

The exercise price and number of common stock issuable upon exercise will proportionally adjust in the event of certain stock dividends and distributions, stock splits, stock combinations, reclassifications or similar events affecting our common stock.

Each Class C Warrant is exercisable for one-half of a share of common stock, subject to adjustment in the event of stock dividends, stock splits, stock combinations, reclassifications or similar events affecting our common stock as described herein.

Fundamental Transaction. In the event we consummate a merger or consolidation with or into another person or other reorganization event in which our common stock are converted or exchanged for securities, cash or other property, or we sell, lease, license, assign, transfer, convey or otherwise dispose of all or substantially all of our assets or we or another person acquire 50% or more of our outstanding shares of common stock, then following such event, the holders of the Class C Warrants will be entitled to receive upon exercise of such Class C Warrants the same kind and amount of securities, cash or property which the holders would have received had they exercised their Class C Warrants immediately prior to such fundamental transaction. Any successor to us or surviving entity shall assume the obligations under the Class C Warrants. Additionally, as more fully described in the Class C Warrants, in the event of certain fundamental transactions, the holders of the Class C Warrants will be entitled to receive consideration in an amount equal to the Black Scholes value of the Class C Warrants on the date of consummation of such transaction.

Exchange Listing. There is no established public trading market for the Class C Warrants, and we do not expect a market to develop. In addition, we do not intend to list the Class C Warrants on any securities exchange or nationally recognized trading system. Without an active trading market, the liquidity of the Class C Warrants will be limited.

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

Listing on the Nasdaq Capital Market

Our common stock is listed on The Nasdaq Capital Market under the trading symbol "XFOR." There is no established public trading market for the Warrants, and we do not expect a market to develop. We do not intend to list the Warrants on The Nasdaq Capital Market, any other national securities exchange or any other nationally recognized trading system.

Transfer Agent and Registrar

The transfer agent and registrar for shares of our common stock (including the underlying shares of common stock issuable upon exercise of the Warrants) is Computershare Trust Company, N.A. We are the warrant agent for the Pre-Funded Warrants and the warrant agent for the Class C Warrants is Computershare Trust Company, N.A.

MATERIAL U.S. FEDERAL TAX CONSIDERATIONS FOR HOLDERS OF OUR COMMON STOCK AND WARRANTS

The following discussion describes the material U.S. federal income tax consequences of the acquisition, ownership and disposition of our common stock, Class C Warrants and Pre-Funded Warrants acquired in this offering. Our common stock, Class C Warrants, and Pre-Funded Warrants are referred to collectively herein as our “securities.” This discussion is based on the current provisions of the Internal Revenue Code of 1986, as amended, referred to as the Code, existing and proposed U.S. Treasury regulations promulgated thereunder, and administrative rulings and court decisions in effect as of the date hereof, all of which are subject to change at any time, possibly with retroactive effect. No ruling has been or will be sought from the Internal Revenue Service, or IRS, with respect to the matters discussed below, and there can be no assurance the IRS will not take a contrary position regarding the tax consequences of the acquisition, ownership or disposition of our securities, or that any such contrary position would not be sustained by a court.

We assume in this discussion that our securities will be held as capital assets (generally, property held for investment). This discussion does not address all aspects of U.S. federal income taxes, does not discuss the potential application of the Medicare contribution tax or the alternative minimum tax and does not address state or local taxes or U.S. federal gift and estate tax laws, or any non-U.S. tax consequences that may be relevant to holders in light of their particular circumstances. This discussion also does not address (i) the tax consequences to holders of Class C Warrants of certain aspects of the Class C Warrants (including but not limited to the tax consequences of certain automatic adjustments to the exercise price of the Warrants or certain payments that may be made to the holders of Class C Warrants in certain fundamental transactions) and (ii) special tax rules applicable to particular holders, such as:

- persons who acquired our securities as compensation for services;
- traders in securities that elect to use a mark-to-market method of accounting for their securities holdings;
- persons that own, or are deemed to own, more than 5% of our securities (except to the extent specifically set forth below);
- persons required for U.S. federal income tax purposes to conform the timing of income accruals to their financial statements under Section 451(b) of the Code;
- persons for whom our shares of common stock or Pre-Funded Warrants constitute “qualified small business stock” within the meaning of Section 1202 of the Code or “Section 1244 stock” for purposes of Section 1244 of the Code;
- persons deemed to sell our securities under the constructive sale provisions of the Code;
- financial institutions;
- brokers or dealers in securities;
- tax-exempt organizations or tax-qualified retirement plans;
- pension plans;
- regulated investment companies or real estate investment trusts;
- owners that hold our securities as part of a straddle, hedge, conversion transaction, synthetic security or other integrated investment;
- insurance companies;
- controlled foreign corporations, passive foreign investment companies, or corporations that accumulate earnings to avoid U.S. federal income tax;
- “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; and
- certain U.S. expatriates, former citizens, or long-term residents of the United States.

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In addition, this discussion does not address the tax treatment of partnerships or other pass-through entities or persons who hold our securities through partnerships or other entities which are pass-through entities for U.S. federal income tax purposes. A partner in a partnership or other pass-through entity that will hold our securities should consult his, her or its own tax advisor regarding the tax consequences of the ownership and disposition of our securities through a partnership or other pass-through entity, as applicable.

This discussion of U.S. federal income tax considerations is for general information purposes only and is not tax advice. Prospective investors should consult their own tax advisors regarding the U.S. federal, state, local and non-U.S. income and other tax considerations of acquiring, holding and disposing of our securities.

For purposes of this discussion, a “U.S. Holder” means a beneficial owner of our securities that is for U.S. federal income tax purposes (a) an individual citizen or resident of the United States, (b) a corporation (or other entity taxable as a corporation for U.S. federal income tax purposes), created or organized in or under the laws of the United States, any state thereof or the District of Columbia, (c) an estate the income of which is subject to U.S. federal income taxation regardless of its source, or (d) a trust if it (1) is subject to the primary supervision of a court within the United States and one or more U.S. persons (within the meaning of Section 7701(a)(30) of the Code) has the authority to control all substantial decisions of the trust or (2) has a valid election in effect under applicable U.S. Treasury regulations to be treated as a U.S. person. A “Non-U.S. Holder” is, for U.S. federal income tax purposes, a beneficial owner of securities that is not a U.S. Holder or a partnership for U.S. federal income tax purposes.

Treatment of Pre-Funded Warrants

Although it is not entirely free from doubt, a Pre-Funded Warrant should be treated as a share of our common stock for U.S. federal income tax purposes and a holder of Pre-Funded Warrants should generally be taxed in the same manner as a holder of common stock, as described below. Accordingly, no gain or loss should be recognized upon the exercise of a Pre-Funded Warrant and, upon exercise, the holding period of a Pre-Funded Warrant should carry over to the share of common stock received. Similarly, the tax basis of the Pre-Funded Warrant should carry over to the share of common stock received upon exercise, increased by the exercise price of \$0.001 per share. This characterization is not binding on the IRS, and each holder should consult his, her or its own tax advisor regarding the risks associated with the acquisition of Pre-Funded Warrants pursuant to this offering (including potential alternative characterizations). The balance of this discussion generally assumes that the characterization described above is respected for U.S. federal income tax purposes.

Allocation of Purchase Price

For U.S. federal income tax purposes, each share of common stock (or, in lieu of common stock, Pre-Funded Warrants) and the accompanying Class C Warrants issued pursuant to this offering will be treated as an “investment unit” consisting of one share of common stock or Pre-Funded Warrant, as applicable and the accompanying Class C Warrants to acquire our common stock. The purchase price for each investment unit will be allocated between these components in proportion to their relative fair market values at the time the unit is purchased by the holder. This allocation of the purchase price for each unit will establish the holder’s initial tax basis for U.S. federal income tax purposes in the share of common stock (or, in lieu of common stock, Pre-Funded Warrants) and the accompanying Class C Warrant included in each unit. The separation of the share of common stock (or, in lieu of common stock, Pre-Funded Warrants) and the accompanying Class C Warrant included in a unit should not be a taxable event for U.S. federal income tax purposes. Each holder should consult his, her or its own tax advisor regarding the allocation of the purchase price between the common stock (or, in lieu of common stock, Pre-Funded Warrants) and the accompanying Class C Warrant.

Tax Considerations Applicable to U.S. Holders

Distributions

As discussed above, we currently anticipate that we will retain future earnings, if any, to finance the growth and development of our business and do not intend to pay cash dividends in respect of our common stock in the foreseeable future. In the event that we do make distributions on our common stock to a U.S. Holder, those distributions generally will constitute dividends for U.S. tax purposes to the extent paid out of our current or accumulated earnings and profits (as determined under U.S. federal income tax principles). In general, dividends are includible in income as ordinary income when received. However, with respect to dividends received by individuals, such dividends generally are taxed under current law at applicable long-term capital gains rates, provided certain holding period and other requirements are satisfied. Distributions in excess of our current and accumulated earnings and profits will constitute a return of capital that is applied against and reduces, but not below zero, a U.S. Holder's adjusted tax basis in our common stock. Any remaining excess will be treated as gain realized on the sale or exchange of our common stock as described below under the section titled — Disposition of Our Securities.”

As described above in connection with our description of the securities we are offering, if we make certain distributions on our common stock, the exercise price of the Class C Warrants and the Pre-Funded Warrants and the number of shares of common stock issuable upon exercise of the Class C Warrants and the Pre-Funded Warrants is subject to appropriate adjustment. The taxation of such an adjustment is unclear. It is possible such an adjustment would be treated as a constructive distribution subject to the rules described in this section, although other treatments may also be possible. Under Section 305 of the Code, for example, an adjustment to (or failure to adjust) the number of shares that will be issued on the exercise of the Class C Warrants or Pre-Funded Warrants, or an adjustment to (or failure to adjust) the exercise price of the Class C Warrants or Pre-Funded Warrants, may be treated as a constructive distribution to a U.S. Holder of the Class C Warrants or 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 principles, depending on the circumstances of such adjustment (for example, if such adjustment is to compensate for a distribution of cash or other property to our shareholders). In addition, if we make certain distributions to holders of our common stock, we are required to make corresponding distributions to holders of our Class C Warrants. The U.S. federal income tax consequences of such distributions made to holders of our Class C Warrants are unclear. It is possible such a distribution would be treated as a distribution (or constructive distribution) as described above, although other treatments are possible. You should consult your tax advisors regarding the proper tax treatment of any adjustments in respect of the Pre-Funded Warrants and the Class C Warrants and any distributions on the Class C Warrants.

Disposition of Our Securities

Upon a sale or other taxable disposition (other than a redemption treated as a distribution, which will be taxed as described above under “Distributions”) of our common stock, Class C Warrants or Pre-Funded Warrants, a U.S. Holder generally will recognize capital gain or loss in an amount equal to the difference between the amount realized and the U.S. Holder's adjusted tax basis in the common stock, Class C Warrants or Pre-Funded Warrants. Capital gain or loss will constitute long-term capital gain or loss if the U.S. Holder's holding period for the common stock, Class C Warrants or Pre-Funded Warrants exceeds one year. The deductibility of capital losses is subject to certain limitations. U.S. Holders who recognize losses with respect to a disposition of our common stock, Class C Warrants or Pre-Funded Warrants should consult their own tax advisors regarding the tax treatment of such losses.

Exercise of Class C Warrants

A U.S. Holder generally will not recognize gain or loss on the exercise of a Class C Warrant and the related receipt of common stock, except to the extent that cash is received in lieu of a fractional share of our common

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stock. A U.S. Holder's initial tax basis in the common stock received on exercise of a Class C Warrant will be equal to the sum of (a) such U.S. Holder's tax basis in the Class C Warrant plus (b) the exercise price paid by such U.S. Holder on the exercise of such Class C Warrant. A U.S. Holder's holding period in the common stock received on exercise of a Class C Warrant generally should begin on the day after the date that such Class C Warrant is exercised by such U.S. Holder.

In certain circumstances, the Class C Warrants may be exercised on a cashless basis. The U.S. federal income tax treatment of an exercise of a Class C Warrant on a cashless basis is not clear, and could differ from the consequences described above. It is possible that a cashless exercise could be a taxable event. U.S. Holders are urged to consult their tax advisors as to the consequences of an exercise of a Class C Warrant on a cashless basis, including with respect to their holding period and tax basis in the common stock.

As noted above, this discussion assumes that Pre-Funded Warrants should be treated as common stock for federal income tax purposes. If that assumption is correct, then the exercise of a Class C Warrant for Pre-Funded Warrants should generally have the tax consequences described above in connection with an exercise of Class C Warrants for common stock. However, other characterizations are possible, and no assurances can be made regarding the tax consequences of that exercise.

Lapse of Class C Warrants

Upon the lapse or expiration of a Class C Warrant, a U.S. Holder will recognize a loss in an amount equal to such U.S. Holder's tax basis in the Class C Warrant. Any such loss generally will be a capital loss and will be long-term capital loss if the Class C Warrant is held for more than one year. The deductibility of capital losses is subject to limitations.

Contingent Payments on the Warrants

The Class C Warrants entitle a holder to receive payments upon the occurrence of certain contingencies, including a distribution on shares of our common stock. The tax treatment of such payments, if made, is subject to substantial uncertainty, but may result in ordinary income to a U.S. Holder and, in the case of distributions, likely would not be eligible for the lower tax rate applicable to certain dividends paid to non-corporate U.S. holders of shares of our common stock as described above in "—Distributions." U.S. Holders should consult their own tax advisors as to the appropriate tax treatment of any such contingent payments that may be made to them in respect of the Class C Warrants.

Information Reporting and Backup Reporting

Information reporting requirements generally will apply to payments of dividends (including constructive dividends) on the common stock, Class C Warrants and Pre-Funded Warrants paid by us to a U.S. Holder and to the proceeds of a sale or other disposition of common stock, Class C Warrants and Pre-Funded Warrants unless such U.S. Holder is an exempt recipient, such as a corporation. Backup withholding will apply to those payments if the U.S. Holder fails to provide the holder's taxpayer identification number, or certification of exempt status, or if the holder otherwise fails to comply with applicable requirements to establish an exemption.

Backup withholding is not an additional tax. Rather, any amounts withheld under the backup withholding rules will be allowed as a refund or a credit against the U.S. Holder's U.S. federal income tax liability provided the required information is timely furnished to the IRS. U.S. Holders should consult their own tax advisors regarding their qualification for exemption from information reporting and backup withholding and the procedure for obtaining such exemption.

Tax Considerations Applicable to Non-U.S. Holders

Certain Adjustments to Warrants

As described under “—U.S. Holders—Distributions,” an adjustment to the Warrants could result in a constructive distribution to a Non-U.S. Holder, which would be treated as described under “Distributions” below. Any resulting withholding tax attributable to deemed dividends would be collected from other amounts payable or distributable to the Non-U.S. Holder. Non-U.S. Holders should consult their tax advisors regarding the proper treatment of any adjustments to the Warrants.

Distributions

As discussed above, we currently anticipate that we will retain future earnings, if any, to finance the growth and development of our business and do not intend to pay cash dividends in respect of our common stock in the foreseeable future. In the event that we do make distributions on our common stock to a Non-U.S. Holder, those distributions generally will constitute dividends for U.S. federal income tax purposes as described in “—U.S. Holders—Distributions.”

Any distribution (including constructive distributions) on our common stock that is treated as a dividend paid to a Non-U.S. Holder that is not effectively connected with the holder’s conduct of a trade or business in the United States will generally be subject to withholding tax at a 30% rate or such lower rate as may be specified by an applicable income tax treaty between the United States and the Non-U.S. Holder’s country of residence. To obtain a reduced rate of withholding under a treaty, a Non-U.S. Holder generally will be required to provide the applicable withholding agent with a properly executed IRS Form W-8BEN, IRS Form W-8BEN-E or other appropriate form, certifying the Non-U.S. Holder’s entitlement to benefits under that treaty. Such form must be provided prior to the payment of dividends and must be updated periodically. If a Non-U.S. Holder holds stock through a financial institution or other agent acting on the holder’s behalf, the holder will be required to provide appropriate documentation to such agent. The holder’s agent may then be required to provide certification to the applicable withholding agent, either directly or through other intermediaries. If you are eligible for a reduced rate of U.S. withholding tax under an income tax treaty, you should consult with your own tax advisor to determine if you are able to obtain a refund or credit of any excess amounts withheld by timely filing an appropriate claim for a refund with the IRS.

We generally are not required to withhold tax on dividends paid (or constructive dividends deemed paid) to a Non-U.S. Holder that are effectively connected with the holder’s conduct of a trade or business within the United States (and, if required by an applicable income tax treaty, are attributable to a permanent establishment or fixed base that the holder maintains in the United States) if a properly executed IRS Form W-8ECI, stating that the dividends are so connected, is furnished to us (or, if stock is held through a financial institution or other agent, to the applicable withholding agent). In general, such effectively connected dividends will be subject to U.S. federal income tax on a net income basis at the regular tax rates applicable to U.S. persons. A corporate Non-U.S. Holder receiving effectively connected dividends may also be subject to an additional “branch profits tax,” which is imposed, under certain circumstances, at a rate of 30% (or such lower rate as may be specified by an applicable treaty) on the corporate Non-U.S. Holder’s effectively connected earnings and profits, subject to certain adjustments.

See also the sections below titled “—Backup Withholding and Information Reporting” and “—Foreign Accounts” for additional withholding rules that may apply to dividends paid to certain foreign financial institutions or non-financial foreign entities.

Disposition of Our Securities

Subject to the discussions below under the sections titled “—Backup Withholding and Information Reporting” and “—Foreign Accounts,” a Non-U.S. Holder generally will not be subject to U.S. federal income or

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withholding tax with respect to gain recognized on a sale or other disposition (other than a redemption treated as a distribution, which will be taxable as described above under “Distributions”) of our securities unless:

- the gain is effectively connected with the Non-U.S. Holder’s conduct of a trade or business in the United States, and if an applicable income tax treaty so provides, the gain is attributable to a permanent establishment or fixed base maintained by the Non-U.S. Holder in the United States; in these cases, the Non-U.S. Holder will be taxed on a net income basis at the regular tax rates and in the manner applicable to U.S. persons, and if the Non-U.S. Holder is a corporation, an additional branch profits tax at a rate of 30%, or a lower rate as may be specified by an applicable income tax treaty, may also apply;
- the Non-U.S. Holder is a nonresident alien present in the United States for 183 days or more in the taxable year of the disposition and certain other requirements are met, in which case the Non-U.S. Holder will be subject to a 30% tax (or such lower rate as may be specified by an applicable income tax treaty between the United States and such holder’s country of residence) on the net gain derived from the disposition, which may be offset by certain U.S.-source capital losses of the Non-U.S. Holder, if any; or
- our common stock constitutes a U.S. real property interest because we are, or have been at any time during the five-year period preceding such disposition (or the Non-U.S. Holder’s holding period of the common stock or Warrants, if shorter), a “U.S. real property holding corporation,” unless our common stock is regularly traded on an established securities market, as defined by applicable Treasury Regulations, and the Non-U.S. Holder held no more than 5% of our outstanding common stock, directly or indirectly, during the shorter of the five-year period ending on the date of the disposition or the period that the Non-U.S. Holder held our common stock. It is unclear how a non-U.S. Holder’s ownership of Warrants impacts the determination of the 5% threshold with respect to such non-U.S. holder’s actual or constructive ownership of our common stock. Generally, a corporation is a “U.S. real property holding corporation” if the fair market value of its “U.S. real property interests” (as defined in the Code and applicable regulations) equals or exceeds 50% of the sum of the fair market value of its worldwide real property interests plus its other assets used or held for use in a trade or business. Although there can be no assurance, we believe that we are not currently, and we do not anticipate becoming, a “U.S. real property holding corporation” for U.S. federal income tax purposes. 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. Non-U.S. Holders are urged to consult their own tax advisors regarding the U.S. federal income tax considerations that could result if we are or become a “U.S. real property holding corporation.”

See the sections titled “—Backup Withholding and Information Reporting” and “—Foreign Accounts” for additional information regarding withholding rules that may apply to proceeds of a disposition of our securities paid to foreign financial institutions or non-financial foreign entities.

Exercise of Warrants

A non-U.S. Holder generally will not recognize gain or loss for U.S. federal income tax purposes on the exercise of a Class C Warrant and the related receipt of common stock (except to the extent cash is received in lieu of the issuance of a fractional share of our common stock and certain other conditions are present, as discussed above under “—Disposition of Our Securities”). See “—Tax Considerations Applicable to U.S. Holders—Exercise of Class C Warrants.” However, if a cashless exercise of purchase warrants results in a taxable exchange, as described in “—Tax Considerations Applicable to U.S. Holders—Exercise of Class C Warrants,” the rules described above under “—Disposition of Our Securities” would apply.

Lapse of Class C Warrants

If a non-U.S. Holder allows a Class C Warrant to expire unexercised, such non-U.S. holder will recognize a capital loss for U.S. federal income tax purposes in an amount equal to such holder’s tax basis in the Warrant. See “—Tax Considerations Applicable to U.S. Holders—Lapse of Class C Warrants” above.

Contingent Payments on the Class C Warrants

As described above under the heading “—Tax Considerations Applicable to U.S. Holders—Contingent Payments on the Class C Warrants,” in certain circumstances, a holder of Class C Warrants may receive payments upon the occurrence of certain contingencies. The tax treatment of such payments, if made, is subject to substantial uncertainty. Non-U.S. Holders should consult their own tax advisors as to the appropriate U.S. federal income tax treatment of any such contingent payments that may be made to them in respect of the Class C Warrants and the potential for any such payments being subject to a U.S. dividend or other withholding tax. Any U.S. federal income tax required to be withheld on any portion of such contingent payment may be withheld from shares of our common stock, sales proceeds subsequently paid or credited, or other amounts payable or distributable to a non-U.S. Holder.

Backup Withholding and Information Reporting

We must report annually to the IRS and to each Non-U.S. Holder the gross amount of the distributions (including constructive distributions) on our securities paid to such holder and the tax withheld, if any, with respect to such distributions. Non-U.S. Holders may have to comply with specific certification procedures to establish that the holder is not a U.S. person (as defined in the Code) in order to avoid backup withholding at the applicable rate, currently 24%, with respect to dividends (or constructive dividends) on our securities. Generally, a holder will comply with such procedures if it provides a properly executed IRS Form W-8BEN (or other applicable Form W-8) or otherwise meets documentary evidence requirements for establishing that it is a Non-U.S. Holder, or otherwise establishes an exemption. Dividends paid to Non-U.S. Holders subject to withholding of U.S. federal income tax, as described above under the heading “Dividends,” will generally be exempt from U.S. backup withholding.

Information reporting and backup withholding generally will apply to the proceeds of a disposition of our securities by a Non-U.S. Holder effected by or through the U.S. office of any broker, U.S. or foreign, unless the holder certifies its status as a Non-U.S. Holder and satisfies certain other requirements, or otherwise establishes an exemption. Generally, information reporting and backup withholding will not apply to a payment of disposition proceeds to a Non-U.S. Holder where the transaction is effected outside the United States through a non-U.S. office of a broker. However, for information reporting purposes, dispositions effected through a non-U.S. office of a broker with substantial U.S. ownership or operations generally will be treated in a manner similar to dispositions effected through a U.S. office of a broker. Non-U.S. Holders should consult their own tax advisors regarding the application of the information reporting and backup withholding rules to them.

Copies of information returns may be made available to the tax authorities of the country in which the Non-U.S. Holder resides or is incorporated under the provisions of a specific treaty or agreement.

Backup withholding is not an additional tax. Any amounts withheld under the backup withholding rules from a payment to a Non-U.S. Holder can be refunded or credited against the Non-U.S. Holder’s U.S. federal income tax liability, if any, provided that an appropriate claim is timely filed with the IRS.

Foreign Accounts

The Foreign Account Tax Compliance Act, or FATCA, generally imposes a 30% withholding tax on dividends (including constructive dividends) on, and gross proceeds from the sale or other disposition of, our securities if paid to a non-U.S. entity unless (i) if the non-U.S. entity is a “foreign financial institution,” the non-U.S. entity undertakes certain due diligence, reporting, withholding, and certification obligations, (ii) if the non-U.S. entity is not a “foreign financial institution,” the non-U.S. entity identifies certain of its U.S. investors, if any, or (iii) the non-U.S. entity is otherwise exempt under FATCA.

Withholding under FATCA generally will apply to payments of dividends (including constructive dividends) on our securities. While withholding under FATCA may apply to payments of gross proceeds from a

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sale or other disposition of our securities, under proposed U.S. Treasury Regulations, withholding on payments of gross proceeds is not required. Although such regulations are not final, applicable withholding agents may rely on the proposed regulations until final regulations are issued.

An intergovernmental agreement between the United States and an applicable foreign country may modify the requirements described in this section. Under certain circumstances, a holder may be eligible for refunds or credits of the tax. Holders should consult their own tax advisors regarding the possible implications of FATCA on their investment in our securities.

The preceding discussion of material U.S. federal tax considerations is for information only. It is not tax advice. Prospective investors should consult their own tax advisors regarding the particular U.S. federal, state, local and non-U.S. tax consequences of purchasing, holding and disposing of our securities, including the consequences of any recent and proposed changes in applicable laws.

UNDERWRITING

Subject to the terms and conditions set forth in the underwriting agreement between us and Piper Sandler & Co., Stifel, Nicolaus & Company, Incorporated and Cantor Fitzgerald & Co. as the representatives of 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, at the public offering price less the underwriting discounts and commissions set forth on the cover page of this prospectus supplement, the number of shares of common stock and Warrants listed opposite its name below.

Underwriters	Number of Shares of Common Stock	Number of Pre-Funded Warrants to Be Purchased	Number of Class C Warrants
Piper Sandler & Co.	20,920,000	2,720,000	11,820,000
Stifel, Nicolaus & Company, Incorporated	20,920,000	2,720,000	11,820,000
Cantor Fitzgerald & Co.	10,460,000	1,360,000	5,910,000
Total	<u>52,300,000</u>	<u>6,800,000</u>	<u>29,550,000</u>

The underwriting agreement provides that the obligations of the several underwriters are subject to certain conditions precedent such as the receipt by the underwriters of officers' certificates and legal opinions and approval of certain legal matters by their counsel. The underwriting agreement provides that the underwriters will purchase all of the securities sold under the underwriting agreement if any of these securities are purchased. If an underwriter defaults, the underwriting agreement provides that the purchase commitments of the non-defaulting underwriters may be increased or the underwriting agreement may be terminated.

The underwriters are offering the shares of our common stock and Pre-Funded Warrants, and the accompanying Class C Warrants, subject to their acceptance of them as and if issued from us and subject to prior sale. The underwriters reserve the right to withdraw, cancel or modify offers to the public and to reject orders in whole or in part.

Option to Purchase Additional Shares

We have granted the underwriters an option to purchase up to additional 8,865,000 shares of our common stock and/or Class C Warrants to purchase up to 4,432,500 additional shares of our common stock. The underwriters may exercise this option at any time and from time to time during the 30-day period from the date of this prospectus supplement. If any additional shares of our common stock and/or Class C Warrants are purchased, the underwriters will offer the additional shares of our common stock and/or Class C Warrants to purchase additional shares of our common stock on the same terms as those on which the shares are being offered.

Discounts and Commissions

The underwriters have advised us that they propose to offer the shares of our common stock (or Pre-Funded Warrants) and accompanying Class C Warrants directly to the public at the offering price set forth on the cover of this prospectus supplement. The underwriters propose to offer the shares (or Pre-Funded Warrants) and accompanying Class C Warrants to certain dealers at the same price less a concession of not more than \$0.0396 per share of common stock and accompanying Class C Warrant and \$0.03956 per Pre-Funded Warrant and accompanying Class C Warrant. After the offering, if all of the shares of our common stock (or Pre-Funded Warrants) and accompanying Class C Warrants are not sold at the public offering price, the public offering price and concession may be reduced by the representatives. No such reduction will change the amount of proceeds to be received by us as set forth on the cover of this prospectus supplement.

The underwriting fee is equal to the public offering price per share of our common stock (or per Pre-Funded Warrant) and accompanying Class C Warrants less the amount paid by the underwriters to us per share of common stock (or Pre-Funded Warrants) and accompanying Class C Warrants. The following table shows the

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per share and total underwriting discount to be paid by the underwriters in connection with this offering, assuming both no exercise and full exercise of the underwriters' option:

			TOTAL	
	Per Share and Accompanying Class C Warrants	Per Pre-Funded Warrant and Accompanying Class C Warrants	Without Option to Purchase Additional Shares and Accompanying Class C Warrants	With Option to Purchase Additional Shares and Accompanying Class C Warrants
Public offering price	\$ 1.10	\$ 1.099	\$ 65,003,200	\$ 74,754,700
Underwriting discounts and commissions paid by us	\$ 0.66	\$ 0.066	\$ 3,900,192	\$ 4,485,282
Proceeds, before expenses, to us	\$ 1.034	\$ 1.033	\$ 61,103,800	\$ 70,269,418

We estimate that the total fees and expenses payable by us, excluding underwriting discount, will be approximately \$1,317,100, which includes up to \$15,000 that we have agreed to reimburse the underwriters for their counsel fees.

H.C. Wainwright & Co. and Brookline Capital Markets (a division of Arcadia Securities, LLC) are acting as financial advisors for the offering, for which we will pay customary advisory fees.

Indemnification of Underwriters

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

No Sales of Similar Securities

We, our executive officers and our directors have agreed, subject to specified exceptions, not to directly or indirectly:

- 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 or securities convertible into or exercisable or exchangeable for common stock;
- enter into any swap, hedge or similar agreement or arrangement that transfers in whole or in part, the economic risk of ownership of the common stock or securities convertible into or exercisable or exchangeable for common stock, whether now owned or acquired after the date of this prospectus supplement;
- engage in any short selling of the common stock or securities convertible into or exercisable or exchangeable for common stock; or
- publicly announce an intention to do any of the foregoing for a period of 90 days after the date of this prospectus supplement without the prior written consent of and Piper Sandler & Co. and Stifel, Nicolaus & Company, Incorporated.

These restrictions terminate after the close of trading of our common stock on and including the 90th day after the date of this prospectus supplement.

The representatives may, in their discretion and at any time or from time to time before the termination of the 90-day period, release all or any portion of the securities subject to lock-up agreements. There are no existing agreements between the underwriters and any of our stockholders who will execute a lock-up agreement, providing consent to the sale of shares prior to the expiration of the lock-up period.

The forgoing restrictions do not apply to, among other things and subject to restrictions, to: (a) issue common stock or options pursuant to employee benefit plans, (b) issue common stock upon exercise of outstanding options or warrants, (c) issue securities in connection with acquisitions or similar transactions, or (d) file registration statements on Form S-8. The exceptions permit parties to the "lock-up" agreements, among other things and subject to restrictions, to: (a) make certain gifts, (b) if the party is a corporation, partnership, limited liability company or other business entity, make transfers to any shareholders, partners, members of, or

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owners of similar equity interests in, the party, or to an affiliate of the party, if such transfer is not for value, (c) if the party is a corporation, partnership, limited liability company or other business entity, make transfers in connection with the sale or transfer of all of the party's capital stock, partnership interests, membership interests or other similar equity interests, as the case may be, or all or substantially all of the party's assets, in any such case not undertaken for the purpose of avoiding the restrictions imposed by the "lock-up" agreement and (d) participate in tender offers, mergers or similar transactions involving the acquisition of 90% of the voting power of our stock. In addition, the lock-up provision will not restrict broker-dealers from engaging in market making and similar activities conducted in the ordinary course of their business.

Listing

Our common stock is listed on the Nasdaq Capital Market under the symbol "XFOR." There is no established trading market for the Warrants, and we do not expect a trading market to develop. We do not intend to list the Warrants on any securities exchange or nationally recognized trading system. Without a trading market, the liquidity of the Warrants will be extremely limited.

Price Stabilization, Short Positions and Penalty Bids

Until the distribution of the shares of our common stock and the Warrants is completed, SEC rules may limit underwriters and selling group members from bidding for and purchasing shares of our common stock. However, the underwriters may engage in transactions that stabilize the price of our 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 shares of our 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 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 underwriters' option. "Naked" short sales are sales in excess of the underwriters' 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 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 our 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 common stock or preventing or retarding a decline in the market price of our common stock. As a result, the price of our common stock may be higher than the price that might otherwise exist in the open market. The underwriters may conduct these transactions on the Nasdaq Capital Market, 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 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.

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The underwriters may also engage in passive market making transactions in our common stock on the Nasdaq Capital Market in accordance with Rule 103 of Regulation M promulgated under the Exchange Act during a period before the commencement of offers or sales of the securities in this offering and extending through the completion of distribution. A passive market maker must display its bid at a price not in excess of the highest independent bid of that security. However, if all independent bids are lowered below the passive market maker's bid, that bid must then be lowered when specified purchase limits are exceeded. If passive market making is commenced, it may be discontinued at any time.

Electronic Distribution

A prospectus in electronic format may be made available by e-mail or on the websites or through online services maintained by one or more of the underwriters or their affiliates. In those cases, prospective investors may view offering terms online and may be allowed to place orders online. The underwriters may agree with us to allocate a specific number of shares of our common stock (or Pre-Funded Warrants) and accompanying Class C Warrants for sale to online brokerage account holders. Any such allocation for online distributions will be made by the underwriters on the same basis as other allocations. Other than the prospectus in electronic format, the information on each underwriter's or its affiliates' websites and any information contained in any other website maintained by any of the underwriters or their respective affiliates is not part of this prospectus, has not been approved and/or endorsed by us or the underwriters and should not be relied upon by investors.

Affiliations

The underwriters and certain of their respective 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. The underwriters and certain of their respective affiliates have, from time to time, performed, and may in the future perform, various commercial and investment banking and financial advisory services for us and our affiliates, for which they received or will receive customary fees and expenses. For example, Stifel, Nicolaus & Company, Incorporated and Cantor Fitzgerald & Co. are sales agents under the Sales Agreement. Under the Sales Agreement, we may offer and sell, from time to time, shares of our common stock through B. Riley Securities, Inc., Cantor Fitzgerald & Co. and Stifel, Nicolaus & Company, Incorporated through an "at the market offering" as defined in Rule 415(a)(4) promulgated under the Securities Act. In addition, from time to time, certain of the underwriters and their respective affiliates may effect transactions for their own account or the account of customers, and hold on behalf of themselves or their customers, long or short positions in our debt or equity securities or loans, and may do so in the future. Certain of 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

Other than in the United States, no action has been taken by us or the underwriters that would permit a public offering of the securities offered by this prospectus supplement in any jurisdiction where action for that purpose is required. The securities offered by this prospectus supplement may not be offered or sold, directly or indirectly, nor may this prospectus supplement or any other offering material or advertisements in connection with the offer and sale of any such securities be distributed or published in any jurisdiction, except under circumstances that will result in compliance with the applicable rules and regulations of that jurisdiction. Persons into whose possession this prospectus supplement comes are advised to inform themselves about and to observe any restrictions relating to the offering and the distribution of this prospectus supplement. This prospectus supplement does not constitute an offer to sell or a solicitation of an offer to buy any securities offered by this prospectus supplement in any jurisdiction in which such an offer or a solicitation is unlawful.

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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 this 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 offers of securities may be made to the public in that Relevant State at any time under the following exemptions under the Prospectus Regulation:

- (a) to any legal entity which is a qualified investor as defined under the Prospectus Regulation;
- (b) to fewer than 150 natural or legal persons (other than qualified investors as defined under the Prospectus Regulation), subject to obtaining the prior consent of the underwriters; or
- (c) in any other circumstances falling within Article 1(4) of the Prospectus Regulation,

provided that no such offer of the securities shall require us or any underwriter to publish a prospectus pursuant to Article 3 of the Prospectus Regulation or supplement a prospectus pursuant to Article 23 of the Prospectus Regulation and each person who initially acquires any securities or to whom any offer is made will be deemed to have represented, acknowledged and agreed to and with each of the underwriters and the Company that it is a “qualified investor” within the meaning of Article 2(e) of the Prospectus Regulation. In the case of any securities being offered to a financial intermediary as that term is used in the Prospectus Regulation, each such financial intermediary will be deemed to have represented, acknowledged and agreed that the securities acquired by it in the offer have not been acquired on a nondiscretionary basis on behalf of, nor have they been acquired with a view to their offer or resale to, persons in circumstances which may give rise to an offer of any securities to the public other than their offer or resale in a Relevant State to qualified investors as so defined or in circumstances in which the prior consent of the underwriters have been obtained to each such proposed offer or resale.

For the purposes of this provision, the expression an “offer to the public” in relation to 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.

We have not authorized and do not authorize the making of any offer of the securities through any financial intermediary on their behalf, other than offers made by the underwriters with a view to the final placement of the securities in this document. Accordingly, no purchaser of the securities, other than the underwriters, is authorized to make any further offer of the securities on behalf of us or the underwriters.

United Kingdom

In relation to the United Kingdom, no securities have been offered or will be offered pursuant to this offering to the public in the United Kingdom prior to the publication of a prospectus in relation to the securities that has been approved by the Financial Conduct Authority, except that offers of securities may be made to the public in the United Kingdom at any time under the following exemptions under the UK Prospectus Regulation:

- to any legal entity which is a qualified investor as defined in Article 2 of the UK Prospectus Regulation;
- to fewer than 150 natural or legal persons (other than qualified investors as defined in Article 2 of the UK Prospectus Regulation), subject to obtaining the prior consent of the underwriters; or

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- in any other circumstances falling within section 86 of the Financial Services and Markets Act 2000, or FSMA,

provided that no such offer of securities shall require us or any representatives to publish a prospectus pursuant to 85 of the FSMA or supplement a prospectus pursuant to Article 23 of the UK Prospectus Regulation.

Each person in the United Kingdom who initially acquires any securities or to whom any offer is made will be deemed to have represented, acknowledged and agreed to and with us and the representatives that it is a qualified investor within the meaning of Article 2 of the UK Prospectus Regulation.

In the case of any securities being offered to a financial intermediary as that term is used in Article 1(4) of the U.K. Prospectus Regulation, each financial intermediary will also be deemed to have represented, acknowledged and agreed that the securities acquired by it in the offer have not been acquired on a non-discretionary basis on behalf of, nor have they been acquired with a view to their offer or resale to, persons in circumstances which may give rise to an offer of any securities to the public, other than their offer or resale in the United Kingdom to qualified investors as so defined or in circumstances in which the prior consent of the representatives has been obtained to each such proposed offer or resale.

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 “UK Prospectus Regulation” means Regulation (EU) 2017/1129 as it forms part of domestic law by virtue of the European Union (Withdrawal) Act 2018.

Australia

No placement document, prospectus, product disclosure statement or other disclosure document has been lodged with the Australian Securities and Investments Commission in relation to this offering. This prospectus supplement does not constitute a prospectus, product disclosure statement or other disclosure document under the Corporations Act 2001, or the Corporations Act, and does not purport to include the information required for a prospectus, product disclosure statement or other disclosure document under the Corporations Act.

Any offer in Australia of the securities may only be made to persons, or the Exempt Investors, who are “sophisticated investors” (within the meaning of section 708(8) of the Corporations Act), “professional investors” (within the meaning of section 708(11) of the Corporations Act) or otherwise pursuant to one or more exemptions contained in section 708 of the Corporations Act so that it is lawful to offer the securities without disclosure to investors under Chapter 6D of the Corporations Act.

The securities applied for by Exempt Investors in Australia must not be offered for sale in Australia in the period of 12 months after the date of allotment under this offering, except in circumstances where disclosure to investors under Chapter 6D of the Corporations Act would not be required pursuant to an exemption under section 708 of the Corporations Act or otherwise or where the offer is pursuant to a disclosure document which complies with Chapter 6D of the Corporations Act. Any person acquiring securities must observe such Australian on-sale restrictions.

This prospectus supplement contains general information only and does not take account of the investment objectives, financial situation or particular needs of any particular person. It does not contain any securities recommendations or financial product advice. Before making an investment decision, investors need to consider whether the information in this prospectus supplement is appropriate to their needs, objectives and circumstances, and, if necessary, seek expert advice on those matters.

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Canada

The securities may be sold only to purchasers purchasing as principal that are both “accredited investors” as defined in National Instrument 45-106 Prospectus and Registration Exemptions and “permitted clients” as defined in National Instrument 31-103 Registration Requirements, Exemptions and Ongoing Registrant Obligations. Any resale of our securities must be made in accordance with an exemption from the prospectus requirements and in compliance with the registration requirements of applicable securities laws.

France

This prospectus (including any amendment, supplement or replacement thereto) is not being distributed in the context of a public offering in France within the meaning of Article L. 411-1 of the French Monetary and Financial Code (Code monétaire et financier).

This prospectus has not been and will not be submitted to the French Autorité des marchés financiers, or the AMF, for approval in France and accordingly may not and will not be distributed to the public in France.

Pursuant to Article 211-3 of the AMF General Regulation, French residents are hereby informed that:

(a) the transaction does not require a prospectus to be submitted for approval to the AMF;

(b) persons or entities referred to in Point 2°, Section II of Article L.411-2 of the Monetary and Financial Code may take part in the transaction solely for their own account, as provided in Articles D. 411-1, D. 734-1, D. 744-1, D. 754-1 and D. 764-1 of the Monetary and Financial Code; and

(c) the financial instruments thus acquired cannot be distributed directly or indirectly to the public otherwise than in accordance with Articles L. 411-1, L. 411-2, L. 412-1 and L. 621-8 to L. 621-8-3 of the Monetary and Financial Code.

This prospectus is not to be further distributed or reproduced (in whole or in part) in France by the recipients of this prospectus. This prospectus has been distributed on the understanding that such recipients will only participate in the issue or sale of our securities for their own account and undertake not to transfer, directly or indirectly, our securities to the public in France, other than in compliance with all applicable laws and regulations and in particular with Articles L. 411-1 and L. 411-2 of the French Monetary and Financial Code.

Germany

Each person who is in possession of this prospectus is aware of the fact that no German securities prospectus (wertpapierprospekt) within the meaning of the German Securities Prospectus Act (Wertpapier-prospektgesetz, or the Act) of the Federal Republic of Germany has been or will be published with respect to the securities. In particular, each underwriter has represented that it has not engaged and has agreed that it will not engage in a public offering in the Federal Republic of Germany within the meaning of the Act with respect to any of the securities otherwise than in accordance with the Act and all other applicable legal and regulatory requirements.

Hong Kong

The securities may not be offered or sold in Hong Kong by means of any document other than (i) in circumstances which do not constitute an offer to the public within the meaning of the Companies Ordinance (Cap. 32, Laws of Hong Kong), or (ii) to “professional investors” within the meaning of the Securities and Futures Ordinance (Cap. 571, Laws of Hong Kong) and any rules made thereunder, or (iii) in other circumstances which do not result in the document being a “prospectus” within the meaning of the Companies Ordinance (Cap. 32, Laws of Hong Kong) and no advertisement, invitation or document relating to the securities may be issued or

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may be in the possession of any person for the purpose of issue (in each case whether in Hong Kong or elsewhere), which is directed at, or the contents of which are likely to be accessed or read by, the public in Hong Kong (except if permitted to do so under the laws of Hong Kong) other than with respect to securities which are or are intended to be disposed of only to persons outside Hong Kong or only to “professional investors” within the meaning of the Securities and Futures Ordinance (Cap. 571, Laws of Hong Kong) and any rules made thereunder.

Israel

This document does not constitute a prospectus under the Israeli Securities Law, 5728-1968 (the Securities Law) and has not been filed with or approved by the Israel Securities Authority. In Israel, this prospectus is being distributed only to, and is directed only at, and any offer of the securities is directed only at, (i) a limited number of persons in accordance with the Israeli Securities Law and (ii) investors listed in the first addendum (the Addendum), to the Israeli Securities Law, consisting primarily of joint investment in trust funds, provident funds, insurance companies, banks, portfolio managers, investment advisors, members of the Tel Aviv Stock Exchange, underwriters, venture capital funds, entities with equity in excess of NIS 50 million and “qualified individuals,” each as defined in the Addendum (as it may be amended from time to time), collectively referred to as qualified investors (in each case, purchasing for their own account or, where permitted under the Addendum, for the accounts of their clients who are investors listed in the Addendum). Qualified investors are required to submit written confirmation that they fall within the scope of the Addendum, are aware of the meaning of same and agree to it.

Singapore

This prospectus supplement has not been registered as a prospectus with the Monetary Authority of Singapore. Accordingly, the securities were not offered or sold or caused to be made the subject of an invitation for subscription or purchase and will not be offered or sold or caused to be made the subject of an invitation for subscription or purchase, and this prospectus or any other document or material in connection with the offer or sale, or invitation for subscription or purchase, of the securities, has not been circulated or distributed, nor will it be circulated or distributed, whether directly or indirectly, to any person in Singapore other than (i) to an institutional investor (as defined in Section 4A of the Securities and Futures Act (Chapter 289) of Singapore, as modified or amended from time to time, or the SFA,) pursuant to Section 274 of the SFA, (ii) to a relevant person (as defined in Section 275(2) of the SFA) pursuant to Section 275(1) of the SFA, or any person pursuant to Section 275(1A) of the SFA, and in accordance with the conditions specified in Section 275 of the SFA, or (iii) otherwise pursuant to, and in accordance with the conditions of, any other applicable provision of the SFA.

Where the securities are subscribed or purchased under Section 275 of the SFA by a relevant person which is:

- a. a corporation (which is not an accredited investor (as defined in Section 4A of the SFA)) the sole business of which is to hold investments and the entire share capital of which is owned by one or more individuals, each of whom is an accredited investor; or
- b. a trust (where the trustee is not an accredited investor) whose sole purpose is to hold investments and each beneficiary of the trust is an individual who is an accredited investor, securities (as defined in Section 239(1) of the SFA) of that corporation or the beneficiaries’ rights and interest (howsoever described) in that trust shall not be transferred within six months after that corporation or that trust has acquired the securities pursuant to an offer made under Section 275 of the SFA except:
 - a. to an institutional investor or to a relevant person defined in Section 275(2) of the SFA, or to any person arising from an offer referred to in Section 275(1A) or Section 276(4)(i)(B) of the SFA;

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- b. where no consideration is or will be given for the transfer;
- c. where the transfer is by operation of law;
- d as specified in Section 276(7) of the SFA; or
- e. as specified in Regulation 32 of the Securities and Futures (Offers of Investment) (Shares and Debentures) Regulations 2005.

Singapore Securities and Futures Act Product Classification

Solely for the purposes of our obligations pursuant to sections 309B(1)(a) and 309B(1)(c) of the SFA, we have determined, and hereby notify all relevant persons (as defined in Section 309A of the SFA), that the securities are “prescribed capital markets products” (as defined in the Securities and Futures (Capital Markets Products) Regulations 2018) and Excluded Investment Products (as defined in MAS Notice SFA 04-N12: Notice on the Sale of Investment Products and MAS Notice FAA-N16: Notice on Recommendations on Investment Products).

Japan

The securities have not been and will not be registered under the Financial Instruments and Exchange Law of Japan (Law No. 25 of 1948, as amended) and, accordingly, will not be offered or sold, directly or indirectly, in Japan, or for the benefit of any Japanese Person or to others for re-offering or resale, directly or indirectly, in Japan or to any Japanese Person, except in compliance with all applicable laws, regulations and ministerial guidelines promulgated by relevant Japanese governmental or regulatory authorities in effect at the relevant time. For the purposes of this paragraph, “Japanese Person” shall mean any person resident in Japan, including any corporation or other entity organized under the laws of Japan.

Switzerland

The securities may not be publicly offered in Switzerland and will not be listed on the SIX Swiss Exchange, or the SIX, or on any other stock exchange or regulated trading facility in Switzerland. This document has been prepared without regard to the disclosure standards for issuance prospectuses under art. 652a or art. 1156 of the Swiss Code of Obligations or the disclosure standards for listing prospectuses under art. 27 ff. of the SIX Listing Rules or the listing rules of any other stock exchange or regulated trading facility in Switzerland. Neither this document nor any other offering or marketing material relating to the securities or this offering may be publicly distributed or otherwise made publicly available in Switzerland.

Neither this document nor any other offering or marketing material relating to this offering, our company or the securities have been or will be filed with or approved by any Swiss regulatory authority. In particular, this document will not be filed with, and the offer of securities will not be supervised by, the Swiss Financial Market Supervisory Authority FINMA (FINMA), and the offer of securities has not been and will not be authorized under the Swiss Federal Act on Collective Investment Schemes, or CISA. The investor protection afforded to acquirers of interests in collective investment schemes under the CISA does not extend to acquirers of securities.

United Arab Emirates

This offering has not been approved or licensed by the Central Bank of the United Arab Emirates, or the UAE, Securities and Commodities Authority of the UAE and/or any other relevant licensing authority in the UAE including any licensing authority incorporated under the laws and regulations of any of the free zones established and operating in the territory of the UAE, in particular the Dubai Financial Services Authority, or the DFSA, a regulatory authority of the Dubai International Financial Centre, or DIFC. This offering does not constitute a public offer of securities in the UAE, DIFC and/or any other free zone in accordance with the

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Commercial Companies Law, Federal Law No 8 of 1984 (as amended), DFSA Offered Securities Rules and NASDAQ Dubai Listing Rules, accordingly, or otherwise. The securities may not be offered to the public in the UAE and/or any of the free zones.

The securities may be offered and issued only to a limited number of investors in the UAE or any of its free zones who qualify as sophisticated investors under the relevant laws and regulations of the UAE or the free zone concerned.

LEGAL MATTERS

The validity of the issuance of the securities offered by us in this offering will be passed upon for us by Cooley LLP, New York, New York. Certain legal matters will be passed upon for the underwriters by Goodwin Procter LLP, New York, New York.

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, 2021 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 is part of a registration statement we filed with the SEC. This prospectus supplement 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 supplement, 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 and the accompanying prospectus or incorporated by reference in this prospectus and the accompanying prospectus. 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 is accurate as of any date other than the date on the front page of this prospectus supplement, regardless of the time of delivery of this prospectus supplement or any sale of the securities offered by this prospectus supplement.

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 in this prospectus.

INCORPORATION OF DOCUMENTS BY REFERENCE

The SEC allows us to “incorporate by reference” information into this prospectus supplement, which means that we can disclose important information to you by referring you to another document filed separately with the SEC. The SEC file number for the documents incorporated by reference in this prospectus supplement is 001-38295. The documents incorporated by reference into this prospectus contain important information that you should read about us.

The following documents are incorporated by reference into this document:

- Our Annual Report on [Form 10-K](#) for the fiscal year ended December 31, 2021 (the “2021 Annual Report”), filed with the SEC on March 17, 2022, including the information specifically incorporated by reference in the 2021 Annual Report from our [definitive proxy statement](#) for the 2022 Annual Meeting of Stockholders, filed with the SEC on April 25, 2022;
- Our Quarterly Report on Form 10-Q for the fiscal quarter ended March 31, 2022, filed with the SEC on [May 12, 2022](#), our Quarterly Report on Form 10-Q for the fiscal quarter ended June 30, 2022, filed with the SEC on [August 4, 2022](#) and our Quarterly Report on Form 10-Q for the fiscal quarter ended September 30, 2022, filed with the SEC on [November 3, 2022](#);
- Our Current Reports on Form 8-K filed with the SEC on [January 14, 2022](#), [January 14, 2022](#), [January 26, 2022](#), [February 9, 2022](#), [March 3, 2022](#), [May 20, 2022](#), [June 7, 2022](#), [July 1, 2022](#), [July 29, 2022](#), [September 1, 2022](#), [September 27, 2022](#), [October 4, 2022](#), [November 3, 2022](#), [November 9, 2022](#) and [November 29, 2022](#) (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 4.12](#) to our Annual Report on Form 10-K for the fiscal year ended December 31, 2020.

We also incorporate by reference into this prospectus supplement all documents (other than current reports 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) that are filed by us with the SEC pursuant to Sections 13(a), 13(c), 14 or 15(d) of the Exchange Act (i) after the date of the initial filing of the registration statement of which this prospectus supplement forms a part and prior to effectiveness of the registration statement, or (ii) after the date of this prospectus supplement but prior to the termination of the offering. These documents include periodic reports, such as Annual Reports on Form 10-K, Quarterly Reports on Form 10-Q and Current Reports on Form 8-K, as well as proxy statements.

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 in this prospectus supplement or contained in a document incorporated or deemed to be incorporated by reference into this prospectus supplement will be deemed to be modified or superseded to the extent that a statement contained in this prospectus supplement, or document deemed to be incorporated by reference into this prospectus supplement, modifies or supersedes such statement.

PROSPECTUS



\$150,000,000

**Common Stock
Preferred Stock
Debt Securities
Warrants**

From time to time, we may offer up to \$150,000,000 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 October 14, 2020, the last reported sale price of our common stock was \$6.76 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 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 entitled "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 over-allotment options 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 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 as described on page 6 of 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 October 26, 2020.

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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 Securities and Exchange Commission, or 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 \$150,000,000. 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.”

SUMMARY

This summary highlights selected information from this prospectus 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 the context indicates otherwise, as used in this prospectus, unless the context otherwise requires, references to “we,” “us,” “our,” “the company” and “X4 Pharmaceuticals” refer to X4 Pharmaceuticals, Inc., formerly Arsanis, Inc., and its subsidiaries. We own various U.S. federal trademark applications and unregistered trademarks, including our company name. All other trademarks or trade names referred to in this 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.

Company Overview

We are a clinical-stage biopharmaceutical company focused on the research, development and commercialization of novel therapeutics for the treatment of rare diseases. Our pipeline is comprised of potentially first-in-class, oral, small molecule antagonists of chemokine receptor CXCR4, which have the potential to treat a broad range of rare diseases, including primary immunodeficiencies, or PIs, and certain types of cancer. PIs are a group of more than 250 rare, chronic disorders in which flaws in the immune system cause increased susceptibility to infections and, in some cases, increased risk of cancers. Within this broad disease classification, a number of PIs are attributed to the improper trafficking of immune cells related to the CXCR4 receptor and its ligand CXCL12. CXCR4 is stimulated by its only chemokine ligand, CXCL12, and plays a key role in enabling the trafficking of immune cells and effectively monitoring the function of the immune system, or immunosurveillance. Overstimulation of the CXCL12/CXCR4 pathway leads to inhibition of the immune response, or immunosuppression. Our lead product candidate, mavorixafor, is a potentially first-in-class, oral, allosteric antagonist of the CXCR4 receptor designed to correct the abnormal signaling caused by the receptor/ligand interaction and enable mobilization and trafficking of immune cells.

We have completed a Phase 2 clinical trial of mavorixafor in patients with Warts, Hypogammaglobulinemia, Infections, and Myelokathexis, or WHIM, syndrome, which is a rare, inherited primary immunodeficiency disease. In June 2019, we initiated 4WHIM, a pivotal, 52-week Phase 3 global clinical trial of mavorixafor for the treatment of patients with WHIM syndrome. In November 2019, the U.S. Food and Drug Administration, or FDA, granted Breakthrough Therapy Designation for mavorixafor for the treatment of adults with WHIM. We continue to expect that the timing of reporting of top-line data from this trial will be delayed into 2022 due to the impact of the ongoing COVID pandemic. We are also investigating mavorixafor in combination with axitinib (Inlyta®), an FDA-approved small molecule tyrosine kinase inhibitor, in the Phase 2a portion of an open-label Phase 1/2 clinical trial in patients with clear cell renal cell carcinoma, or ccRCC. In September 2019, we announced positive results from the Phase 2a portion of this trial. We plan to pursue future development and potential commercialization of mavorixafor in ccRCC and other possible immuno-oncology indications only as part of a potential strategic collaboration.

In November 2019, we announced the initiation of a 14-day, proof-of-concept Phase 1b clinical trial of mavorixafor in patients with severe congenital neutropenia, or SCN. We currently expect that the reporting of initial data from the SCN trial will be delayed into 2021 due to delays in clinical site activation and the pace of

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enrollment caused by the COVID-19 pandemic. In December 2019, we announced the initiation of a Phase 1b clinical trial of mavorixafor, in combination with ibrutinib, in patients with Waldenström’s macroglobulinemia, or WM. Due to impacts of the ongoing COVID-19 pandemic, we expect to release initial data results from the WM trial in the first half of 2021.

We are also advancing two early stage candidates towards the clinic: X4P-003, a second-generation CXCR4 antagonist designed to have an enhanced pharmacokinetic profile relative to mavorixafor, potentially enabling improved patient compliance and ease of use; and X4P-002, a CXCR4 antagonist designed to cross blood-brain barrier and provide appropriate therapeutic exposures to treat brain cancers.

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, or the Merger Agreement, that we entered into with X4 Therapeutics, Inc. and Artemis AC Corp., a Delaware corporation and our wholly owned subsidiary, or 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, or the Reverse Stock Split, 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 and preferred stock, various series of debt securities and warrants to purchase any of such securities, up to a total aggregate offering price of \$150,000,000 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

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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.

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

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 over-allotment options, if any; and
- the estimated net proceeds to us.

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

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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 preferred stock. 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. We may issue warrants independently or together with common stock, preferred stock

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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, 2019, 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 and the documents incorporated by reference herein 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 entitled “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, 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 and Section 21E of the Securities Exchange Act of 1934, as amended, or the Exchange Act, these forward-looking statements include statements regarding:

- our plans to develop and commercialize our product candidates;
- the timing of our planned clinical trials for our product candidates;
- the timing of and our ability to obtain and maintain regulatory approvals for our product candidates;
- the clinical utility of our product candidates;
- our commercialization, marketing and manufacturing capabilities and strategy;
- the impact of the COVID-19 pandemic on our business, operations, strategy, goals and anticipated timelines;
- our intellectual property position;
- our plans to in-license, acquire, develop and commercialize additional product candidates;
- our competitive position and the development of and projections relating to our competitors or our industry;
- our ability to identify, recruit and retain key personnel;
- the impact of laws and regulations;
- our plans to identify additional product candidates with significant commercial potential that are consistent with our commercial objectives; and
- our estimates regarding future revenue, expenses and needs for additional financing.

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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 for working capital, capital expenditures and general corporate purposes. We may also use a portion of the net proceeds to invest in or acquire businesses or technologies that we believe are complementary to our own, although we have no current plans, commitments or agreements with respect to any acquisitions as of the date of this prospectus. 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 these uses, we intend to invest the net proceeds in investment-grade, interest-bearing securities.

DESCRIPTION OF CAPITAL STOCK

The following description of our capital stock and 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.

General

Our restated certificate authorizes us to issue up to 125,000,000 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 October 14, 2020, we had outstanding 16,286,645 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.

Registration Rights

Private Placement Registration Rights

Under the terms of a share purchase agreement with New Enterprise Associates 16, L.P., or NEA, we have granted NEA the right to require us to register 333,333 shares of our common stock under the Securities Act, subject to specified limitations set forth in such share purchase agreement. We are not obligated to file a registration statement pursuant to this provision on more than two occasions. After registration pursuant to these rights, the registrable securities will become freely tradable without restriction under the Securities Act. NEA's registration rights will terminate upon the earlier to occur of November 17, 2020 or the date on which NEA has sold all shares subject to NEA's registration rights.

Expenses

Pursuant to the share purchase agreement, we are required to pay all registration expenses, including all registration, filing and printing fees, issuer counsel and accounting fees and expenses, costs and expenses associated with clearing the shares for sale under applicable Blue Sky laws, listing fees, expenses incurred by us in connection with any "road show," and reasonable fees, charges and disbursements of counsel to NEA, but excluding underwriting discounts or commissions and fees with respect to the shares being sold.

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The share purchase agreement contains customary cross-indemnification provisions, pursuant to which we are obligated to indemnify NEA in the event of material misstatements or omissions in the registration statement attributable to us, and NEA is obligated to indemnify us for material misstatements or omissions in the registration statement attributable to NEA.

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;

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- 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;

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- 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 the 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.

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

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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 250 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;

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- 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;

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- 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.

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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;”

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- 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.

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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 fundamentally change the terms that are set forth in this prospectus or 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 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;
- in the case of warrants to purchase common stock or preferred stock, the number of shares of common stock or preferred stock, as the case may be, 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;
- the effect of any merger, consolidation, sale or other disposition of our business on the warrant agreements and the warrants;

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- 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 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; or
- in the case of warrants to purchase common stock or 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.

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 depository 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 depository on behalf of other financial institutions that participate in the depository’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 depository or its participants. Consequently, for global securities, we will recognize only the depository as the holder of the securities, and we will make all payments on the securities to the depository. The depository 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 depository 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 depository’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 that are not issued in 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 depository 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 depository 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.

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For example, once we make a payment or give a notice to the holder, we have no further responsibility for the payment or notice even if that 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 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 depository'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 depository. 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 depository. Unless we specify otherwise in the applicable prospectus supplement, The Depository Trust Company, New York, New York, known as DTC, will be the depository 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 depository, its nominee or a successor depository, 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 depository, 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 depository 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's rights relating to a global security will be 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.

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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 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 from time to time pursuant to underwritten public offerings, negotiated transactions, block trades or a combination of these methods. 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 over-allotment options under 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. 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 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.

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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 offer, other than common stock, will be new issues of securities with no established trading market. Any 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.

Any underwriter may engage in overallocation, stabilizing transactions, short covering transactions and penalty bids. Overallocation 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 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, 2019 have been so incorporated in reliance on the report (which contains an emphasis of matter paragraph related to the Company's requirement for additional financing to fund future operations and management's plans as described in Note 1 to the consolidated 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. 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 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 in this prospectus.

INCORPORATION OF CERTAIN INFORMATION BY REFERENCE

The SEC allows us to “incorporate by reference” information into this prospectus, which means that we can disclose important information to you by referring you to another document filed separately with the SEC. The SEC file number for the documents incorporated by reference in this prospectus is 001-38295. The documents incorporated by reference into this prospectus contain important information that you should read about us.

The following documents are incorporated by reference into this document:

- Our Annual Report on [Form 10-K](#) for the fiscal year ended December 31, 2019, filed with the SEC on March 12, 2020, including the information specifically incorporated by reference in the Annual Report on Form 10-K from our [definitive proxy statement](#) for the 2020 Annual Meeting of Stockholders, filed with the SEC on April 28, 2020;
- Our Quarterly Report on Form 10-Q for the fiscal quarter ended March 31, 2020, filed with the SEC on [May 7, 2020](#) and our Quarterly Report on Form 10-Q for the fiscal quarter ended June 30, 2020, filed with the SEC on [August 4, 2020](#);
- Our Current Reports on Form 8-K filed with the SEC on [February 13, 2020](#); [March 17, 2020](#); [March 20, 2020](#) [June 11, 2020](#), [September 11, 2020](#), [October 1, 2020](#), [October 7, 2020](#) and [October 16, 2020](#) (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.

We also incorporate by reference into this prospectus all documents (other than current reports 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) that are filed by us with the SEC pursuant to Sections 13(a), 13(c), 14 or 15(d) of the Exchange Act (i) after the date of the initial filing of the registration statement of which this prospectus forms a part and prior to effectiveness of the registration statement, or (ii) after the date of this prospectus but prior to the termination of the offering. These documents include periodic reports, such as Annual Reports on Form 10-K, Quarterly Reports on Form 10-Q and Current Reports on Form 8-K, as well as proxy statements.

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 in this prospectus or contained in a document incorporated or deemed to be incorporated by reference into this prospectus will be deemed to be modified or superseded to the extent that a statement contained in this prospectus or any subsequently filed supplement to this prospectus, or document deemed to be incorporated by reference into this prospectus, modifies or supersedes such statement.



52,300,000 Shares of Common Stock

Pre-Funded Warrants to Purchase 6,800,000 Shares of Common Stock

Class C Warrants to Purchase 29,550,000 Shares of Common Stock (or Pre-Funded Warrants)

PROSPECTUS SUPPLEMENT

Piper Sandler

Stifel

Cantor

December 7, 2022
