

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

FORM S-3
REGISTRATION STATEMENT
UNDER
THE SECURITIES ACT OF 1933

X4 PHARMACEUTICALS, INC.

(Exact name of registrant as specified in its charter)

Delaware
(State or other jurisdiction of incorporation or organization)

27-3181608
(I.R.S. Employer Identification Number)

61 North Beacon Street, 4th Floor
Boston, Massachusetts 02134
(857) 529-8300
(Address, including zip code, and telephone number, including area code, of registrant's principal executive offices)

Adam R. Craig, M.D., Ph.D.
Executive Chairman
c/o X4 Pharmaceuticals, Inc.
61 North Beacon Street, 4th Floor
Boston, Massachusetts 02134
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(Name, address, including zip code, and telephone number, including area code, of agent for service)
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From time to time after the effective date of this Registration Statement
(Approximate date of commencement of proposed sale to the public)

If the only securities being registered on this Form are being offered pursuant to dividend or interest reinvestment plans, please check the following box:
If any of the securities being registered on this Form are to be offered on a delayed or continuous basis pursuant to Rule 415 under the Securities Act of 1933, as amended, other than securities offered only in connection with dividend or interest reinvestment plans, check the following box:
If this Form is filed to register additional securities for an offering pursuant to Rule 462(b) under the Securities Act, please check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering.
If this Form is a post-effective amendment filed pursuant to Rule 462(c) under the Securities Act, check the following box and list the Securities Act registration statement number of the earlier effective registration statement for the same offering.

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

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

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

Large accelerated filer	<input type="checkbox"/>	Accelerated filer	<input type="checkbox"/>
Non-accelerated filer	<input checked="" type="checkbox"/>	Smaller reporting company	<input checked="" type="checkbox"/>
		Emerging growth company	<input type="checkbox"/>

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 7(a)(2)(B) of the Securities Act.

The registrant hereby amends this registration statement on such date or dates as may be necessary to delay its effective date until the registrant shall file a further amendment that specifically states that this registration statement shall thereafter become effective in accordance with Section 8(a) of the Securities Act of 1933, as amended, or until this registration statement shall become effective on such date as the Commission, acting pursuant to said Section 8(a), may determine.

EXPLANATORY NOTE

This registration statement contains the following documents:

- a base prospectus which covers the offering, issuance and sale by us of up to a maximum aggregate offering price of \$300,000,000 of common stock, preferred stock, debt securities, warrants and/or units, in each case from time to time in one or more offerings; and
- a sales agreement prospectus covering the offering, issuance and sale by us of up to a maximum aggregate offering price of \$75,000,000 (which amount is included in the \$300,000,000 aggregate offering price set forth in the base prospectus) of our common stock that may be issued and sold under an Open Market Sale AgreementSM, dated May 6, 2026, with Jefferies LLC (the “Sales Agreement”).

The base prospectus immediately follows this explanatory note. The specific terms of any securities to be offered pursuant to the base prospectus other than the shares under the Sales Agreement will be specified in a prospectus supplement to the base prospectus. The specific terms of the securities to be issued and sold under the Sales Agreement are specified in the sales agreement prospectus that immediately follows the base prospectus. In the event of the termination of the Sales Agreement, any portion of the \$75,000,000 included in the sales agreement prospectus contained in this registration statement that is not sold pursuant to the Sales Agreement will be available for sale in other offerings pursuant to the base prospectus, and if no shares are sold under the Sales Agreement, the full \$75,000,000 of securities may be sold in other offerings pursuant to the base prospectus and a corresponding prospectus supplement.

The information in this prospectus is not complete and may be changed. These securities may not be sold until the registration statement filed with the Securities and Exchange Commission is effective. This prospectus is not an offer to sell these securities, and it is not soliciting an offer to buy these securities in any jurisdiction where the offer or sale is not permitted.

Subject to completion, dated May 6, 2026

PROSPECTUS



COMMON STOCK PREFERRED STOCK DEBT SECURITIES WARRANTS UNITS

From time to time, we may issue, in one or more series or classes, up to \$300,000,000 in aggregate principal amount of our common stock, preferred stock, debt securities, warrants and/or units, at prices and on terms that we will determine at the time of the offering.

We may offer these securities through agents, underwriters or dealers or directly to investors. See “Plan of Distribution” in this prospectus. This prospectus provides you with 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. We may not sell any securities under this prospectus without delivery of the applicable prospectus supplement. If information in any prospectus supplement is inconsistent with the information in this prospectus, then the information in that prospectus supplement will apply and will supersede the information in this prospectus.

You should read this prospectus, the applicable prospectus supplement and any related free writing prospectus carefully, as well as any documents incorporated by reference, before you invest in any of the securities being offered.

Our common stock is listed on The Nasdaq Stock Market LLC (“Nasdaq”) under the symbol “XFOR.” On May 4, 2026, the last reported sale price of our common stock on Nasdaq was \$4.21 per share. We recommend that you obtain current market quotations for our common stock prior to making an investment decision.

Investing in our securities involves a high degree of risk. You should review carefully the risks and uncertainties described under the heading “[Risk Factors](#)” contained in this prospectus beginning on page 5 and any applicable prospectus supplement, and under

similar headings in the other documents that are incorporated by reference into this prospectus.

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

The date of this prospectus is , 2026.

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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 (the “SEC” or the “Commission”) 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 dollar amount of \$300,000,000. This prospectus provides you with a general description of the securities we may offer.

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

We have not authorized anyone to provide you with any information other than that contained or incorporated by reference in this prospectus and any applicable prospectus supplement, along with the information contained in any free writing prospectuses we have authorized for use in connection with a specific offering. We take no responsibility for, and can provide no assurance as to the reliability of, any other information that others may give you. This prospectus is an offer to sell only the securities offered hereby, but only under circumstances and in jurisdictions where it is lawful to do so. 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.

Unless the context otherwise requires, references to “we,” “us,” “our,” “X4,” or the “Company” refer to X4 Pharmaceuticals, Inc.

CAUTIONARY NOTE REGARDING FORWARD-LOOKING STATEMENTS

This prospectus, including the documents that we incorporate by reference, contains “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 Securities Exchange Act of 1934, as amended (the “Exchange Act”). All statements, other than statements of historical facts contained in this prospectus, including statements concerning our plans, objectives, goals, strategies, future events, future revenues or performance, financing needs, plans or intentions relating to acquisitions, business trends and other information referred to in the section entitled “Risk Factors” in this prospectus and the sections entitled “Business,” “Risk Factors” and “Management’s Discussion and Analysis of Financial Condition and Results of Operations” in our most recent Annual Report on Form 10-K, as may be updated by subsequent annual, quarterly and other reports, which is incorporated by reference herein, are forward-looking statements. Forward-looking statements generally relate to future events or our future financial or operating performance. In some cases, you can identify forward-looking statements by terms such as “may,” “might,” “will,” “objective,” “intend,” “should,” “could,” “can,” “would,” “expect,” “believe,” “design,” “estimate,” “predict,” “potential,” “plan,” “anticipate,” “target,” “forecast,” or the negative of these terms, and similar expressions intended to identify forward-looking statements. Forward-looking statements are not historical facts and reflect our current views with respect to future events and are based on assumptions and subject to risks and uncertainties. Given these uncertainties, you should not place undue reliance on these forward-looking statements.

There are a number of risks, uncertainties and other important factors that could cause our actual results to differ materially from the forward-looking statements contained in this prospectus and incorporated by reference herein. Such risks, uncertainties and other important factors include, among others, the following risks, uncertainties and factors:

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

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

There may be other factors that may cause our actual results to differ materially from the forward-looking statements, including factors disclosed in “Risk Factors” and “Management’s Discussion and Analysis of Financial Condition and Results of Operations” in our most recent Annual Report on Form 10-K and subsequent Quarterly Reports on Form 10-Q, which are incorporated by reference herein. You should evaluate all forward-looking statements made in this prospectus in the context of these risks and uncertainties.

These factors should not be construed as exhaustive and should be read in conjunction with the other cautionary statements that are included in this prospectus, any accompanying prospectus supplement, information incorporated by reference herein or therein, and any related free-writing prospectus. In addition, we cannot assure you that we will realize the results, benefits or developments that we expect or anticipate or, even if substantially realized, that they will result in the consequences or affect us or our business in the way expected. All forward-looking statements contained in this prospectus are made as of the date hereof and we undertake no obligation to publicly update or revise any forward-looking statements to reflect subsequent events or circumstances.

THE COMPANY

We are a biopharmaceutical company developing and commercializing novel therapeutics for the treatment of rare hematology diseases. Our goal is to build a profitable company by generating income from products we develop and commercialize, either alone or with partners.

Our primary asset is mavorixafor, a small molecule delivered in a capsule for oral dosing as a selective antagonist of the chemokine receptor, CXCR4. We have one commercially approved product, XOLREMDI® (mavorixafor), which has received accelerated approval in the United States from the FDA for use as an oral, once-daily therapy in patients 12 years of age and older with WHIM (warts, hypogammaglobulinemia, infections, and myelokathexis) syndrome, to increase the number of circulating mature neutrophils and lymphocytes. WHIM syndrome is a rare combined primary immunodeficiency and chronic neutropenic disorder. Mavorixafor is currently being studied in a pivotal clinical trial in chronic neutropenia (“CN”).

We are focused on the continued progress of our global, pivotal Phase 3 clinical trial (the “4WARD” trial) to evaluate the efficacy, safety, and tolerability of oral, once-daily mavorixafor (with or without stable doses of granulocyte colony-stimulating factor) in people with congenital, acquired primary autoimmune, or idiopathic CN who are experiencing recurrent and/or serious infections. The 52-week trial is a randomized, double-blind, placebo-controlled, multicenter study aiming to enroll up to 176 patients, with full enrollment targeted for the end of the third quarter of 2026. The FDA has granted Fast Track designation to mavorixafor for the treatment of CN.

We are committed to making XOLREMDI available to patients in need in the U.S. while prioritizing our long-term strategy to successfully complete the 4WARD trial in patients with moderate and severe CN.

Corporate Information

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

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

Implications of Being a Smaller Reporting Company

We are currently a “smaller reporting company” as defined in Item 10(f)(1) of Regulation S-K. Smaller reporting companies may take advantage of certain reduced disclosure obligations, including, among other things, providing only two years of audited financial statements. We may continue to be a smaller reporting company if either (i) the market value of our stock held by non-affiliates is less than \$250.0 million or (ii) our annual revenue was less than \$100.0 million during the most recently completed fiscal year and the market value of our stock held by non-affiliates is less than \$700.0 million. Specifically, as a smaller reporting company, we may choose to present only the two most recent fiscal years of audited financial statements in our Annual Report on Form 10-K and have reduced disclosure obligations regarding executive compensation.

RISK FACTORS

Investing in our securities involves risks. You should carefully consider the risks, uncertainties and other factors described in our most recent Annual Report on Form 10-K, as supplemented and updated by subsequent Quarterly Reports on Form 10-Q and Current Reports on Form 8-K that we have filed or will file with the SEC, and in other documents that are incorporated by reference into this prospectus, as well as the risk factors and other information contained in or incorporated by reference into any accompanying prospectus supplement, before investing in any of our securities. Our business, financial condition, results of operations, cash flows or prospects could be materially and adversely affected by any of these risks. The risks and uncertainties described in the documents incorporated by reference herein are not the only risks and uncertainties that you may face.

For more information about our SEC filings, please see “Where You Can Find Additional Information” and “Incorporation of Certain Information by Reference.”

USE OF PROCEEDS

We will retain broad discretion over the use of the net proceeds from the sale of the securities offered hereby. Unless otherwise specified in a prospectus supplement accompanying this prospectus, the net proceeds from the sale by us of the securities to which this prospectus relates will be used to advance our ongoing and planned clinical trials and to develop and advance additional product candidates, as well as for working capital and general corporate purposes. We may also use a portion of the proceeds to license, acquire, or invest in complementary businesses, technology, products, or assets, however, we have no current commitments to do so. Our expected use of proceeds from the sale of the securities offered hereby represents our current intentions based on our present plans and business condition. As of the date of this prospectus, we cannot predict with certainty all of the particular uses for the proceeds to be received from the sale of the securities offered hereby or the amounts that we will actually spend on the uses set forth above.

Pending the use of the proceeds, we may invest the proceeds in a variety of capital preservation investments, including interest-bearing, investment-grade securities, certificates of deposit, or government securities. When we offer and sell the securities to which this prospectus relates, the prospectus supplement related to such offering will set forth our intended use of the proceeds, if any, received from the sale of such securities.

SECURITIES WE MAY OFFER

This prospectus contains summary descriptions of the securities we may offer from time to time. These summary descriptions are not meant to be complete descriptions of each security. The particular terms of any security will be described in the applicable prospectus supplement.

DESCRIPTION OF SECURITIES

General

The following is a summary of the material terms of our capital stock, as well as other material terms of our restated certificate of incorporation, as amended (“restated certificate”), amended and restated by-laws (“by-laws”) and certain provisions of Delaware law. This summary does not purport to be complete and is qualified in its entirety by the provisions of our restated certificate and our by-laws. For more information on how you can obtain our certificate of incorporation and our bylaws, see the heading “Where You Can Find Additional Information.”

Authorized Capital Stock

Our restated certificate authorizes us to issue up to 500,000,000 shares of common stock, \$0.001 par value per share, and 10,000,000 shares of preferred stock, \$0.001 par value per share.

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 (our “Board”), subject to any preferential dividend rights of any series of preferred stock that we may designate and issue in the future.

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

Preferred Stock

Under the terms of our restated certificate, our Board has the authority, without further action by our stockholders, to issue up to 10,000,000 shares of preferred stock in one or more series, to establish from time to time the number of shares to be included in each such series, to fix the dividend, voting and other rights, preferences and privileges of the shares of each wholly unissued series and any qualifications, limitations or restrictions thereon, and to increase or decrease the number of shares of any such series, but not below the number of shares of such series then outstanding.

Our Board may authorize the issuance of preferred stock with voting or conversion rights that could adversely affect the voting power or other rights of the holders of our common stock. The issuance of preferred stock, while providing flexibility in connection with possible acquisitions and other corporate purposes, could, among other things, have the effect of delaying, deferring or preventing a change in our control and may adversely affect the market price of our common stock and the voting and other rights of the holders of our common stock. We have no current plans to issue any shares of preferred stock.

Anti-Takeover Provisions

Section 203 of the Delaware General Corporation Law

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

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

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

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

In general, Section 203 defines an “interested stockholder” as an entity or person who, together with 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 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, including a vacancy resulting from an enlargement of our Board, 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, subject to the rights of any holders of preferred stock to elect directors. The classification of our Board 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 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 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 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 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, our chief executive officer or our Board. In addition, our 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. 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, or by a stockholder of record on the record date for the meeting who is entitled to vote at the meeting and who has delivered timely written notice in proper form to our secretary of the stockholder's intention to bring such business before the meeting. These provisions could have the effect of delaying until the next stockholder meeting stockholder actions that are favored by the holders of a majority of our outstanding voting securities. These provisions also could discourage a third party from making a tender offer for our common stock because even if the third party acquired a majority of our outstanding voting stock, it would be able to take action as a stockholder, such as electing new directors or approving a merger, only at a duly called stockholders meeting and not by written consent.

Super Majority Voting

The DGCL provides generally that the affirmative vote of a majority of the shares entitled to vote on any matter is required to amend a corporation's certificate of incorporation or by-laws, unless a corporation's certificate of incorporation or by-laws, as the case may be, require a greater percentage. Our by-laws may be amended or repealed by a majority vote of our Board 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 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 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 establishes 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.

Listing on Nasdaq

Our common stock is listed on The Nasdaq Stock Market LLC under the symbol “XFOR.”

Debt Securities

The paragraphs below describe the general terms and provisions of the debt securities we may issue. When we offer to sell a particular series of debt securities, we will describe the specific terms of the securities in a supplement to this prospectus, including any additional covenants or changes to existing covenants relating to such series. The prospectus supplement also will indicate whether the general terms and provisions described in this prospectus apply to a particular series of debt securities. You should read the actual indenture if you do not fully understand a term or the way we use it in this prospectus.

If we issue debt securities at a discount from their principal amount, then, for purposes of calculating the aggregate initial offering price of the offered securities issued under this prospectus, we will include only the initial offering price of the debt securities and not the principal amount of the debt securities.

We have summarized below the material provisions of the indenture, or indicated which material provisions will be described in the related prospectus supplement. The prospectus supplement relating to any particular securities offered will describe the specific terms of the securities, which may be in addition to or different from the general terms summarized in this prospectus. We have included the form of the indenture as an exhibit to our registration statement of which this prospectus is a part, and it is incorporated into this prospectus by reference. Because the summary in this prospectus and in any prospectus supplement does not contain all of the information that you may find useful, you should read the documents relating to the securities that are described in this prospectus or in any applicable prospectus supplement. Please read “Where You Can Find Additional Information” in this prospectus to find out how you can obtain a copy of those documents. References below to an “indenture” are references to the indenture, as supplemented, under which a particular series of debt securities is issued. As used under this caption, the term “debt securities” includes the debt securities being offered by this prospectus and all other debt securities issued by us under the indenture.

General

The indenture:

- does not limit the amount of debt securities that we may issue;
- allows us to issue debt securities in one or more series;
- does not require us to issue all of the debt securities of a series at the same time; and
- allows us to reopen a series to issue additional debt securities without the consent of the holders of the debt securities of such series.

The prospectus supplement for each offering of debt securities will provide the following terms, where applicable:

- the title of the debt securities and whether they are senior, senior subordinated or subordinated debt securities;
- the aggregate principal amount of the debt securities being offered and any limit on their aggregate principal amount, and, if the series is to be issued at a discount from its face amount, the method of computing the accretion of such discount;
- the price at which the debt securities will be issued, expressed as a percentage of the principal and, if other than the full 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 common stock or preferred stock or the method by which any such portion shall be determined;
- if convertible, the terms on which such debt securities are convertible, including the initial conversion price or rate or the method of calculation, how and when the conversion price or exchange ratio may be adjusted,

whether conversion or exchange is mandatory, at the option of the holder or at our option, the conversion or exchange period, and any other provision in relation thereto, and any applicable limitations on the ownership or transferability of common stock or preferred stock received on conversion;

- the date or dates, or the method for determining the date or dates, on which the principal of the debt securities will be payable;
- the fixed or variable interest rate or rates of the debt securities, or the method by which the interest rate or rates is determined;
- the date or dates, or the method for determining the date or dates, from which interest will accrue;
- the dates on which interest will be payable;
- the record dates for interest payment dates, or the method by which we will determine those dates;
- the persons to whom interest will be payable;
- the basis upon which interest will be calculated if other than that of a 360-day year of twelve 30-day months;
- any collateral securing the performance of our obligations under the debt securities;
- the place or places where the principal of, premium, if any, and interest on, the debt securities will be payable;
- where the debt securities may be surrendered for registration of transfer or conversion or exchange;
- where notices or demands to or upon us in respect of the debt securities and the applicable indenture may be served;
- any provisions regarding our right to redeem or purchase debt securities or the right of holders to require us to redeem or purchase debt securities;
- any right or obligation we have to redeem, repay or purchase the debt securities pursuant to any sinking fund or analogous provision;
- the currency or currencies (including any composite currency) in which the debt securities are denominated and payable if other than United States dollars, and the currency or currencies (including any composite currency) in which principal, premium, if any, and interest, if any, will be payable, and if such payments may be made in a currency other than that in which the debt securities are denominated, the manner for determining such payments, including the time and manner of determining the exchange rate between the currency in which such securities are denominated and the currency in which such securities or any of them may be paid, and any additions to, modifications of or deletions from the terms of the debt securities to provide for or to facilitate the issuance of debt securities denominated or payable in a currency other than U.S. dollars;
- whether the amount of payments of principal of, premium, if any, or interest on, the debt securities may be determined according to an index, formula or other method and how such amounts will be determined;
- whether the debt securities will be in registered form, bearer form or both, and the terms of these forms;
- whether the debt securities will be issued in whole or in part in the form of a global security and, if applicable, the identity of the depository for such global security;
- any provision for electronic issuance of the debt securities or issuance of the debt securities in uncertificated form;
- whether and upon what terms the debt securities of such series may be defeased or discharged, if different from the provisions set forth in the indenture for the series to which the supplemental indenture or authorizing resolution relates;
- any provisions granting special rights to holders of securities upon the occurrence of such events as specified in the applicable prospectus supplement;
- any deletions from, modifications of, or additions to our events of default or covenants or other provisions set forth in the indenture for the series to which the supplemental indenture or authorizing resolution relates; and

- any other material terms of the debt securities, which may be different from the terms set forth in this prospectus.

We may issue debt securities at a discount below their principal amount and provide for less than the entire principal amount thereof to be payable upon declaration of acceleration of the maturity of the debt securities. We refer to any such debt securities throughout this prospectus as “original issue discount securities.” The applicable prospectus supplement will describe the United States federal income tax consequences and other relevant considerations applicable to original issue discount securities.

Neither the DGCL nor our governing instruments define the term “substantially all” as it relates to the sale of assets. Additionally, Delaware cases interpreting the term “substantially all” rely upon the facts and circumstances of each particular case. Consequently, to determine whether a sale of “substantially all” of our assets has occurred, a holder of debt securities must review the financial and other information that we have disclosed to the public.

The applicable prospectus supplement will also describe any material covenants to which a series of debt securities will be subject and the applicability of those covenants to any of our subsidiaries to be restricted thereby, which are referred to herein as “restricted subsidiaries.” The applicable prospectus supplement will also describe provisions for restricted subsidiaries to cease to be restricted by those covenants.

Events of Default

Unless the applicable prospectus supplement states otherwise, when we refer to “events of default” as defined in the indentures with respect to any series of debt securities, we mean:

- our failure to pay interest on any debt security of such series when the same becomes due and payable and the continuance of any such failure for a period of 30 days;
- our failure to pay the principal or premium of any debt security of such series when the same becomes due and payable at maturity, upon acceleration, redemption or otherwise;
- our failure or the failure of any restricted subsidiary to comply with any of its agreements or covenants in, or provisions of, the debt securities of such series or the indenture (as they relate thereto) and such failure continues for a period of 60 days after our receipt of notice of the default from the trustee or from the holders of at least 25 percent in aggregate principal amount of the then outstanding debt securities of that series (except in the case of a default with respect to the provisions of the indenture regarding the consolidation, merger, sale, lease, conveyance or other disposition of all or substantially all of the assets of us (or any other provision specified in the applicable supplemental indenture or authorizing resolution), which will constitute an event of default with notice but without passage of time); or
- certain events of bankruptcy, insolvency or reorganization occur with respect to X4 or any restricted subsidiary of X4 that is a significant subsidiary (as defined in the indenture).

If an event of default occurs and is continuing with respect to debt securities of any series outstanding, then the trustee or the holders of 25% or more in principal amount of the outstanding debt securities of that series will have the right to declare the principal amount of all the debt securities of that series to be due and payable immediately. However, the holders of at least a majority in principal amount of outstanding debt securities of such series may rescind and annul such declaration and its consequences, except an acceleration due to nonpayment of principal or interest on such series, if the rescission would not conflict with any judgment or decree and if all existing events of default with respect to such series have been cured or waived.

The indenture also provides that the holders of at least a majority in principal amount of the outstanding debt securities of any series, by notice to the trustee, may, on behalf of all holders, waive any existing default and its consequences with respect to such series of debt securities, other than any event of default in payment of principal or interest.

The indenture will require the trustee to give notice to the holders of debt securities within 90 days after the trustee obtains knowledge of a default that has occurred and is continuing. However, the trustee may withhold notice to the holders of any series of debt securities of any default, except a default in payment of principal or interest, if any, with respect to such series of debt securities, if the trustee considers it in the interest of the holders of such series of debt securities to do so.

The holders of a majority of the outstanding principal amount of the debt securities of any series will have the right to direct the time, method and place of conducting any proceedings for any remedy available to the trustee with respect to such series, subject to limitations specified in the indenture.

Amendment, Supplement and Waiver

Without notice to or the consent of any holder, we and the trustee may amend or supplement the indenture or the debt securities of a series:

- to cure any ambiguity, omission, defect or inconsistency;
- to comply with the provisions of the indenture regarding the consolidation, merger, sale, lease, conveyance or other disposition of all or substantially all of our assets;
- to provide that specific provisions of the indenture shall not apply to a series of debt securities not previously issued or to make a change to specific provisions of the indenture that only applies to any series of debt securities not previously issued or to additional debt securities of a series not previously issued;
- to create a series and establish its terms;
- to provide for uncertificated debt securities in addition to or in place of certificated debt securities;
- to release a guarantor in respect of any series which, in accordance with the terms of the indenture applicable to such series, ceases to be liable in respect of its guarantee;
- to add a guarantor subsidiary in respect of any series of debt securities;
- to secure any series of debt securities;
- to add to the covenants of X4 for the benefit of the holders or surrender any right or power conferred upon X4;
- to appoint a successor trustee with respect to the securities;
- to comply with requirements of the SEC in order to effect or maintain the qualification of the indenture under the Trust Indenture Act;
- to make any change that does not adversely affect the rights of holders; or
- to conform the provisions of the indenture to the final offering document in respect of any series of debt securities.

The indenture will provide that we and the trustee may amend or supplement any provision of the debt securities of a series or of the indenture relating to such series with the written consent of the holders of at least a majority in principal amount of the outstanding debt securities of such series. However, without the consent of each holder of a debt security the terms of which are directly amended, supplemented or waived, an amendment, supplement or waiver may not:

- reduce the amount of debt securities of such series whose holders must consent to an amendment, supplement or waiver;
- reduce the rate of or extend the time for payment of interest, including defaulted interest;
- reduce the principal of or extend the fixed maturity of any debt security or alter the provisions with respect to redemptions or mandatory offers to repurchase debt securities of a series in a manner adverse to holders;

- make any change that adversely affects any right of a holder to convert or exchange any debt security into or for shares of our common stock or other securities, cash or other property in accordance with the terms of such security;
- modify the ranking or priority of the debt securities of the relevant series;
- release any guarantor of any series from any of its obligations under its guarantee or the indenture otherwise than in accordance with the terms of the indenture;
- make any change to any provision of the indenture relating to the waiver of existing defaults, the rights of holders to receive payment of principal and interest on the debt securities, or to the provisions regarding amending or supplementing the indenture or the debt securities of a particular series with the written consent of the holders of such series, except to increase the percentage required for modification or waiver or to provide for consent of each affected holder of debt securities of such series;
- waive a continuing default or event of default in the payment of principal of or interest on the debt securities; or
- make any debt security payable at a place or in money other than that stated in the debt security, or impair the right of any holder of a debt security to bring suit as permitted by the indenture.

The holders of a majority in aggregate principal amount of the outstanding debt securities of such series may, on behalf of all holders of debt securities of that series, waive any existing default under, or compliance with, any provision of the debt securities of a particular series or of the indenture relating to a particular series of debt securities, other than any event of default in payment of interest or principal.

Defeasance

The indenture will permit us to terminate all our respective obligations under the indenture as they relate to any particular series of debt securities, other than the obligation to pay interest, if any, on and the principal of the debt securities of such series and certain other obligations, at any time by:

- depositing in trust with the trustee, under an irrevocable trust agreement, money or government obligations in an amount sufficient to pay principal of and interest, if any, on the debt securities of such series to their maturity or redemption; and
- complying with other conditions, including delivery to the trustee of an opinion of counsel to the effect that holders will not recognize income, gain or loss for federal income tax purposes as a result of our exercise of such right and will be subject to federal income tax on the same amount and in the same manner and at the same times as would have been the case otherwise.

The indenture will also permit us to terminate all of our respective obligations under the indenture as they relate to any particular series of debt securities, including the obligations to pay interest, if any, on and the principal of the debt securities of such series and certain other obligations, at any time by:

- depositing in trust with the trustee, under an irrevocable trust agreement, money or government obligations in an amount sufficient to pay principal of and interest, if any, on the debt securities of such series to their maturity or redemption; and
- complying with other conditions, including delivery to the trustee of an opinion of counsel to the effect that (A) we have received from, or there has been published by, the Internal Revenue Service a ruling, or (B) since the date such series of debt securities were originally issued, there has been a change in the applicable federal income tax law, in either case to the effect that, and based thereon such opinion of counsel shall state that, holders will not recognize income, gain or loss for federal income tax purposes as a result of our exercise of such right and will be subject to federal income tax on the same amount and in the same manner and at the same times as would have been the case otherwise.

In addition, the indenture will permit us to terminate substantially all our respective obligations under the indenture as they relate to a particular series of debt securities by depositing with the trustee money or government obligations sufficient to pay all principal and interest on such series at its maturity or redemption date if the debt securities of

such series will become due and payable at maturity within one year or are to be called for redemption within one year of the deposit.

Transfer and Exchange

A holder will be able to transfer or exchange debt securities only in accordance with the indenture. The registrar may require a holder, among other things, to furnish appropriate endorsements and transfer documents, and to pay any taxes and fees required by law or permitted by the indenture.

Concerning the Trustee

The indenture will contain limitations on the rights of the trustee, should it become our creditor, to obtain payment of claims in specified cases or to realize on property received in respect of any such claim as security or otherwise. The indenture will permit the trustee to engage in other transactions; however, if it acquires any conflicting interest, it must eliminate such conflict or resign.

The indenture will provide that in case an event of default occurs and is not cured, the trustee will be required, in the exercise of its power, to use the degree of care of a prudent person in similar circumstances in the conduct of such person's own affairs. The trustee shall be under no obligation to exercise any of the rights or powers vested in it by the indenture at the request or direction of any of the holders pursuant to the indenture, unless such holders shall have offered to the trustee security or indemnity satisfactory to the trustee against the costs, expenses and liabilities which might be incurred by it in compliance with such request or direction.

No Recourse Against Others

The indenture will provide that there is no recourse under any obligation, covenant or agreement in the applicable indenture or with respect to any debt security against any of our or our successor's past, present or future stockholders, employees, officers or directors.

Governing Law

The laws of the State of New York will govern the indenture and the debt securities.

Warrants

We may issue warrants for the purchase of common stock, preferred stock and/or debt securities in one or more series, from time to time. We may issue warrants independently or together with common stock, preferred stock and/or debt securities, and the warrants may be attached to or separate from those securities.

If we issue warrants, they will be evidenced by warrant agreements or warrant certificates issued under one or more warrant agreements, which are contracts between us and an agent for the holders of the warrants. We urge you to read the prospectus supplement related to any series of warrants we may offer, as well as the complete warrant agreement and warrant certificate that contain the terms of the warrants. If we issue warrants, forms of warrant agreements and warrant certificates relating to warrants for the purchase of common stock, preferred stock and debt securities will be incorporated by reference into the registration statement of which this prospectus is a part from reports we would subsequently file with the SEC.

Units

We may issue units consisting of any combination of the other types of securities offered under this prospectus in one or more series. We may evidence each series of units by unit certificates that we will issue under a separate agreement. We may enter into unit agreements with a unit agent. Each unit agent will be a bank or trust company that we select. We will indicate the name and address of the unit agent in the applicable prospectus supplement relating to a particular series of units.

The following description, together with the additional information included in any applicable prospectus supplement, summarizes the general features of the units that we may offer under this prospectus. You should read any prospectus supplement and any free writing prospectus that we may authorize to be provided to you related to the series of units being offered, as well as the complete unit agreements that contain the terms of the units. Specific unit agreements will contain additional important terms and provisions and we will file as an exhibit to the registration statement of which this prospectus is a part, or will incorporate by reference from another report that we file with the SEC, the form of each unit agreement relating to units offered under this prospectus.

If we offer any units, certain terms of that series of units will be described in the applicable prospectus supplement, including, without limitation, the following, as applicable:

- the title of the series of units;
- identification and description of the separate constituent securities comprising the units;
- the price or prices at which the units will be issued;
- the date, if any, on and after which the constituent securities comprising the units will be separately transferable;
- a discussion of certain United States federal income tax considerations applicable to the units; and
- any other terms of the units and their constituent securities.

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, either:

- on or through the facilities of Nasdaq 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; and/or
- to or through a market maker otherwise than on Nasdaq or such other securities exchanges or quotation or trading services.

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

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

- the name or names of any underwriters, dealers or agents, if any;
- the purchase price of the securities and the proceeds we will receive from the sale;
- any options 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 re-allowed 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 re-allowed 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.

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

Any underwriters who are qualified market makers on Nasdaq may engage in passive market making transactions in the securities on Nasdaq 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

Certain legal matters, including the legality of the securities offered, will be passed upon for us by Gibson, Dunn & Crutcher LLP, San Francisco, California. 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, 2025 have been so incorporated in reliance on the report 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 ADDITIONAL INFORMATION

We file annual, quarterly and special reports, proxy statements and other information with the SEC, and we have filed with the SEC a registration statement on Form S-3 under the Securities Act with respect to the securities offered by this prospectus. This prospectus, which forms part of the registration statement, does not contain all of the information included in the registration statement, including its exhibits and schedules. For further information about us and the securities described in this prospectus, you should refer to the registration statement, its exhibits and schedules and our reports, proxies, information statements and other information filed with the SEC.

Our filings are available to the public on the Internet, through a database maintained by the SEC at www.sec.gov. We also maintain a website at www.x4pharma.com. We have included our website address for the information of prospective investors and do not intend it to be an active link to our website. Information contained on our website does not constitute a part of this prospectus or any applicable prospectus supplement (or any document incorporated by reference herein or therein).

INCORPORATION OF CERTAIN INFORMATION BY REFERENCE

The SEC allows us to incorporate by reference the information and reports we file with it, which means that we can disclose important information to you by referring you to these documents. The information incorporated by reference is an important part of this prospectus, and information that we file after the date hereof with the SEC will automatically update and supersede the information already incorporated by reference. We are incorporating by reference the documents listed below:

- our Annual Report on Form 10-K for the year ended December 31, 2025 filed with the SEC on [March 17, 2026](#) (and any portions of our Definitive Proxy Statement on Schedule 14A filed on [March 20, 2026](#) that are incorporated by reference therein);
- our Quarterly Report on Form 10-Q for the quarter ended March 31, 2026 filed with the SEC on May 6, 2026; and
- the description of our common stock contained in our registration statement on Form 8-A filed with the SEC on [November 15, 2017](#), including any amendments or reports filed for the purposes of updating this description.

All documents we file with the SEC pursuant to Sections 13(a), 13(c), 14 or 15(d) of the Exchange Act shall be deemed incorporated by reference in this prospectus and to be a part of this prospectus from the date of filing of those documents, with the exception of any portion of any report or document that is not deemed “filed” under such provisions on or after the date of this prospectus, until the earlier of the date on which: (i) all of the securities registered hereunder have been sold; or (ii) the registration statement of which this prospectus is a part has been withdrawn.

Under no circumstances will any information furnished but not filed under Items 2.02 or 7.01 of Current Report on Form 8-K be deemed incorporated herein by reference unless such Form 8-K expressly provides to the contrary.

Upon written or oral request, we will provide without charge to each person to whom a copy of the prospectus is delivered a copy of the documents incorporated by reference herein (other than exhibits to such documents unless such exhibits are specifically incorporated by reference herein). You may request a copy of these filings, at no cost, by writing, calling or emailing us at the contact information set forth below. We have not authorized anyone to provide you with any information that differs from that contained in this prospectus. Accordingly, we take no responsibility for any other information that others may give you. You should not assume that the information in this prospectus is accurate as of any date other than the date of the front cover of this prospectus.

X4 Pharmaceuticals, Inc.
61 North Beacon Street, 4th Floor
Boston, MA 02134
(857) 529-8300



**COMMON STOCK
PREFERRED STOCK
DEBT SECURITIES
WARRANTS
UNITS**

PROSPECTUS

, 2026

The information in this prospectus is not complete and may be changed. These securities may not be sold until the registration statement filed with the Securities and Exchange Commission is effective. This prospectus is not an offer to sell these securities, and it is not soliciting an offer to buy these securities in any jurisdiction where the offer or sale is not permitted.

Subject to completion, dated May 6, 2026

PROSPECTUS



Up to \$75,000,000

Common Stock

We have entered into an Open Market Sale AgreementSM (the “Sales Agreement”) with Jefferies LLC (“Jefferies”), dated May 6, 2026, relating to shares of our common stock, \$0.001 par value per share. Under this prospectus, and in accordance with the terms of the Sales Agreement, we may offer and sell shares of our common stock having an aggregate offering price of up to \$75,000,000 from time to time through Jefferies, as our sales agent.

Our common stock is listed on The Nasdaq Stock Market LLC (“Nasdaq”) under the symbol “XFOR.” On May 4, 2026, the last reported sale price of our common stock on Nasdaq was \$4.21 per share.

Sales of our common stock, if any, under this prospectus may be made in sales deemed to be an “at the market offering” as defined in Rule 415(a)(4) promulgated under the Securities Act of 1933, as amended (the “Securities Act”). Jefferies is not required to sell any specific number or dollar amounts of securities but will act as sales agent using commercially reasonable efforts consistent with their normal trading and sales practices, on mutually agreed terms between Jefferies and us. There is no arrangement for funds to be received in any escrow, trust or similar arrangement.

Jefferies will be entitled to compensation at a commission of 3.0% of the aggregate gross sales price per share sold under the Sales Agreement. In connection with the sale of our common stock on our behalf, Jefferies will be deemed to be an “underwriter” within the meaning of the Securities Act and the compensation of Jefferies will be deemed to be underwriting commissions or discounts. We have also agreed to provide indemnification and contributions to Jefferies against certain liabilities, including liabilities under the Securities Act and the Securities Exchange Act of 1934, as amended (the “Exchange Act”). See “Plan of Distribution” beginning on page [S-14](#) of this prospectus for additional information regarding the compensation to be paid to Jefferies.

We are a smaller reporting company as defined in Rule 12b-2 promulgated under the Exchange Act. As such, we have elected to rely on certain reduced public company disclosure requirements. See “Prospectus Summary—Implications of Being a Smaller Reporting Company” beginning on page [S-2](#) of this prospectus for additional information.

Investing in our common stock involves a high degree of risk. You should review carefully the risks and uncertainties described under the heading “[Risk Factors](#)” on page S-4 of this prospectus, and under similar headings in the documents that are incorporated by reference into this prospectus.

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

Jefferies

The date of this prospectus is _____, 2026.

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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 (the “SEC”) utilizing a “shelf” registration process. Under this shelf registration process, we may offer shares of our common stock having an aggregate offering price of up to \$75,000,000 from time to time at prices and on terms to be determined by market conditions at the time of offering.

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

We are offering to sell, and seeking offers to buy, shares of common stock only in jurisdictions where offers and sales are permitted. The distribution of this prospectus and the offering of our common stock in certain jurisdictions may be restricted by law. Persons outside the United States who come into possession of this prospectus must inform themselves about, and observe any restrictions relating to, the offering of our common stock and the distribution of this prospectus outside the United States. This prospectus does 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 by any person in any jurisdiction in which it is unlawful for such person to make such an offer or solicitation.

This prospectus and the information incorporated herein and therein by reference include trademarks, servicemarks and tradenames owned by us or other companies. All trademarks, servicemarks and tradenames included or incorporated by reference in this prospectus are the property of their respective owners.

PROSPECTUS SUMMARY

This summary highlights selected information and does not contain all of the information that you should consider before deciding to invest in our common stock. You should read the entire prospectus, including the information incorporated by reference herein, and any related free writing prospectus, carefully, including the section titled “Risk Factors” contained in this prospectus and any related free writing prospectus, and under similar headings in the other documents that are incorporated by reference into this prospectus, and our financial statements and notes thereto included in our most recent Annual Report on Form 10-K, which are incorporated by reference herein, before making an investment decision. Some of the statements in this summary constitute forward-looking statements, see “Cautionary Note Regarding Forward-Looking Statements.” In this prospectus, unless the context requires otherwise, references to “we,” “us,” “our,” “X4” or the “Company” refer to X4 Pharmaceuticals, Inc.

Overview

We are a biopharmaceutical company developing and commercializing novel therapeutics for the treatment of rare hematology diseases. Our goal is to build a profitable company by generating income from products we develop and commercialize, either alone or with partners.

Our primary asset is mavorixafor, a small molecule delivered in a capsule for oral dosing as a selective antagonist of the chemokine receptor, CXCR4. We have one commercially approved product, XOLREMDI® (mavorixafor), which has received accelerated approval in the United States from the FDA for use as an oral, once-daily therapy in patients 12 years of age and older with WHIM (warts, hypogammaglobulinemia, infections, and myelokathexis) syndrome, to increase the number of circulating mature neutrophils and lymphocytes. WHIM syndrome is a rare combined primary immunodeficiency and chronic neutropenic disorder. Mavorixafor is currently being studied in a pivotal clinical trial in chronic neutropenia (“CN”).

We are focused on the continued progress of our global, pivotal Phase 3 clinical trial (the “4WARD” trial) to evaluate the efficacy, safety, and tolerability of oral, once-daily mavorixafor (with or without stable doses of granulocyte colony-stimulating factor) in people with congenital, acquired primary autoimmune, or idiopathic CN who are experiencing recurrent and/or serious infections. The 52-week trial is a randomized, double-blind, placebo-controlled, multicenter study aiming to enroll up to 176 patients, with full enrollment targeted for the end of the third quarter of 2026. The FDA has granted Fast Track designation to mavorixafor for the treatment of CN.

We are committed to making XOLREMDI available to patients in need in the U.S. while prioritizing our long-term strategy to successfully complete the 4WARD trial in patients with moderate and severe CN.

Corporate Information

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

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

Implications of Being a Smaller Reporting Company

We are currently a “smaller reporting company” as defined in Item 10(f)(1) of Regulation S-K. Smaller reporting companies may take advantage of certain reduced disclosure obligations, including, among other things, providing only two years of audited financial statements. We may continue to be a smaller reporting company if either (i) the market value of our stock held by non-affiliates is less than \$250.0 million or (ii) our annual revenue was less than \$100.0 million during the most recently completed fiscal year and the market value of our stock held by non-affiliates is less than \$700.0 million. Specifically, as a smaller reporting company, we may choose to present only the two most recent fiscal years of audited financial statements in our Annual Report on Form 10-K and have reduced disclosure obligations regarding executive compensation.

THE OFFERING

Common stock offered by us	Shares of our common stock having an aggregate offering price of up to \$75,000,000.
Common stock to be outstanding after this offering	Up to 112,134,422 shares, assuming sales of 17,814,726 shares of our common stock in this offering at an assumed offering price of \$4.21 per share, which was the last reported sale price of our common stock on Nasdaq on May 4, 2026. The actual number of shares issued will vary depending on the sales prices at which our common stock is sold under this offering.
Plan of Distribution	“At the market offering” that may be made from time to time through Jefferies, as our sales agent. See “Plan of Distribution” on page S-14 of this prospectus.
Use of Proceeds	We currently intend to use the net proceeds from this offering, if any, to advance our ongoing and planned clinical trials and to develop and advance additional product candidates, as well as for working capital and general corporate purposes. See “Use of Proceeds” on page S-10 of this prospectus.
Risk Factors	You should read the “Risk Factors” section of this prospectus and in the documents incorporated by reference into this prospectus for a discussion of factors you should carefully consider before deciding to purchase shares of our common stock.
Nasdaq symbol	“XFOR”

The number of our shares of common stock outstanding after this offering is based on an aggregate of 94,319,696 shares of our common stock outstanding as of March 31, 2026, and excludes the following:

- 4,180 shares of our common stock issuable upon the exercise of options outstanding as of March 31, 2026 under the 2015 Employee, Director and Consultant Equity Incentive Plan, as amended (the “2015 Plan”), having a weighted average exercise price of \$267.23 per share;
- 3,745,911 shares of our common stock issuable upon the exercise of options outstanding as of March 31, 2026 under the Amended and Restated 2017 Equity Incentive Plan (the “2017 Plan”), having a weighted average exercise price of \$4.49 per share;
- 12,105,423 shares of our common stock issuable upon the exercise of options outstanding as of March 31, 2026 under the 2019 Inducement Equity Incentive Plan (the “2019 Plan”), having a weighted average exercise price of \$1.99 per share;
- 54,410 shares of our common stock issuable upon the vesting and settlement of outstanding restricted stock unit awards outstanding as of March 31, 2026 under our 2017 Plan;
- 31,977,618 shares of common stock issuable upon the exercise of pre-funded warrants outstanding as of March 31, 2026, with 31,367,428 having an exercise price of \$0.001 per share and 610,190 having an exercise price of \$0.03 per share;
- 2,545,948 shares of common stock issuable upon the exercise of warrants outstanding as of March 31, 2026, having a weighted average exercise price of \$39.18 per share; and
- 1,496,929 shares of common stock reserved for future issuance under our 2017 Plan, Amended and Restated 2017 Employee Stock Purchase Plan (the “2017 ESPP”) and 2019 Plan as of March 31, 2026.

Except as otherwise indicated, all information in this prospectus assumes no exercise of outstanding options, pre-funded warrants or warrants and no vesting of restricted stock units after March 31, 2026.

RISK FACTORS

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

Additional Risks Related to This Offering

Management will have broad discretion as to the use of the proceeds from this offering, and may not use the proceeds effectively.

While we currently intend to use the net proceeds from this offering, if any, to advance our ongoing and planned clinical trials and to develop and advance additional product candidates, as well as for working capital and general corporate purposes, because we have not designated the amount of net proceeds from this offering to be used for any particular purpose, our management will have broad discretion as to the application of the net proceeds from this offering and could use them for purposes other than those contemplated at the time of the offering. Our management may use the net proceeds for corporate purposes that may not improve our financial condition or market value.

You may experience immediate and substantial dilution.

The offering price per share in this offering may exceed the net tangible book value per share of our common stock outstanding prior to this offering. Assuming that 17,814,726 shares of our common stock are sold in this offering, based on an assumed sale price of \$4.21 per share, the last reported sale price of a share of our common stock on Nasdaq on May 4, 2026, you will experience immediate dilution, representing the difference between the price you pay and our as adjusted net tangible book value per share as of March 31, 2026, after giving effect to this offering, of \$2.31 per share. The exercise of outstanding stock options, pre-funded warrants and warrants may result in further dilution of your investment. See the section titled “Dilution” below for a more detailed illustration of the dilution you would incur if you participate in this offering.

You may experience future dilution as a result of future equity offerings.

To raise additional capital, we may in the future offer additional shares of our common stock or other securities convertible into or exchangeable for our common stock at prices that may not be the same as the price per share in this offering. We may sell shares or other securities in any other offering at a price per share that is less than the price per share paid by investors in this offering, and investors purchasing shares or other securities in the future could have rights superior to existing stockholders. The price per share at which we sell additional shares of our common stock, or securities convertible or exchangeable into common stock, in future transactions may be higher or lower than the price per share paid by investors in this offering.

It is not possible to predict the aggregate proceeds resulting from sales made under the Sales Agreement.

Subject to certain limitations in the Sales Agreement and compliance with applicable law, we have the discretion to deliver placement notices to Jefferies at any time throughout the term of the Sales Agreement. The number of shares that are sold through Jefferies after delivering a placement notice will fluctuate based on a number of factors, including the market price of our common stock during the sales period, any limits we may set with Jefferies in any

applicable placement notice and the demand for our common stock. Because the price per share of each share sold pursuant to the Sales Agreement will fluctuate over time, it is not currently possible to predict the aggregate proceeds to be raised in connection with sales under the Sales Agreement.

Sales of common stock offered hereby will be in “at the market offerings,” and investors who buy shares at different times will likely pay different prices.

Investors who purchase shares in this offering at different times will likely pay different prices, and accordingly may experience different levels of dilution and different outcomes in their investment results. We will have discretion, subject to market demand, to vary the timing, prices and number of shares sold in this offering. In addition, subject to the final determination by our board of directors or any restrictions we may place in any applicable placement notice delivered to Jefferies, there is no minimum or maximum sales price for shares to be sold in this offering. Investors may experience a decline in the value of the shares they purchase in this offering as a result of sales made at prices lower than the prices they paid.

CAUTIONARY NOTE REGARDING FORWARD-LOOKING STATEMENTS

We make “forward-looking statements” within the meaning of Section 27A of the Securities Act and Section 21E of the Exchange Act in this prospectus, including the documents that we incorporate by reference herein and therein. Our forward-looking statements are subject to risks and uncertainties and include information about our current expectations and possible or assumed future results of our operations. When we use words such as “may,” “might,” “will,” “should,” “believe,” “expect,” “anticipate,” “estimate,” “continue,” “could,” “plan,” “potential,” “predict,” “forecast,” “projected,” “intend” or similar expressions, or make statements regarding our intent, belief, or current expectations, we are making forward-looking statements. Because these forward-looking statements are based on estimates and assumptions that are subject to significant business, economic and competitive uncertainties, many of which are beyond our control or are subject to change, actual results could be materially different from the anticipated future results, performance or achievements expressed or implied by any forward-looking statements. Such business, economic and competitive uncertainties include:

- our ability to raise additional capital or achieve sufficient revenue to properly fund our business and operating plan as well as our ability to continue as a going concern;
- our expectations and goals for commercialization of XOLREMDI® (mavorixafor), which has been approved for use as an oral, once-daily therapy to increase the number of circulating mature neutrophils and lymphocytes in patients 12 years of age and older with WHIM (warts, hypogammaglobulinemia, infections, and myelokathexis) syndrome in the United States, and that XOLREMDI, our one product approved for commercial sale, upon which we depend almost entirely to produce revenue, faces an unknown market size and growth potential, and we have not generated significant revenue from product sales to date, and we may never achieve profitability;
- the initiation, timing, progress and results of our current and future preclinical studies and clinical trials and related preparatory work and the period during which the results of the trials will become available, as well as our research and development programs;
- the potential benefits, including clinical utility, that may be derived from XOLREMDI or any of our product candidates;
- the timing of and our ability to obtain and maintain regulatory approval of our existing product XOLREMDI (mavorixafor) or any product candidates that we may develop in the future, and any related restrictions, limitations, or warnings in the label of any approved product candidates;
- our plans to research, develop, manufacture and commercialize XOLREMDI or our product candidates;
- the timing of our regulatory filings for our product candidates, along with regulatory developments in the United States and other foreign countries;
- the size and growth potential of the markets for XOLREMDI and our product candidates, if approved, and the rate and degree of market acceptance of XOLREMDI and our product candidates, including reimbursement that may be received from payors;
- the benefits of the FDA and European Commission designations, including, without limitation, Fast Track, Orphan Drug and Breakthrough Therapy;
- our commercialization, marketing and manufacturing capabilities and strategy;
- our ability to attract and retain qualified employees and key personnel;
- our competitive position and the development of and projections relating to our competitors or our industry;
- our expectations regarding our ability to obtain and maintain intellectual property protection;
- the success of competing therapies that are or may become available;
- our estimates and expectations regarding future operations, financial position, revenues, costs, expenses, uses of cash, capital requirements or our need for additional financing;
- our plans to in-license, acquire, develop and commercialize additional product candidates;
- the impact of laws and regulations;

- our plans to identify additional product candidates with significant commercial potential that are consistent with our commercial objectives;
- our strategies, prospects, plans, expectations or objectives;
- the anticipated use of proceeds from this offering, if any; and
- the other risks more fully discussed in the “Risk Factors” section in this prospectus and the risk factors and cautionary statements described in other documents that we file from time to time with the SEC, specifically under “Risk Factors” and elsewhere in our most recent Annual Report on Form 10-K and subsequent Quarterly Reports on Form 10-Q.

Other factors not currently anticipated may also materially and adversely affect our results of operations, cash flows and financial position. Readers should not place undue reliance on any such forward-looking statements, which are based on information available to us on the date of this report or, if made elsewhere, as of the date made. We do not undertake, and expressly disclaim, any intention to update or alter any statements whether as a result of new information, future events or otherwise except as required by law.

USE OF PROCEEDS

We may offer and sell shares of our common stock having an aggregate offering price of up to \$75,000,000 from time to time through Jefferies, as our sales agent. Because there is no minimum offering amount required pursuant to the Sales Agreement, the actual total public offering amount, commissions and proceeds to us, if any, are not determinable at this time. Actual net proceeds will depend on the number of shares we sell and the prices at which such sales occur. There can be no assurance that we will sell any shares under or fully utilize the Sales Agreement with Jefferies as a source of financing.

We currently intend to use the net proceeds from this offering, if any, to advance our ongoing and planned clinical trials and to develop and advance additional product candidates, as well as for working capital and general corporate purposes.

As of the date of this prospectus, we cannot specify with certainty all of the particular uses for the net proceeds to us from the sale of the securities offered by us hereunder. Accordingly, our management will have broad discretion in the timing and application of these proceeds. Pending application of the net proceeds as described above, we intend to invest the proceeds in a variety of capital preservation investments, including interest-bearing, investment-grade securities, certificates of deposit or government securities.

DESCRIPTION OF SECURITIES

General

The following is a summary of the material terms of our capital stock, as well as other material terms of our restated certificate of incorporation, as amended (“restated certificate”), amended and restated by-laws (“by-laws”) and certain provisions of Delaware law. This summary does not purport to be complete and is qualified in its entirety by the provisions of our restated certificate and our by-laws. For more information on how you can obtain our certificate of incorporation and our bylaws, see the heading “Where You Can Find Additional Information.”

Authorized Capital Stock

Our restated certificate authorizes us to issue up to 500,000,000 shares of common stock, \$0.001 par value per share, and 10,000,000 shares of preferred stock, \$0.001 par value per share.

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 (our “Board”), subject to any preferential dividend rights of any series of preferred stock that we may designate and issue in the future.

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

Preferred Stock

Under the terms of our restated certificate, our Board has the authority, without further action by our stockholders, to issue up to 10,000,000 shares of preferred stock in one or more series, to establish from time to time the number of shares to be included in each such series, to fix the dividend, voting and other rights, preferences and privileges of the shares of each wholly unissued series and any qualifications, limitations or restrictions thereon, and to increase or decrease the number of shares of any such series, but not below the number of shares of such series then outstanding.

Our Board may authorize the issuance of preferred stock with voting or conversion rights that could adversely affect the voting power or other rights of the holders of our common stock. The issuance of preferred stock, while providing flexibility in connection with possible acquisitions and other corporate purposes, could, among other things, have the effect of delaying, deferring or preventing a change in our control and may adversely affect the market price of our common stock and the voting and other rights of the holders of our common stock. We have no current plans to issue any shares of preferred stock.

Anti-Takeover Provisions

Section 203 of the Delaware General Corporation Law

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

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

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

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

In general, Section 203 defines an “interested stockholder” as an entity or person who, together with 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 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, including a vacancy resulting from an enlargement of our Board, 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, subject to the rights of any holders of preferred stock to elect directors. The classification of our Board 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 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 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 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 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, our chief executive officer or our Board. In addition, our 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. 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, or by a stockholder of record on the record date for the meeting who is entitled to vote at the meeting and who has delivered timely written notice in proper form to our secretary of the stockholder's intention to bring such business before the meeting. These provisions could have the effect of delaying until the next stockholder meeting stockholder actions that are favored by the holders of a majority of our outstanding voting securities. These provisions also could discourage a third party from making a tender offer for our common stock because even if the third party acquired a majority of our outstanding voting stock, it would be able to take action as a stockholder, such as electing new directors or approving a merger, only at a duly called stockholders meeting and not by written consent.

Super Majority Voting

The DGCL provides generally that the affirmative vote of a majority of the shares entitled to vote on any matter is required to amend a corporation's certificate of incorporation or by-laws, unless a corporation's certificate of incorporation or by-laws, as the case may be, require a greater percentage. Our by-laws may be amended or repealed by a majority vote of our Board 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 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 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 establishes 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.

Listing on Nasdaq

Our common stock is listed on The Nasdaq Stock Market LLC under the symbol "XFOR."

DILUTION

If you purchase common stock in this offering, your ownership interest will be immediately diluted to the extent of the difference between the purchase price per share of our common stock and the as adjusted net tangible book value per share of common stock immediately after giving effect to this offering. Our net tangible book value as of March 31, 2026 was \$141.0 million, or \$1.49 per share of common stock. Our net tangible book value is the amount of our total tangible assets less our total liabilities. Net tangible book value per share of common stock represents net tangible book value divided by an aggregate of 94,319,696 shares of our common stock outstanding as of March 31, 2026.

After giving effect to the assumed sale of 17,814,726 shares of our common stock at a sale price of \$4.21 per share, the last reported sale price of our common stock on Nasdaq on May 4, 2026, after deducting commissions and estimated aggregate offering expenses payable by us, our as adjusted net tangible book value as of March 31, 2026 would have been \$213.6 million, or approximately \$1.90 per share of common stock. This represents an immediate increase in the as adjusted net tangible book value of \$0.41 per share to our existing stockholders and an immediate dilution of approximately \$2.31 per share to new investors purchasing shares of common stock in this offering. Dilution per share to new investors is determined by subtracting as adjusted net tangible book value per share of common stock after this offering from the assumed public offering price per share paid by new investors. The following table illustrates this per share dilution:

Assumed offering price per share		\$4.21
Net tangible book value per share as of March 31, 2026	\$ 1.49	
Increase in net tangible book value per share attributable to new investors in offering	\$ 0.41	
As adjusted net tangible book value per share as of March 31, 2026, after giving effect to this offering		<u>\$1.90</u>
Dilution per share to new investors in this offering		<u>\$2.31</u>

The above illustration of dilution per share to investors participating in this offering assumes no exercise of outstanding options, warrants or pre-funded warrants to purchase our common stock.

Changes in the assumed public offering price of \$4.21 per share would not affect our as adjusted net tangible book value after this offering because this offering is currently limited to \$75,000,000. However, each \$1.00 increase (decrease) in the assumed public offering price of \$4.21 per share would increase (decrease) the dilution per share to new investors by approximately \$0.94 per share (\$0.91 per share). The information discussed above is illustrative only and will adjust based on the actual public offering price, the actual number of shares that we offer in this offering, and other terms of this offering determined at the time of each offer and sale.

The number of our shares of common stock outstanding after this offering is based on an aggregate of 94,319,696 shares of our common stock outstanding as of March 31, 2026, and excludes the following:

- 4,180 shares of our common stock issuable upon the exercise of options outstanding as of March 31, 2026 under the 2015 Plan, having a weighted average exercise price of \$267.23 per share;
- 3,745,911 shares of our common stock issuable upon the exercise of options outstanding as of March 31, 2026 under the 2017 Plan, having a weighted average exercise price of \$4.49 per share;
- 12,105,423 shares of our common stock issuable upon the exercise of options outstanding as of March 31, 2026 under the 2019 Plan, having a weighted average exercise price of \$1.99 per share;
- 54,410 shares of our common stock issuable upon the vesting and settlement of outstanding restricted stock unit awards outstanding as of March 31, 2026 under our 2017 Plan;

- 31,977,618 shares of common stock issuable upon the exercise of pre-funded warrants outstanding as of March 31, 2026, with 31,367,428 having an exercise price of \$0.001 per share and 610,190 having an exercise price of \$0.03 per share;
- 2,545,948 shares of common stock issuable upon the exercise of warrants outstanding as of March 31, 2026, having a weighted average exercise price of \$39.18 per share; and
- 1,496,929 shares of common stock reserved for future issuance under the 2017 ESPP and 2019 Plan as of March 31, 2026.

To the extent that options, pre-funded warrants or common warrants outstanding as of March 31, 2026 have been or are exercised, restricted stock units outstanding as of March 31, 2026 have vested or vest, or other shares are issued, investors purchasing shares in this offering could experience further dilution. In addition, we may choose to raise additional capital 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.

PLAN OF DISTRIBUTION

We have entered into the Sales Agreement with Jefferies, under which we may offer and sell our shares of common stock from time to time through Jefferies acting as agent. Pursuant to this prospectus, we may offer and sell up to \$75,000,000 of our shares of common stock. Sales of our shares of common stock, if any, under this prospectus will be made by any method that is deemed to be an “at the market offering” as defined in Rule 415(a)(4) under the Securities Act.

Each time we wish to issue and sell shares of common stock under the Sales Agreement, we will notify Jefferies of the number of shares to be issued, the dates on which such sales are anticipated to be made, any limitation on the number of shares to be sold in any one day and any minimum price below which sales may not be made. Once we have so instructed Jefferies, unless Jefferies declines to accept the terms of such notice, Jefferies has agreed to use its commercially reasonable efforts consistent with its normal trading and sales practices to sell such shares up to the amount specified on such terms. The obligations of Jefferies under the Sales Agreement to sell our shares of common stock are subject to a number of conditions that we must meet.

The settlement of sales of shares between us and Jefferies is generally anticipated to occur on the first trading day following the date on which the sale was made. Sales of our shares of common stock as contemplated in this prospectus will be settled through the facilities of The Depository Trust Company or by such other means as we and Jefferies may agree upon. There is no arrangement for funds to be received in an escrow, trust or similar arrangement.

We will pay Jefferies a commission of 3.0% of the aggregate gross proceeds we receive from each sale of our shares of common stock. Because there is no minimum offering amount required as a condition to close this offering, the actual total public offering amount, commissions and proceeds to us, if any, are not determinable at this time. In addition, we have agreed to reimburse Jefferies for the fees and disbursements of its counsel, payable upon execution of the Sales Agreement, in an amount not to exceed \$100,000, in addition to certain ongoing disbursements of its legal counsel. We estimate that the total expenses for the offering, excluding any commissions or expense reimbursement payable to Jefferies under the terms of the Sales Agreement, will be approximately \$170,000. The remaining sale proceeds, after deducting any other transaction fees, will equal our net proceeds from the sale of such shares.

Jefferies will provide written confirmation to us before the open on Nasdaq on the day following each day on which shares of common stock are sold under the Sales Agreement. Each confirmation will include the number of shares sold on that day, the aggregate gross proceeds of such sales and the proceeds to us.

In connection with the sale of the shares of common stock on our behalf, Jefferies will be deemed to be an “underwriter” within the meaning of the Securities Act, and the compensation of Jefferies will be deemed to be underwriting commissions or discounts. We have agreed to indemnify Jefferies against certain civil liabilities, including liabilities under the Securities Act. We have also agreed to contribute to payments Jefferies may be required to make in respect of such liabilities.

The offering of our shares of common stock pursuant to the Sales Agreement will terminate upon the earlier of (i) the sale of all shares of common stock subject to the Sales Agreement and (ii) the termination of the Sales Agreement as permitted therein. We and Jefferies may each terminate the sales agreement at any time upon ten trading days’ prior written notice.

This summary of the material provisions of the Sales Agreement does not purport to be a complete statement of its terms and conditions. A copy of the Sales Agreement is filed as an exhibit to the registration statement of which this prospectus forms a part.

Jefferies and its affiliates may in the future provide various investment banking, commercial banking, financial advisory and other financial services for us and our affiliates, for which services they may in the future receive

customary fees. In the course of its business, Jefferies may actively trade our securities for its own account or for the accounts of customers, and, accordingly, Jefferies may at any time hold long or short positions in such securities.

A prospectus in electronic format may be made available on a website maintained by Jefferies, and Jefferies may distribute the prospectus electronically.

LEGAL MATTERS

Gibson, Dunn & Crutcher LLP, San Francisco, California will pass upon the validity of the shares of common stock offered hereby. Jefferies LLC is being represented in connection with this offering by Paul Hastings LLP, New York, New York.

EXPERTS

The financial statements incorporated in this prospectus by reference to the Annual Report on Form 10-K for the year ended December 31, 2025 have been so incorporated in reliance on the report 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 ADDITIONAL INFORMATION

We file annual, quarterly and current reports, proxy statements and other information with the SEC. We also filed a registration statement on Form S-3, including exhibits, under the Securities Act with respect to the securities offered by this prospectus. This prospectus is a part of that registration statement, but does not contain all of the information included in the registration statement or the exhibits. You can find our public filings with the SEC on the internet at a web site maintained by the SEC located at www.sec.gov.

INCORPORATION OF CERTAIN INFORMATION BY REFERENCE

The SEC allows us to incorporate by reference the information and reports we file with it, which means that we can disclose important information to you by referring you to these documents. The information incorporated by reference is an important part of this prospectus, and information that we file after the date hereof with the SEC will automatically update and supersede the information already incorporated by reference. We are incorporating by reference the documents listed below:

- our Annual Report on Form 10-K for the year ended December 31, 2025 filed with the SEC on [March 17, 2026](#) (and any portions of our Definitive Proxy Statement on Schedule 14A filed on [March 20, 2026](#) that are incorporated by reference therein);
- our Quarterly Report on Form 10-Q for the quarter ended March 31, 2026 filed with the SEC on [May 6, 2026](#); and
- the description of our common stock contained in our registration statement on Form 8-A filed with the SEC on [November 15, 2017](#), including any amendments or reports filed for the purposes of updating this description.

All documents we file with the SEC pursuant to Sections 13(a), 13(c), 14 or 15(d) of the Exchange Act shall be deemed incorporated by reference in this prospectus and to be a part of this prospectus from the date of filing of those documents, with the exception of any portion of any report or document that is not deemed “filed” under such provisions on or after the date of this prospectus until the earlier of the date on which: (i) all of the securities registered under the registration statement have been sold; or (ii) the registration statement of which this prospectus is a part has been withdrawn.

Under no circumstances will any information furnished but not filed under Items 2.02 or 7.01 of Current Report on Form 8-K be deemed incorporated herein by reference unless such Form 8-K expressly provides to the contrary.

Upon written or oral request, we will provide without charge to each person to whom a copy of the prospectus is delivered a copy of the documents incorporated by reference herein (other than exhibits to such documents unless such exhibits are specifically incorporated by reference herein). You may request a copy of these filings, at no cost, by writing, calling or emailing us at the contact information set forth below. We have not authorized anyone to provide you with any information that differs from that contained in this prospectus. Accordingly, we take no responsibility for any other information that others may give you. You should not assume that the information in this prospectus is accurate as of any date other than the date of the front cover of this prospectus.

X4 Pharmaceuticals, Inc.
61 North Beacon Street, 4th Floor
Boston, MA 02134
(857) 529-8300



Up to \$75,000,000

Common Stock

PROSPECTUS

Jefferies

, 2026

PART II

INFORMATION NOT REQUIRED IN THE PROSPECTUS

Item 14. Other Expenses of Issuance and Distribution

The following table sets forth an estimate of the fees and expenses, other than the underwriting discounts and commissions, payable by the registrant in connection with the issuance and distribution of the securities being registered. All the amounts shown are estimates, except for the SEC registration fee.

	<u>Amount</u>
SEC registration fee	\$ 25,922.79
Printing and engraving expenses	*
Legal fees and expenses	*
Accounting fees and expenses	*
Transfer agent and registrar fees and expenses	*
Miscellaneous fees and expenses	*
Total	\$ *

* These fees are calculated based on the securities offered and the number of issuances and accordingly cannot be estimated at this time.

Item 15. Indemnification of Directors and Officers

The Company is a Delaware corporation. Section 145(a) of the DGCL provides that a Delaware corporation may indemnify any person who was or is a party or is threatened to be made a party to any threatened, pending or completed action, suit or proceeding, whether civil, criminal, administrative or investigative, other than an action by or in the right of the corporation, by reason of the fact that such person is or was a director, officer, employee or agent of the corporation, or is or was serving at the request of the corporation as a director, officer, employee or agent of another corporation, partnership, joint venture, trust or other enterprise, against expenses (including attorneys' fees), judgments, fines and amounts paid in settlement actually and reasonably incurred by the person in connection with such action, suit or proceeding if the person acted in good faith and in a manner the person reasonably believed to be in or not opposed to the best interests of the corporation, and, with respect to any criminal action or proceeding, had no reasonable cause to believe his or her conduct was unlawful.

Section 145(b) of the DGCL provides that a Delaware corporation may indemnify any person who was or is a party or is threatened to be made a party to any threatened, pending or completed action or suit by or in the right of the corporation to procure a judgment in its favor by reason of the fact that such person acted in any of the capacities set forth above, against expenses (including attorneys' fees) actually and reasonably incurred by such person in connection with the defense or settlement of such action or suit if the person acted in good faith and in a manner the person reasonably believed to be in, or not opposed to, the best interests of the corporation, except that no indemnification shall be made in respect of any claim, issue or matter as to which such person shall have been adjudged to be liable to the corporation, unless and only to the extent that the Court of Chancery or the state of Delaware or the court in which such action or suit was brought shall determine, upon application, that, despite the adjudication of liability but in view of all the circumstances of the case, such person is fairly and reasonably entitled to indemnity for such expenses which the court shall deem proper.

Further subsections of DGCL Section 145 provide that:

- (1) to the extent a present or former director or officer of a corporation has been successful on the merits or otherwise in the defense of any action, suit or proceeding referred to in subsections (i) and (ii) of Section 145 or in the defense of any claim, issue or matter therein, such person shall be indemnified against expenses, including attorneys' fees, actually and reasonably incurred by such person in connection therewith;
- (2) the indemnification and advancement of expenses provided for pursuant to Section 145 shall not be deemed exclusive of any other rights to which those seeking indemnification or advancement of expenses may be entitled under any bylaw, agreement, vote of shareholders or disinterested directors or otherwise; and
- (3) the corporation shall have the power to purchase and maintain insurance of behalf of any person who is or was a director, officer, employee or agent of the corporation, or is or was serving at the request of the corporation as a director, officer, employee or agent of another corporation, partnership, joint venture, trust or other enterprise, against any liability asserted against such person and incurred by such person in any such capacity, or arising out of such person's status as such, whether or not the corporation would have the power to indemnify such person against such liability under Section 145.

As used in this Item 15, the term "proceeding" means any threatened, pending or completed action, suit or proceeding, whether or not by or in the right of the Company, and whether civil, criminal, administrative, investigative or otherwise.

Section 145 of the DGCL makes provision for the indemnification of officers and directors in terms sufficiently broad to indemnify officers and directors of the Company under certain circumstances from liabilities (including reimbursement for expenses incurred) arising under the Securities Act. The Company's organizational documents provide, in effect, that, to the fullest extent and under the circumstances permitted by Section 145 of the DGCL, the Company will indemnify any and all of its officers and directors. The Company has entered into indemnification agreements with its officers and directors. The Company may, in its discretion, similarly indemnify its employees and agents. The Company's restated certificate also relieves its directors from monetary damages to the Company or its stockholders for breach of such director's fiduciary duty as a director to the fullest extent permitted by the DGCL. Under Section 102(b)(7) of the DGCL, a corporation may relieve its directors from personal liability to such corporation or its stockholders for monetary damages for any breach of their fiduciary duty as directors except (i) for a breach of the duty of loyalty, (ii) for failure to act in good faith, (iii) for intentional misconduct or knowing violation of law, (iv) for willful or negligent violations of certain provisions in the DGCL imposing certain requirements with respect to stock repurchases, redemptions and dividends or (v) for any transactions from which the director derived an improper personal benefit.

The Company has purchased and expects to maintain insurance policies that, within the limits and subject to the terms and conditions thereof, cover certain expenses and liabilities that may be incurred by directors and officers in connection with proceedings that may be brought against them as a result of an act or omission committed or suffered while acting as a director or officer of the Company. The underwriting agreements that we may enter into may provide for the indemnification by the underwriters of us and our officers and directors for certain liabilities, including liabilities arising under the Securities Act, and afford certain rights of contribution with respect thereto.

Item 16. Exhibits

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

Exhibit No.	Description
1.1*	Form of Underwriting Agreement.
1.2***	Open Market Sales AgreementSM , dated as of May 6, 2026, by and between X4 Pharmaceuticals, Inc. and Jefferies LLC.
3.1	Restated Certificate of Incorporation, as amended, as of September 1, 2022 (incorporated by reference from Exhibit 3.1 to X4's Current Report on Form 8-K filed on September 1, 2022 (Commission File No. 001-38295)) .
3.2	Certificate of Amendment to the Restated Certificate of Incorporation of X4 Pharmaceuticals, Inc. (incorporated by reference from Exhibit 3.1 to X4's Current Report on Form 8-K filed on April 24, 2025 (Commission File No. 001-38295)) .
3.3	Amended and Restated By-laws of the Company (incorporated by reference from Exhibit 3.2 to X4's Current Report on Form 8-K filed on November 20, 2017 (Commission File No. 001-38295)) .
4.1	Form of Common Stock Certificate (incorporated by reference from Exhibit 4.1 of X4's Current Report on Form 8-K filed on March 13, 2019 (Commission File No. 001-38295)) .
4.2***	Form of Debt Indenture .
4.3*	Form of Debt Securities.
4.4*	Form of Warrant Agreement and Warrant Certificate.
4.5*	Form of Unit Agreement and Unit Certificate.
5.1***	Opinion of Gibson, Dunn & Crutcher LLP, related to the base prospectus .
5.2***	Opinion of Gibson, Dunn & Crutcher LLP, related to the sales agreement prospectus .
23.1***	Consent of Independent Registered Public Accounting Firm .
23.2***	Consent of Gibson, Dunn & Crutcher LLP (included in Exhibit 5.1 hereto) .
24.1***	Power of Attorney (included on the signature pages to the registration statement) .
25.1**	Statement of Eligibility of Trustee under the Indenture.
107***	Filing Fee Table .

* To be filed, if necessary, by amendment or as an exhibit to a document to be incorporated or deemed to be incorporated by reference in this registration statement, including a Current Report on Form 8-K.

** To be filed in accordance with the requirements of Section 305(b)(2) of the Trust Indenture Act of 1939, as amended, and the applicable rules thereunder.

*** Filed herewith.

Item 17. Undertakings

The undersigned registrant hereby undertakes:

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

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

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

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

provided, however, that paragraphs (1)(i), (1)(ii) and (1)(iii) do not apply if the information required to be included in a post-effective amendment by those paragraphs is contained in reports filed with or furnished to the Commission by the registrant pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m or 78o(d)) that are incorporated by reference in the registration statement, or is contained in a form of prospectus filed pursuant to Rule 424(b) that is part of the registration statement.

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

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

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

(i) Each prospectus filed by the registrant pursuant to Rule 424(b)(3) shall be deemed to be part of the registration statement as of the date the filed prospectus was deemed part of and included in the registration statement; and

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

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

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

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

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

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

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

(7) That, for purposes of determining any liability under the Securities Act, (i) the information omitted from the form of prospectus filed as part of the registration statement in reliance upon Rule 430A and contained in the form of prospectus filed by the registrant pursuant to Rule 424(b)(1) or (4) or 497(h) under the Securities Act shall be deemed to be a part of the registration statement as of the time it was declared effective; and (ii) each post-effective amendment that contains a form of prospectus shall be deemed to be a new registration statement relating to the securities offered therein, and the offering of such securities at that time shall be deemed to be the initial *bona fide* offering thereof.

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

(9) To file an application for the purpose of determining the eligibility of the trustee to act under subsection (a) of Section 310 of the Trust Indenture Act in accordance with the rules and regulations prescribed by the Commission under Section 305(b)(2) of the Trust Indenture Act.

SIGNATURES

Pursuant to the requirements of the Securities Act of 1933, the registrant certifies that it has reasonable grounds to believe that it meets all of the requirements for filing on Form S-3 and has duly caused this registration statement to be signed on its behalf by the undersigned, thereunto duly authorized, in the City of Boston, Commonwealth of Massachusetts, on May 6, 2026.

X4 Pharmaceuticals, Inc.

By: /s/ Adam R. Craig
Adam R. Craig, M.D.,
Ph.D.
Executive Chairman

POWER OF ATTORNEY

KNOW ALL PERSONS BY THESE PRESENTS, that each person whose signature appears below constitutes and appoints Dr. Adam Craig and David Kirske, and each of them, as true and lawful attorneys-in-fact and agents, with full powers of substitution and resubstitution, for them and in their name, place and stead, in any and all capacities, to sign any and all amendments (including post-effective amendments) to this registration statement (or any registration statement for the same offering that is to be effective upon filing pursuant to Rule 462(b) under the Securities Act of 1933), and to file the same, with all exhibits thereto, and other documents in connection therewith, with the SEC, and generally to do all such things in their names and behalf in their capacities as officers and directors to enable X4 Pharmaceuticals, Inc. to comply with the provisions of the Securities Act of 1933 and all requirements of the SEC, granting unto said attorneys-in-fact and agents, and each of them, full power and authority to do and perform each and every act and thing requisite and necessary to be done in connection therewith, as fully to all intents and purposes as he might or could do in person, ratifying and confirming all that said attorneys-in-fact and agents, or any of them, or their or his substitutes or substitute, may lawfully do or cause to be done by virtue hereof.

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

Signatures	Title	Date
<u>/s/ Adam R. Craig</u> Adam R. Craig, M.D., Ph.D.	Executive Chairman, Chairman of the Board of Directors <i>(principal executive officer)</i>	May 6, 2026
<u>/s/ David Kirske</u> David Kirske	Chief Financial Officer and Treasurer <i>(principal financial officer and principal accounting officer)</i>	May 6, 2026
<u>/s/ Michael S. Wyzga</u> Michael S. Wyzga	Lead Independent Director of the Board of Directors	May 6, 2026
<u>/s/ Gary J. Bridger</u> Gary J. Bridger, Ph.D.	Director	May 6, 2026
<u>/s/ Françoise De Craecker</u> Françoise De Craecker	Director	May 6, 2026
<u>/s/ Murray W. Stewart</u> Murray W. Stewart, M.D.	Director	May 6, 2026

- (1) Separate consideration may or may not be received for securities that are issuable upon the conversion or exercise of, or in exchange for, other securities offered hereby.
- (2) X4 Pharmaceuticals, Inc. (the "Registrant") is registering hereunder such indeterminate number of shares of common stock and preferred stock, such indeterminate principal amount of debt securities and such indeterminate number of warrants to purchase common stock, preferred stock and/or debt securities to be sold by the Registrant from time to time at unspecified prices which shall have an aggregate initial offering price not to exceed \$300,000,000. If any debt securities are issued at an original issue discount, then the principal amount of such debt securities shall be in such greater amount as shall result in an aggregate initial offering price not to exceed \$300,000,000, less the aggregate dollar amount of all securities previously issued hereunder. The securities registered for sale also include such indeterminate number of shares of common stock and preferred stock as may be issued upon conversion of debt securities, such indeterminate number of shares of common stock that may be issued upon conversion of preferred stock and such indeterminate number of shares of common stock and preferred stock and principal amount of debt securities that may be issued upon exercise of warrants. In addition, pursuant to Rule 416 under the Securities Act of 1933, as amended (the "Securities Act"), the shares being registered hereunder include such indeterminate number of shares of common stock and preferred stock as may be issuable with respect to the shares being registered hereunder as a result of stock splits, stock dividends or similar transactions.
- (3) The proposed maximum offering price per share will be determined, from time to time, by the Registrant in connection with the issuance by the Registrant of the securities registered hereunder and is not specified as to each class of security pursuant to Instruction 2.A.iii.b. to the Calculation of Filing Fee Tables and Related Disclosure on Item 16(b) of Form S-3 under the Securities Act.
- (4) Pursuant to Rule 415(a)(6) under the Securities Act, the securities registered pursuant to this registration statement include \$112,289,730 of unsold securities (the "August 2023 Unsold Securities") previously registered pursuant to the Registration Statement on Form S-3 (File No. 333-273961), which was declared effective on August 24, 2023 (the "August 2023 Registration Statement"). The August 2023 Unsold Securities include (x) \$48,603,790 of unsold common stock pursuant to the sales agreement prospectus included in the August 2023 Registration Statement, (y) \$34,794,620 of unsold common stock pursuant to the prospectus supplement dated January 14, 2022 and (z) \$28,891,320 of unsold unallocated securities. In connection with the filing of the August 2023 Registration Statement, the Registrant paid a filing fee of \$12,374.33 associated with the offering of the August 2023 Unsold Securities (based on the filing fee rate in effect at the time of the filing of the August 2023 Registration Statement). The filing fee associated with the offering of the August 2023 Unsold Securities is hereby carried forward to be applied to the August 2023 Unsold Securities registered hereunder, and no additional filing fee is due with respect to the August 2023 Unsold Securities in connection with the filing of this registration statement. To the extent that, after the filing date hereof and prior to the effectiveness of this registration statement, the Registrant sells any August 2023 Unsold Securities pursuant to the August 2023 Registration Statement, the Registrant will identify in a pre-effective amendment to this registration statement the updated number of August 2023 Unsold Securities from the August 2023 Registration Statement to be included in this registration statement pursuant to Rule 415(a)(6) and the updated amount of new securities to be registered on this registration statement. Pursuant to Rule 415(a)(6), the offering of securities under the August 2023 Registration Statement will be deemed terminated as of the date of effectiveness of this registration statement.

OPEN MARKET SALE AGREEMENTSM

May 6, 2026

JEFFERIES LLC
520 Madison Avenue
New York, New York 10022

Ladies and Gentlemen:

X4 Pharmaceuticals, Inc., a Delaware corporation (the “**Company**”), proposes, subject to the terms and conditions stated herein, to issue and sell from time to time through Jefferies LLC, as sales agent and/or principal (the “**Agent**”), shares of the Company’s common stock, par value \$0.001 per share (the “**Common Shares**”), having an aggregate offering price of up to \$75,000,000 on the terms set forth in this agreement (this “**Agreement**”).

Section 1. DEFINITIONS

(a) Certain Definitions. For purposes of this Agreement, capitalized terms used herein and not otherwise defined shall have the following respective meanings:

“**Affiliate**” of a Person means another Person that directly or indirectly, through one or more intermediaries, controls, is controlled by, or is under common control with, such first- mentioned Person. The term “control” (including the terms “controlling,” “controlled by” and “under common control with”) means the possession, direct or indirect, of the power to direct or cause the direction of the management and policies of a Person, whether through the ownership of voting securities, by contract or otherwise.

“**Agency Period**” means the period commencing on the date of this Agreement and expiring on the earliest to occur of (x) the date on which the Agent shall have placed the Maximum Program Amount (as defined below) pursuant to this Agreement and (y) the date this Agreement is terminated pursuant to Section 7.

“**BHC Act**” means the Bank Holding Company Act of 1956, as amended.

“**Commission**” means the U.S. Securities and Exchange Commission.

“**Exchange Act**” means the Securities Exchange Act of 1934, as amended, and the rules and regulations of the Commission thereunder.

“**Floor Price Limitation**” means the minimum price per share set by the Company in the Issuance Notice below which the Agent shall not sell Shares during the applicable period set forth in the applicable Issuance Notice, which may be adjusted by the Company at any time during the period set forth in the applicable Issuance Notice by delivering written notice of such change to the Agent and which in no event shall be less than \$1.00 per share without the prior written consent of the Agent, which may be withheld in the Agent’s sole discretion.

“**Governmental Authority**” means (i) any federal, provincial, state, local, municipal, national or international government or governmental authority, regulatory or administrative agency, governmental

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commission, department, board, bureau, agency or instrumentality, court, tribunal, arbitrator or arbitral body (public or private); (ii) any self-regulatory organization; or (iii) any political subdivision of any of the foregoing.

“**Issuance Amount**” means the aggregate Sales Price of the Shares to be sold by the Agent pursuant to any Issuance Notice.

“**Issuance Notice**” means a written notice delivered to the Agent by the Company in accordance with this Agreement in the form attached hereto as Exhibit A that is executed by its Chief Executive Officer, President or Chief Financial Officer.

“**Issuance Notice Date**” means any Trading Day during the Agency Period that an Issuance Notice is delivered pursuant to Section 3(b)(i).

“**Issuance Price**” means the Sales Price less the Selling Commission.

“**Maximum Program Amount**” means Common Shares with an aggregate Sales Price of the lesser of (a) the number or dollar amount of Common Shares registered under the effective Registration Statement (as defined below) pursuant to which the offering is being made, (b) the number of authorized but unissued Common Shares (less Common Shares issuable upon exercise, conversion or exchange of any outstanding securities of the Company or otherwise reserved from the Company’s authorized capital stock), (c) the number or dollar amount of Common Shares permitted to be sold under Form S-3 (including General Instruction I.B.6 thereof, if applicable), or (d) the number or dollar amount of Common Shares for which the Company has filed a Prospectus (as defined below).

“**Person**” means an individual or a corporation, partnership, limited liability company, trust, incorporated or unincorporated association, joint venture, joint stock company, governmental authority or other entity of any kind.

“**Principal Market**” means the Nasdaq Capital Market or such other national securities exchange on which the Common Shares, including any Shares (as defined below), are then listed.

“**Rule 462(b) Registration Statement**” means any registration statement filed by the Company pursuant to Rule 462(b) under the Securities Act in connection with the Registration Statement and the offer and sale of Shares.

“**Sales Price**” means the actual sale execution price of each Share placed by the Agent pursuant to this Agreement.

“**Securities Act**” means the Securities Act of 1933, as amended, and the rules and regulations of the Commission thereunder.

“**Selling Commission**” means three percent (3%) of the gross proceeds of Shares sold pursuant to this Agreement, or as otherwise agreed between the Company and the Agent with respect to any Shares sold pursuant to this Agreement.

“**Settlement Date**” means the first business day, or such other time period as required by the Exchange Act, following each Trading Day during the period set forth in the applicable Issuance Notice on which Shares are

sold pursuant to this Agreement, when the Company shall deliver to the Agent the amount of Shares sold on such Trading Day and the Agent shall deliver to the Company the Issuance Price received on such sales.

“**Shares**” means the Common Shares issued or issuable pursuant to this Agreement.

“**Trading Day**” means any day on which the Principal Market is open for trading.

Section 2. REPRESENTATIONS AND WARRANTIES OF THE COMPANY

The Company represents and warrants to, and agrees with, the Agent that as of (1) the date of this Agreement, (2) each Issuance Notice Date, (3) each Settlement Date, (4) each Triggering Event Date (as defined below) and (5) each Time of Sale (as defined below) (each of the times referenced above is referred to herein as a “**Representation Date**”), except as may be disclosed in the Prospectus (including any documents incorporated by reference therein and any amendments or supplements thereto) on or before a Representation Date, and unless such representation, warranty or agreement specifies a different time:

(a) **Registration Statement.** The Company has prepared and filed or will file with the Commission a shelf registration statement on Form S-3 that contains a base prospectus. Such registration statement registers the issuance and sale by the Company of the Shares under the Securities Act. The Company may file one or more additional registration statements from time to time that will contain a base prospectus and related prospectus or prospectus supplement, if applicable, with respect to the Shares. Except where the context otherwise requires, such registration statement(s), including any information deemed to be a part thereof pursuant to Rule 430B under the Securities Act, including all financial statements, exhibits and schedules thereto and all documents incorporated or deemed to be incorporated therein by reference pursuant to Item 12 of Form S-3 under the Securities Act as from time to time amended or supplemented, is herein referred to as the “**Registration Statement**,” and the prospectus constituting a part of such registration statement(s), together with any prospectus supplement filed with the Commission pursuant to Rule 424(b) under the Securities Act relating to a particular issuance of the Shares, including all documents incorporated or deemed to be incorporated therein by reference pursuant to Item 12 of Form S-3 under the Securities Act, in each case, as from time to time amended or supplemented, is referred to herein as the “**Prospectus**,” except that if any revised prospectus is provided to the Agent by the Company for use in connection with the offering of the Shares that is not required to be filed by the Company pursuant to Rule 424(b) under the Securities Act, the term “**Prospectus**” shall refer to such revised prospectus from and after the time it is first provided to the Agent for such use. The Registration Statement at the time it originally became effective is herein called the “**Original Registration Statement**.” As used in this Agreement, the terms “amendment” or “supplement” when applied to the Registration Statement or the Prospectus shall be deemed to include the filing by the Company with the Commission of any document under the Exchange Act after the date hereof that is or is deemed to be incorporated therein by reference.

All references in this Agreement to financial statements and schedules and other information which is “contained,” “included” or “stated” in the Registration Statement or the Prospectus (and all other references of like import) shall be deemed to mean and include all such financial statements and schedules and other information which is or is deemed to be incorporated by reference in or otherwise deemed under the Securities Act to be a part of or included in the Registration Statement or the Prospectus, as the case may be, as of any specified date; and all references in this Agreement to amendments or supplements to the Registration Statement or the Prospectus shall be deemed to mean and include, without limitation, the filing of any document under the Exchange Act which is or is deemed to be incorporated by reference in or otherwise deemed under the Securities Act to be a part of or included in the Registration Statement and/or the Prospectus, as the case may be, as of any specified date. The Company’s obligations under this Agreement to furnish, provide or deliver or make available

(and all other similar references) copies of any report or statement shall be deemed satisfied if the same is filed with the Commission through its Electronic Data Gathering, Analysis and Retrieval system (“EDGAR”).

At the time the Original Registration Statement was or will be originally declared or deemed to become effective and at the time the Company’s most recent annual report on Form 10-K was filed with the Commission, if later, the Company met the then-applicable requirements for use of Form S-3 under the Securities Act. During the Agency Period, each time the Company files an annual report on Form 10-K, the Company will meet the then-applicable requirements for use of Form S-3 under the Securities Act.

(b) Compliance with Registration Requirements. The Original Registration Statement and any Rule 462(b) Registration Statement have been or will be declared effective by the Commission under the Securities Act. The Company has complied, to the Commission’s satisfaction, with all requests of the Commission for additional or supplemental information, if any. No stop order suspending the effectiveness of the Registration Statement or any Rule 462(b) Registration Statement is in effect and no proceedings for such purpose have been instituted or are pending or, to the knowledge of the Company, are contemplated or threatened by the Commission.

The Prospectus, when filed, complied, and at each Representation Date, will comply, in all material respects with the Securities Act and, if filed with the Commission through EDGAR (except as may be permitted by Regulation S-T under the Securities Act), was identical to the copy thereof delivered to the Agent for use in connection with the issuance and sale of the Shares. Each of the Registration Statement, any Rule 462(b) Registration Statement and any post-effective amendment thereto, at the time it became or becomes effective, complied, and at each Representation Date, will comply, in all material respects with the Securities Act and did not and will not contain any untrue statement of a material fact or omit to state a material fact required to be stated therein or necessary to make the statements therein not misleading. As of the date of this Agreement, the Prospectus and any Free Writing Prospectus (as defined in Section 4(e) below) considered together (collectively, the “**Time of Sale Information**”) did not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements therein, in light of the circumstances under which they were made, not misleading. The Prospectus, as amended or supplemented, as of its date, did not, and at each Representation Date, will not, contain any untrue statement of a material fact or omit to state a material fact necessary in order to make the statements therein, in light of the circumstances under which they were made, not misleading. The representations and warranties set forth in the three immediately preceding sentences do not apply to statements in or omissions from the Registration Statement, any Rule 462(b) Registration Statement, or any post-effective amendment thereto, or the Prospectus, or any amendments or supplements thereto, made in reliance upon and in conformity with information relating to the Agent furnished to the Company in writing by the Agent expressly for use therein, it being understood and agreed that only such information furnished by the Agent to the Company consists of the Agent Information (as defined below). There are no contracts or other documents required to be described in the Prospectus or to be filed as exhibits to the Registration Statement which have not been described or filed as required. The Registration Statement and the offer and sale of the Shares as contemplated hereby meet the requirements of Rule 415 under the Securities Act and comply in all material respects with said rule.

(c) Status Under the Securities Act. The Company was not and is not an ineligible issuer as defined in Rule 405 under the Securities Act at the times specified in Rules 164 and 433 under the Securities Act in connection with the offering of the Shares.

(d) No Misstatement or Omission in a Free Writing Prospectus. Each Free Writing Prospectus, as of its issue date and as of the applicable Settlement Date, did not, does not and will not include any information that conflicted, conflicts or will conflict with the information contained in the Registration Statement or the Prospectus, including any document incorporated or deemed to be a part thereof that has not been superseded or

modified. The foregoing sentence does not apply to statements in or omissions from any Free Writing Prospectus based upon and in conformity with the Agent Information.

(e) Conformity with EDGAR Filing. The Prospectus delivered to the Agent for use in connection with the sale of the Shares pursuant to this Agreement will be identical to the versions of the Prospectus created to be transmitted to the Commission for filing via EDGAR, except to the extent permitted by Regulation S-T.

(f) Incorporated Documents. The documents incorporated or deemed to be incorporated by reference in the Registration Statement and the Prospectus, at the time they were or hereafter are filed with the Commission, complied and will comply in all material respects with the requirements of the Exchange Act, as applicable, and, when read together with the other information in the Prospectus, do not contain an untrue statement of a material fact or omit to state a material fact required to be stated therein or necessary to make the statements therein, in light of the circumstances under which they were made, not misleading.

(g) Exchange Act Compliance. The Registration Statement, the Prospectus, any Free Writing Prospectus or any amendment or supplement thereto, and the documents incorporated by reference in the Registration Statement, the Prospectus or any amendment or supplement thereto, when such documents were or are filed with the Commission under the Securities Act or the Exchange Act or became or become effective under the Securities Act, as the case may be, conformed or will conform in all material respects with the requirements of the Securities Act and the Exchange Act, as applicable.

(h) Financial Information. The consolidated financial statements of the Company included or incorporated by reference in the Registration Statement, the Prospectus and the Free Writing Prospectuses, if any, together with the related notes and schedules, present fairly, in all material respects, the consolidated financial position of the Company and the Subsidiaries as of the dates indicated and the consolidated results of operations, cash flows and changes in stockholders' equity of the Company for the periods specified and have been prepared in compliance with the requirements of the Securities Act and Exchange Act and in conformity with U.S. generally accepted accounting procedures ("GAAP") applied on a consistent basis during the periods involved; the other financial and statistical data with respect to the Company and the Subsidiaries contained or incorporated by reference in the Registration Statement, the Prospectus and the Free Writing Prospectuses, if any, are accurately and fairly presented and prepared on a basis consistent with the financial statements and books and records of the Company; there are no financial statements (historical or pro forma) that are required to be included or incorporated by reference in the Registration Statement, or the Prospectus that are not included or incorporated by reference as required; the Company and the Subsidiaries do not have any material liabilities or obligations, direct or contingent (including any off-balance sheet obligations), not described in the Registration Statement (excluding the exhibits thereto), and the Prospectus; and all disclosures contained or incorporated by reference in the Registration Statement, the Prospectus and the Free Writing Prospectuses, if any, regarding "non-GAAP financial measures" (as such term is defined by the rules and regulations of the Commission) comply with Regulation G of the Exchange Act and Item 10 of Regulation S-K under the Securities Act, to the extent applicable. The interactive data in eXtensible Business Reporting Language included or incorporated by reference in the Registration Statement and the Prospectus fairly presents the information called for in all material respects and has been prepared in accordance with the Commission's rules and guidelines applicable thereto.

(i) Organization. The Company and each of its Subsidiaries are duly organized, validly existing as a corporation and in good standing under the laws of their respective jurisdictions of organization. The Company and each of its Subsidiaries are duly licensed or qualified as a foreign corporation for transaction of business and in good standing under the laws of each other jurisdiction in which their respective ownership or lease of property or the conduct of their respective businesses requires such license or qualification, and have all corporate power and authority necessary to own or hold their respective properties and to conduct their respective businesses as

described in the Registration Statement and the Prospectus, except where the failure to be so qualified or in good standing or have such power or authority would not, individually or in the aggregate, have a Material Adverse Change (as defined below).

(j) Subsidiaries. The subsidiaries set forth on Schedule B (collectively, the “Subsidiaries”), are the Company’s only significant subsidiaries (as such term is defined in Rule 1-02 of Regulation S-X promulgated by the Commission). Except as set forth in the Registration Statement and in the Prospectus, the Company owns, directly or indirectly, all of the equity interests of the Subsidiaries free and clear of any lien, charge, security interest, encumbrance, right of first refusal or other restriction, and all the equity interests of the Subsidiaries are validly issued and are fully paid, nonassessable and free of preemptive and similar rights. No Subsidiary is currently prohibited, directly or indirectly, from paying any dividends to the Company, from making any other distribution on such Subsidiary’s capital stock, from repaying to the Company any loans or advances to such Subsidiary from the Company or from transferring any of such Subsidiary’s property or assets to the Company or any other Subsidiary of the Company.

(k) No Violation or Default. Neither the Company nor any of the Subsidiaries is (i) in violation of its charter or by-laws or similar organizational documents; (ii) in default, and no event has occurred that, with notice or lapse of time or both, would constitute such a default, in the due performance or observance of any term, covenant or condition contained in any indenture, mortgage, deed of trust, loan agreement or other agreement or instrument to which the Company or any of the Subsidiaries is a party or by which the Company or any of its subsidiaries is bound or to which any of the property or assets of the Company or any of the Subsidiaries are subject; or (iii) in violation of any law or statute or any judgment, order, rule or regulation of any Governmental Authority, except, in the case of each of clauses (ii) and (iii) above, for any such violation or default that would not, individually or in the aggregate, have a Material Adverse Change. To the Company’s knowledge, no other party under any material contract or other agreement to which it or any of the Subsidiaries is a party is in default in any respect thereunder where such default would have a Material Adverse Change.

(l) No Material Adverse Change. Subsequent to the respective dates as of which information is given in the Registration Statement, the Prospectus and the Free Writing Prospectuses, if any (including any document deemed incorporated by reference therein): (i) there has been no material adverse change, or any development that could be reasonably expected to result in a material adverse change, in (A) the condition, financial or otherwise, or in the earnings, business, properties, operations, operating results, assets, liabilities or prospects, whether or not arising from transactions in the ordinary course of business, of the Company and the Subsidiaries, considered as one entity or (B) the ability of the Company to consummate the transactions contemplated by this Agreement or perform its obligations hereunder (any such change being referred to herein as a “**Material Adverse Change**”); (ii) the Company and the Subsidiaries, considered as one entity, have not incurred any material liability or obligation, indirect, direct or contingent, including without limitation any losses or interference with their business from pandemics, fire, explosion, flood, earthquakes, accident or other calamity, whether or not covered by insurance, or from any strike, labor dispute or court or governmental action, order or decree, that are material, individually or in the aggregate, to the Company and the Subsidiaries, considered as one entity, and have not entered into any material transactions not in the ordinary course of business; and (iii) there has not been any material decrease in the capital stock or any material increase in any short-term or long-term indebtedness of the Company or the Subsidiaries and there has been no dividend or distribution of any kind declared, paid or made by the Company or, except for dividends paid to the Company or other Subsidiaries, by any of the Subsidiaries on any class of capital stock, or any repurchase or redemption by the Company or any of the Subsidiaries of any class of capital stock.

(m) Capitalization. The issued and outstanding shares of capital stock of the Company have been duly authorized and validly issued, are fully paid and nonassessable, have been issued in compliance with all federal

and state securities laws and, other than as disclosed in the Registration Statement or the Prospectus, are not subject to any preemptive rights, rights of first refusal or similar rights. The Company has an authorized, issued and outstanding capitalization as set forth in the Registration Statement and the Prospectus as of the dates referred to therein (other than the grant of additional options under the Company's existing stock option plans, or changes in the number of outstanding shares of Common Shares of the Company due to the issuance of shares upon the exercise or conversion of securities exercisable for, or convertible into, Common Shares outstanding on the date hereof) and such authorized capital stock conforms to the description thereof set forth in the Registration Statement and the Prospectus. The description of the securities of the Company in the Registration Statement and the Prospectus is complete and accurate in all material respects. Except as disclosed in or contemplated by the Registration Statement or the Prospectus, as of the date referred to therein, the Company does not have outstanding any options to purchase, or any rights or warrants to subscribe for, or any securities or obligations convertible into, or exchangeable for, or any contracts or commitments to issue or sell, any shares of capital stock or other securities.

(n) Authorization; Enforceability. The Company has full legal right, power and authority to enter into this Agreement and perform the transactions contemplated hereby. This Agreement has been duly authorized, executed and delivered by the Company and is a legal, valid and binding agreement of the Company enforceable in accordance with its terms, except to the extent that enforceability may be limited by bankruptcy, insolvency, reorganization, moratorium or similar laws affecting creditors' rights generally and by general equitable principles (the "**Enforceability Limitations**").

(o) Authorization of the Shares. The Shares, when issued and delivered pursuant to the terms approved by the Board of the Directors of the Company or a duly authorized committee thereof, or a duly authorized executive officer, against payment therefor as provided herein, will be duly and validly authorized and issued and fully paid and nonassessable, free and clear of any pledge, lien, encumbrance, security interest or other claim, including any statutory or contractual preemptive rights, resale rights, rights of first refusal or other similar rights, and will be registered pursuant to Section 12 of the Exchange Act. The Shares, when issued, will conform to the description thereof set forth in or incorporated into the Prospectus.

(p) No Consents Required. No consent, approval, authorization, order, registration or qualification of or with any Governmental Authority is required for the execution, delivery and performance by the Company of this Agreement, the issuance and sale by the Company of the Shares, except for such consents, approvals, authorizations, orders and registrations or qualifications as may be required under applicable state securities laws or by the by-laws and rules of FINRA (as defined below) or the Principal Market in connection with the sale of the Shares by the Agent.

(q) No Preferential Rights. Except as set forth in the Registration Statement and the Prospectus, (i) no person, as such term is defined in Rule 1-02 of Regulation S-X promulgated under the Securities Act (each, a "**Person**"), has the right, contractual or otherwise, to cause the Company to issue or sell to such Person any Common Shares or shares of any other capital stock or other securities of the Company, (ii) no Person has any preemptive rights, resale rights, rights of first refusal, rights of co-sale, or any other rights (whether pursuant to a "poison pill" provision or otherwise) to purchase any Common Shares or shares of any other capital stock or other securities of the Company, (iii) no Person has the right to act as an underwriter or as a financial advisor to the Company in connection with the offer and sale of the Common Shares, and (iv) no Person has the right, contractual or otherwise, to require the Company to register under the Securities Act any Common Shares or shares of any other capital stock or other securities of the Company, or to include any such shares or other securities in the Registration Statement or the offering contemplated thereby, whether as a result of the filing or effectiveness of the Registration Statement or the sale of the Shares as contemplated thereby or otherwise.

(r) Independent Public Accounting Firm. PricewaterhouseCoopers LLC (the “**Accountant**”), whose report on the consolidated financial statements of the Company is filed with the Commission as part of the Company’s most recent Annual Report on Form 10-K filed with the Commission and incorporated by reference into the Registration Statement and the Prospectus, are and, during the periods covered by their report, were an independent registered public accounting firm within the meaning of the Securities Act and the Public Company Accounting Oversight Board (United States). To the Company’s knowledge, the Accountant is not in violation of the auditor independence requirements of the Sarbanes-Oxley Act of 2002 (the “**Sarbanes-Oxley Act**”) with respect to the Company.

(s) Enforceability of Agreements. All agreements between the Company and third parties expressly referenced in the Prospectus are legal, valid and binding obligations of the Company enforceable in accordance with their respective terms, except to the extent that (i) enforceability may be limited by the Enforceability Limitations and (ii) the indemnification provisions of certain agreements may be limited by federal or state securities laws or public policy considerations in respect thereof.

(t) No Litigation. Except as set forth in the Registration Statement or the Prospectus, there are no actions, suits or proceedings by or before any Governmental Authority pending, nor, to the Company’s knowledge, any audits or investigations by or before any Governmental Authority to which the Company or a Subsidiary is a party or to which any property of the Company or any of its Subsidiaries is the subject that, individually or in the aggregate, would have a Material Adverse Change and, to the Company’s knowledge, no such actions, suits, proceedings, audits or investigations are threatened or contemplated by any Governmental Authority or threatened by others; and (i) there are no current or pending audits or investigations, actions, suits or proceedings by or before any Governmental Authority that are required under the Securities Act to be described in the Prospectus that are not so described; and (ii) there are no contracts or other documents that are required under the Securities Act to be filed as exhibits to the Registration Statement that are not so filed.

(u) Consents and Permits. Except as disclosed in the Registration Statement and the Prospectus, the Company and its Subsidiaries have made all filings, applications and submissions required by, possesses and is operating in compliance with, all approvals, licenses, certificates, certifications, clearances, consents, grants, exemptions, marks, notifications, orders, permits and other authorizations issued by, the appropriate federal, state or foreign Governmental Authority (including, without limitation, the United States Food and Drug Administration (the “**FDA**”), the United States Drug Enforcement Administration or any other foreign, federal, state, provincial, court or local government or regulatory authorities including self-regulatory organizations engaged in the regulation of clinical trials, pharmaceuticals, biologics or biohazardous substances or materials) necessary for the ownership or lease of their respective properties or to conduct its businesses as described in the Registration Statement and the Prospectus (collectively, “**Permits**”), except for such Permits the failure of which to possess, obtain or make the same would not have a Material Adverse Change; the Company and its Subsidiaries are in compliance with the terms and conditions of all such Permits, except where the failure to be in compliance would not have a Material Adverse Change; all of the Permits are valid and in full force and effect, except where any invalidity, individually or in the aggregate, would not be reasonably expected to have a Material Adverse Change; and neither the Company nor any of its Subsidiaries has received any written notice relating to the limitation, revocation, cancellation, suspension, modification or non-renewal of any such Permit which, singly or in the aggregate, if the subject of an unfavorable decision, ruling or finding, would have a Material Adverse Change, or has any reason to believe that any such license, certificate, permit or authorization will not be renewed in the ordinary course. To the extent required by applicable laws and regulations of the FDA, the Company or the applicable Subsidiary has submitted to the FDA an Investigational New Drug Application or amendment or supplement thereto for each clinical trial it has conducted or sponsored or is conducting or sponsoring; all such submissions were in material compliance with applicable laws and rules and regulations when submitted and no material deficiencies have been asserted by the FDA with respect to any such submissions.

(v) Regulatory Filings. Except as disclosed in the Registration Statement and the Prospectus, neither the Company nor any of its Subsidiaries has failed to file with the applicable Governmental Authorities (including, without limitation, the FDA, or any foreign, federal, state, provincial or local Governmental Authority performing functions similar to those performed by the FDA) any required filing, declaration, listing, registration, report or submission, except for such failures that, individually or in the aggregate, would not have a Material Adverse Change; except as disclosed in the Registration Statement and the Prospectus, all such filings, declarations, listings, registrations, reports or submissions were in compliance with applicable laws when filed and no deficiencies have been asserted by any applicable regulatory authority with respect to any such filings, declarations, listings, registrations, reports or submissions, except for any deficiencies that, individually or in the aggregate, would not have a Material Adverse Change. The Company has operated and currently is, in all material respects, in compliance with the United States Federal Food, Drug, and Cosmetic Act, all applicable rules and regulations of the FDA and other federal, state, local and foreign Governmental Authority exercising comparable authority.

(w) Intellectual Property. To the Company's knowledge, except as disclosed in the Registration Statement and the Prospectus, the Company and its Subsidiaries own, possess, license or have other rights to use all foreign and domestic patents, patent applications, trade and service marks, trade and service mark registrations, trade names, copyrights, licenses, inventions, trade secrets, technology, Internet domain names, know-how and other intellectual property (collectively, the "**Intellectual Property**"), necessary for the conduct of their respective businesses as now conducted except to the extent that the failure to own, possess, license or otherwise hold adequate rights to use such Intellectual Property would not, individually or in the aggregate, have a Material Adverse Change. Except as disclosed in the Registration Statement and the Prospectus (i) to the Company's knowledge, there are no rights of third parties to any such Intellectual Property owned by the Company and its Subsidiaries; (ii) to the Company's knowledge, there is no infringement by third parties of any such Intellectual Property; (iii) there is no pending or, to the Company's knowledge, threatened action, suit, proceeding or claim by others challenging the Company's and its Subsidiaries' rights in or to any such Intellectual Property, and the Company is unaware of any facts which could form a reasonable basis for any such action, suit, proceeding or claim; (iv) there is no pending or, to the Company's knowledge, threatened action, suit, proceeding or claim by others challenging the validity or scope of any such Intellectual Property; (v) there is no pending or, to the Company's knowledge, threatened action, suit, proceeding or claim by others that the Company and its Subsidiaries infringe or otherwise violate any patent, trademark, copyright, trade secret or other intellectual property rights of others; (vi) to the Company's knowledge, there is no third-party U.S. patent or published U.S. patent application which contains claims for which an Interference Proceeding (as defined in 35 U.S.C. § 135) has been commenced against any patent or patent application described in the Prospectus as being owned by or licensed to the Company; and (vii) to the Company's knowledge, the Company and its Subsidiaries have complied with the terms of each agreement pursuant to which Intellectual Property has been licensed to the Company or such Subsidiary, and all such agreements are in full force and effect, except, in the case of any of clauses (i)-(vii) above, as would not, individually or in the aggregate, result in a Material Adverse Change.

(x) Clinical Studies. The preclinical studies and tests and clinical trials described in the Prospectus were, and, if still pending, are being conducted in all material respects in accordance with the experimental protocols, procedures and controls pursuant to, where applicable, accepted professional and scientific standards for products or product candidates comparable to those being developed by the Company; the descriptions of such studies, tests and trials, and the results thereof, contained in the Prospectus are accurate and complete in all material respects; the Company is not aware of any tests, studies or trials not described in the Prospectus, the results of which reasonably call into question the results of the tests, studies and trials described in the Prospectus; and the Company has not received any written notice or correspondence from the FDA or any foreign, state or local Governmental Authority exercising comparable authority or any institutional review board or comparable

authority requiring the termination, suspension, clinical hold or material modification of any tests, studies or trials.

(y) Market Capitalization. At the time the Registration Statement is filed with the Commission, the Company will meet the then applicable requirements for the use of Form S-3 under the Securities Act, including, but not limited to, General Instruction I.B.1 of Form S-3. The Company is not a shell company (as defined in Rule 405 under the Securities Act) and has not been a shell company for at least 12 calendar months previously and if it has been a shell company at any time previously, has filed current Form 10 information (as defined in Instruction I.B.6 of Form S-3) with the Commission at least 12 calendar months previously reflecting its status as an entity that is not a shell company.

(z) Certain Market Activities. Neither the Company, nor any of the Subsidiaries, nor any of their respective directors, officers or controlling persons has taken, directly or indirectly, any action designed, or that has constituted or might reasonably be expected to cause or result in, under the Exchange Act or otherwise, the stabilization or manipulation of the price of any security of the Company, whether to facilitate the sale or resale of the Shares or otherwise, and has taken no action which would directly or indirectly violate Regulation M under the Exchange Act.

(aa) Broker/Dealer Relationships. Neither the Company nor any of the Subsidiaries (i) is required to register as a “broker” or “dealer” in accordance with the provisions of the Exchange Act or (ii) directly or indirectly through one or more intermediaries, controls or is a “person associated with a member” or “associated person of a member” (within the meaning set forth in the FINRA Manual).

(bb) No Reliance. The Company has not relied upon the Agent or legal counsel for the Agent for any legal, tax or accounting advice in connection with the offering and sale of the Shares.

(cc) Tax Law Compliance. The Company and each of its Subsidiaries have filed all federal, state, local and foreign tax returns which have been required to be filed and paid all taxes shown thereon through the date hereof, to the extent that such taxes have become due and are not being contested in good faith, except where the failure to so file or pay would not have a Material Adverse Change. Except as otherwise disclosed in or contemplated by the Registration Statement or the Prospectus, no tax deficiency has been determined adversely to the Company or any of its Subsidiaries which has had, or would have, individually or in the aggregate, a Material Adverse Change. The Company has no knowledge of any federal, state or other governmental tax deficiency, penalty or assessment which has been or might be asserted or threatened against it which would have a Material Adverse Change.

(dd) Title to Real and Personal Property. Except as set forth in the Registration Statement or the Prospectus, the Company and its Subsidiaries have good and marketable title in fee simple to all items of real property owned by them, good and valid title to all personal property described in the Registration Statement or Prospectus as being owned by them, in each case free and clear of all liens, encumbrances and claims, except those matters that (i) do not materially interfere with the use made and proposed to be made of such property by the Company and any of its Subsidiaries or (ii) would not, individually or in the aggregate, have a Material Adverse Change. Any real or personal property described in the Registration Statement or Prospectus as being leased by the Company and any of its Subsidiaries is held by them under valid, existing and enforceable leases, except those that (A) do not materially interfere with the use made or proposed to be made of such property by the Company or any of its Subsidiaries or (B) would not be reasonably expected, individually or in the aggregate, to have a Material Adverse Change.

(ee) Environmental Laws. Except as set forth in the Registration Statement or the Prospectus, the Company and its Subsidiaries (i) are in compliance with any and all applicable federal, state, local and foreign laws, rules, regulations, decisions and orders relating to the protection of human health and safety, the environment or hazardous or toxic substances or wastes, pollutants or contaminants (collectively, “**Environmental Laws**”); (ii) have received and are in compliance with all permits, licenses or other approvals required of them under applicable Environmental Laws to conduct their respective businesses as described in the Registration Statement and the Prospectus; and (iii) have not received notice of any actual or potential liability for the investigation or remediation of any disposal or release of hazardous or toxic substances or wastes, pollutants or contaminants, except, in the case of any of clauses (i), (ii) or (iii) above, for any such failure to comply or failure to receive required permits, licenses, other approvals or liability as would not, individually or in the aggregate, have a Material Adverse Change.

(ff) Disclosure Controls. The Company and each of its Subsidiaries maintain systems of internal accounting controls sufficient to provide reasonable assurance that (i) transactions are executed in accordance with management’s general or specific authorizations; (ii) transactions are recorded as necessary to permit preparation of financial statements in conformity with generally accepted accounting principles and to maintain asset accountability; (iii) access to assets is permitted only in accordance with management’s general or specific authorization; and (iv) the recorded accountability for assets is compared with the existing assets at reasonable intervals and appropriate action is taken with respect to any differences. The Company’s internal control over financial reporting is effective and the Company is not aware of any material weaknesses in its internal control over financial reporting (other than as set forth in the Prospectus). Since the date of the latest audited financial statements of the Company included in the Prospectus, there has been no change in the Company’s internal control over financial reporting that has materially affected, or is reasonably likely to materially affect, the Company’s internal control over financial reporting (other than as set forth in the Prospectus). The Company has established disclosure controls and procedures (as defined in Exchange Act Rules 13a-15 and 15d-15) for the Company and designed such disclosure controls and procedures to ensure that material information relating to the Company and each of its Subsidiaries is made known to the certifying officers by others within those entities, particularly during the period in which the Company’s Annual Report on Form 10-K or Quarterly Report on Form 10-Q, as the case may be, is being prepared. The Company’s certifying officers have evaluated the effectiveness of the Company’s disclosure controls and procedures as required by Rule 13a-15 of the Exchange Act.

(gg) Sarbanes-Oxley. There is and has been no failure on the part of the Company or, to the Company’s knowledge, any of the Company’s directors or officers, in their capacities as such, to comply in all material respects with any applicable provisions of the Sarbanes-Oxley Act and the rules and regulations promulgated thereunder, including Section 402 related to loans and Sections 302 and 906 related to certifications.

(hh) Finder’s Fees. Neither the Company nor any of the Subsidiaries has incurred any liability for any finder’s fees, brokerage commissions or similar payments in connection with the transactions herein contemplated, except as may otherwise exist with respect to the Agent pursuant to this Agreement.

(ii) Labor Disputes. No labor disturbance by or dispute with employees of the Company or any of its Subsidiaries exists or, to the knowledge of the Company, is threatened which would result in a Material Adverse Change.

(jj) Investment Company Act. Neither the Company nor any of the Subsidiaries is or, after giving effect to the offering and sale of the Shares, will be an “investment company” or an entity “controlled” by an “investment company,” as such terms are defined in the Investment Company Act of 1940, as amended (the “**Investment Company Act**”).

(kk) Operations. The operations of the Company and its Subsidiaries are and have been conducted at all times in compliance with applicable financial recordkeeping and reporting requirements of the Currency and Foreign Transactions Reporting Act of 1970, as amended, the money laundering statutes of all applicable jurisdictions, the rules and regulations thereunder and any related or similar applicable rules, regulations or guidelines, issued, administered or enforced by any governmental agency (collectively, the “**Money Laundering Laws**”) and no action, suit or proceeding by or before any court or governmental agency, authority or body or any arbitrator involving the Company or any of its Subsidiaries with respect to the Money Laundering Laws is pending or, to the knowledge of the Company, threatened.

(ll) Underwriting Agreements. The Company is not a party to any agreement with an agent or underwriter for any other “at the market” or continuous equity transaction.

(mm) ERISA. To the knowledge of the Company, each material employee benefit plan, within the meaning of Section 3(3) of the Employee Retirement Income Security Act of 1974, as amended (“**ERISA**”), that is maintained, administered or contributed to by the Company or any of its Affiliates for employees or former employees of the Company and any of its Subsidiaries has been maintained in material compliance with its terms and the requirements of any applicable statutes, orders, rules and regulations, including but not limited to ERISA and the Internal Revenue Code of 1986, as amended (the “**Code**”); no prohibited transaction, within the meaning of Section 406 of ERISA or Section 4975 of the Code, has occurred which would result in a material liability to the Company with respect to any such plan excluding transactions effected pursuant to a statutory or administrative exemption; and for each such plan that is subject to the funding rules of Section 412 of the Code or Section 302 of ERISA, no “accumulated funding deficiency” as defined in Section 412 of the Code has been incurred, whether or not waived, and the fair market value of the assets of each such plan (excluding for these purposes accrued but unpaid contributions) exceeds the present value of all benefits accrued under such plan determined using reasonable actuarial assumptions.

(nn) Forward-Looking Statements. No forward-looking statement (within the meaning of Section 27A of the Securities Act and Section 21E of the Exchange Act) contained in the Registration Statement and the Prospectus has been made or reaffirmed without a reasonable basis or has been disclosed other than in good faith.

(oo) Agent Purchases. The Company acknowledges and agrees that Agent has informed the Company that the Agent may, to the extent permitted under the Securities Act and the Exchange Act, purchase and sell Common Shares for their own accounts while this Agreement is in effect, provided, that (i) no such purchase or sales shall take place while an Issuance Notice is in effect (except to the extent the Agent may engage in sales of Shares purchased or deemed purchased from the Company as a “riskless principal” or in a similar capacity) and (ii) the Company shall not be deemed to have authorized or consented to any such purchases or sales by the Agent.

(pp) Margin Rules. Neither the issuance, sale and delivery of the Shares nor the application of the proceeds thereof by the Company as described in the Registration Statement and the Prospectus will violate Regulation T, U or X of the Board of Governors of the Federal Reserve System or any other regulation of such Board of Governors.

(qq) Insurance. The Company and each of its Subsidiaries carry, or are covered by, insurance in such amounts and covering such risks as the Company and each of its Subsidiaries reasonably believe are adequate for the conduct of their respective businesses and the value of their respective properties. The Company and each of its Subsidiaries have no reason to believe that they will not be able to renew their existing insurance coverage as and when such coverage expires or to obtain similar coverage from similar insurers as may be necessary to continue its business at a cost that would not have a Material Adverse Change. The Company has not received

written notice from any insurer, agent of such insurer or the broker of the Company that any material capital improvements or any other material expenditures (other than premium payments) are required or necessary to be made in order to continue such insurance.

(rr) No Unlawful Contributions or Other Payments. Except as otherwise disclosed in the Prospectus, neither the Company nor any of the Subsidiaries nor, to the best of the Company's knowledge, any employee or agent of the Company or any Subsidiary, has made any contribution or other payment to any official of, or candidate for, any federal, state or foreign office in violation of any applicable law or of the character required to be disclosed in the Registration Statement and the Prospectus.

(ss) Anti-Corruption and Anti-Bribery Laws. Neither the Company nor any of the Subsidiaries nor any director, officer, or employee of the Company or any of the Subsidiaries, nor to the knowledge of the Company, any agent, Affiliate or other person acting on behalf of the Company or any of the Subsidiaries has, in the course of its actions for, or on behalf of, the Company or any of the Subsidiaries (i) used any corporate funds for any unlawful contribution, gift, entertainment or other unlawful expenses relating to political activity; (ii) made or taken any act in furtherance of an offer, promise, or authorization of any direct or indirect unlawful payment or benefit to any foreign or domestic government official or employee, including of any government-owned or controlled entity or public international organization, or any political party, party official, or candidate for political office; (iii) violated or is in violation of any applicable provision of the U.S. Foreign Corrupt Practices Act of 1977, as amended (the "FCPA"), the UK Bribery Act 2010, or any other applicable anti-bribery or anti-corruption law; or (iv) made, offered, authorized, requested, or taken an act in furtherance of any unlawful bribe, rebate, payoff, influence payment, kickback or other unlawful payment or benefit. The Company and the Subsidiaries and, to the knowledge of the Company, the Company's Affiliates have conducted their respective businesses in compliance with the FCPA and have instituted and maintain policies and procedures designed to ensure, and which are reasonably expected to continue to ensure, continued compliance therewith.

(tt) No Conflicts. Neither the execution of this Agreement, nor the issuance, offering or sale of the Shares, nor the consummation of any of the transactions contemplated herein and therein, nor the compliance by the Company with the terms and provisions hereof and thereof will conflict with, or will result in a breach of, any of the terms and provisions of, or has constituted or will constitute a default under, or has resulted in or will result in the creation or imposition of any lien, charge or encumbrance upon any property or assets of the Company pursuant to the terms of any contract or other agreement to which the Company may be bound or to which any of the property or assets of the Company is subject, except (i) such conflicts, breaches or defaults as may have been waived and (ii) such conflicts, breaches and defaults that would not have a Material Adverse Change; nor will such action result (x) in any violation of the provisions of the organizational or governing documents of the Company, or (y) in any material violation of the provisions of any statute or any order, rule or regulation applicable to the Company or of any Governmental Authority having jurisdiction over the Company.

(uu) Sanctions. Neither the Company nor any of the Subsidiaries directors officers, or employees nor, to the Company's knowledge, any of agents, Affiliates or other person acting on behalf of the Company or any of the Subsidiaries is currently the subject or the target of any U.S. sanctions administered by the Office of Foreign Assets Control of the U.S. Department of the Treasury ("OFAC") or the U.S. Department of State, the United Nations Security Council, the European Union, His Majesty's Treasury of the United Kingdom, or other relevant sanctions authority (collectively, "Sanctions"); nor is the Company or any of the Subsidiaries located, organized or resident in a country or territory that is the subject or the target of Sanctions, including, without limitation, the so-called Donetsk People's Republic, the so-called Luhansk People's Republic, the Crimea region and the non-government controlled areas of the Zaporizhzhia and Kherson Regions of Ukraine, (or any other Covered Region of Ukraine identified pursuant to Executive Order 14065), Russia, Cuba, Iran, North Korea, and Syria; and the Company will not directly or knowingly indirectly use the proceeds of this offering, or lend, contribute or

otherwise make available such proceeds to any Subsidiary, or any joint venture partner or other person or entity, for the purpose of financing the activities of or business with any person, or in any country or territory, that at the time of such financing, is the subject or the target of Sanctions or in any other manner that will result in a violation by any person (including any person participating in the transaction whether as underwriter, advisor, investor or otherwise) of applicable Sanctions. For the past five years, the Company and the Subsidiaries have not knowingly engaged in and are not now knowingly engaged in any dealings or transactions with any person that at the time of the dealing or transaction is or was the subject or the target of Sanctions or with any Sanctioned Country.

(vv) Export Compliance. The Company and each of the Subsidiaries has not, nor has any director, officer, agent, employee or other Person acting on behalf of the Company or any of the Subsidiaries violated or failed to comply with any applicable law related to the export or reexport of goods (including hardware, software and technology), services and know-how except in such cases as would not reasonably be expected, individually or in the aggregate, to have a Material Adverse Change.

(ww) Stock Transfer Taxes. On each Settlement Date, all stock transfer or other taxes (other than income taxes) which are required to be paid in connection with the sale and transfer of the Shares to be sold hereunder will be, or will have been, fully paid or provided for by the Company and all laws imposing such taxes will be or will have been fully complied with.

(xx) Compliance with Laws. The Company and each of its Subsidiaries are in material compliance with all applicable laws, regulations and statutes (including all environmental laws and regulations) in the jurisdictions in which it carries on business; the Company has not received a notice of non-compliance, nor knows of, nor has reasonable grounds to know of, any facts that could give rise to a notice of non-compliance with any such laws, regulations and statutes, and is not aware of any pending change or contemplated change to any applicable law or regulation or governmental position; in each case that would materially adversely affect the business of the Company or the business or legal environment under which the Company operates.

(yy) Statistical and Market-Related Data. The statistical and market-related data included in the Registration Statement and Prospectus are based on or derived from sources that the Company believes to be reliable and accurate (but has not independently verified) or represent the Company's good faith estimates that are made on the basis of data derived from such sources.

(zz) Cybersecurity. (i)(x) There has been no material security breach or attack or other compromise of or relating to any of the Company's and the Subsidiaries information technology and computer systems, networks, hardware, software, data (including the data of their respective customers, employees, suppliers, vendors and any third-party data maintained by or on behalf of them), equipment or technology ("**IT Systems and Data**"), and (y) the Company and the Subsidiaries have not been notified of, and have no knowledge of any event or condition that would reasonably be expected to result in any material security breach, attack or compromise to their IT Systems and Data, (ii) the Company and the Subsidiaries have complied, and are presently in compliance with, in all material respects, all applicable laws, statutes or any judgment, order, rule or regulation of any court or arbitrator or governmental or regulatory authority and all industry guidelines, standards, internal policies and contractual obligations relating to the privacy and security of IT Systems and Data and to the protection of such IT Systems and Data from unauthorized use, access, misappropriation or modification and (iii) the Company and the Subsidiaries have implemented backup and disaster recovery technology consistent with industry standards and practice.

(aaa) Compliance with Data Privacy Laws. The Company and the Subsidiaries are, and at all prior times were, in material compliance with all applicable state and federal data privacy and security laws and

regulations, including without limitation the Health Insurance Portability and Accountability Act of 1996, as amended by the Health Information Technology for Economic and Clinical Health Act (collectively, “**HIPAA**”) and the European Union General Data Protection Regulation (“**GDPR**”) (EU 2016/679) (collectively, the “**Privacy Laws**”). To ensure compliance with the Privacy Laws, the Company has in place, complies with, and takes appropriate steps to ensure compliance in all material respects with their policies and procedures relating to data privacy and security and the collection, storage, use, processing, disclosure, handling, and analysis of Personal Data (defined below) (the “**Policies**”). “**Personal Data**” means (i) a natural person’s name, street address, telephone number, e-mail address, photograph, social security number or tax identification number, driver’s license number, passport number, credit card number, bank information, or customer or account number; (ii) any information which would qualify as “personally identifying information” under the Federal Trade Commission Act, as amended; (iii) “personal data” as defined by GDPR; (iv) any information which would qualify as “protected health information” under HIPAA; and (v) any other piece of information that allows the identification of such natural person, or their family, or permits the collection or analysis of any data related to an identified person’s health or sexual orientation. The Company has at all times made all disclosures to users or customers required by applicable laws and regulatory rules or requirements, and none of such disclosures made or contained in any Policy have been inaccurate or in violation of any applicable laws and regulatory rules or requirements in any material respect. The Company further certifies that neither it nor any Subsidiary: (i) has received notice of any actual or potential liability under or relating to, or actual or potential violation of, any of the Privacy Laws, and has no knowledge of any event or condition that would reasonably be expected to result in any such notice; (ii) is currently conducting or paying for, in whole or in part, any investigation, remediation, or other corrective action pursuant to any Privacy Law; or (iii) is a party to any order, decree, or agreement that imposes any obligation or liability under any Privacy Law.

(bbb) Stock Exchange Listing. The Common Shares are registered pursuant to Section 12(b) or 12(g) of the Exchange Act and are listed on the Principal Market, and the Company has taken no action designed to, or likely to have the effect of, terminating the registration of the Common Shares under the Exchange Act or delisting the Common Shares from the Principal Market, nor has the Company received any notification that the Commission or the Principal Market is contemplating terminating such registration or listing. To the Company’s knowledge, it is in compliance with all applicable listing requirements of the Principal Market.

(ccc) Related Party Transactions. There are no business relationships or related-party transactions involving the Company or any of the Subsidiaries or any other person required to be described in the Registration Statement or the Prospectus which have not been described as required.

(ddd) FINRA Matters. All of the information provided to the Agent or to counsel for the Agent by the Company, its counsel, its officers and directors and, to the Company’s knowledge, the holders of any securities (debt or equity) or options to acquire any securities of the Company in connection with the offering of the Shares is true, complete, correct in all material respects and compliant with Financial Industry Regulatory Authority, Inc.’s (“**FINRA**”) rules and any letters, filings or other supplemental information provided to FINRA pursuant to FINRA Rules or NASD Conduct Rules is true, complete and correct in all material respects.

(eee) No Outstanding Loans or Other Extensions of Credit. The Company does not have any outstanding extension of credit, in the form of a personal loan, to or for any director or executive officer (or equivalent thereof) of the Company except for such extensions of credit as are expressly permitted by Section 13(k) of the Exchange Act.

(fff) Compliance with Health Care Laws. The Company and the Subsidiaries are, and at all times have been, in compliance with all applicable federal, state, provincial, local and foreign Healthcare Laws, except for such non-compliance that, individually or in the aggregate, would not reasonably be expected to result in a

Material Adverse Change. “**Healthcare Laws**” includes, without limitation, the Federal Food, Drug, and Cosmetic Act, 21 U.S.C. §§ 301 et seq., Title XIX of the Social Security Act, 42 U.S.C. §§ 1396-1396v (the Medicaid statute); Title XVIII of the Social Security Act, 42 U.S.C. §§ 1395-1395hhh (the Medicare statute); the U.S. Anti-Kickback Statute (42 U.S.C. Section 1320a-7b(b)); the U.S. civil monetary penalties law (42 U.S.C. Section 1320a-7a); the U.S. Civil False Claims Act (31 U.S.C. Section 3729 et seq.); the U.S. criminal false statements law (42 U.S.C. § 1320a-7b(a)); applicable federal, state, provincial, local and foreign criminal laws relating to health care fraud and abuse, including 18 U.S.C. Sections 286 and 287, and the health care fraud criminal provisions under HIPAA (42 U.S.C. Section 1320d et seq.); the U.S. exclusion law (42 U.S.C. Section 1320a-7); the statutes, regulations and directives of applicable government funded or sponsored healthcare programs, and the regulations promulgated pursuant to such statutes; the U.S. Physician Payments Sunshine Act (42 U.S.C. Section 1320a-7h) and equivalent state transparency laws. During the past three (3) years, neither the Company nor any of the subsidiaries has received written notice of any claim, action, suit, proceeding, hearing, enforcement, investigation, arbitration or other action from any court or arbitrator or governmental or regulatory authority or third party alleging that any product operation or activity is in material violation of any Health Care Laws nor, to the Company’s knowledge, is any such claim, action, suit, proceeding, hearing, enforcement, investigation, arbitration or other action threatened. The Company and the Subsidiaries have filed, maintained or submitted all material reports, documents, forms, notices, applications, records, claims, submissions and supplements or amendments as required by any Health Care Laws, and all such reports, documents, forms, notices, applications, records, claims, submissions and supplements or amendments were complete and accurate on the date filed in all material respects (or were corrected or supplemented by a subsequent submission). Neither the Company nor any of the Subsidiaries, nor, to the knowledge of the Company, any of its or any of the Subsidiaries’ officers, directors or managing employees (as defined in 42 U.S.C. § 1320a-5(b)), is or has been excluded, suspended or debarred from participation in any national or regional health care program or made subject to any pending or, to the knowledge of the Company, threatened action which could reasonably be expected to result in such exclusion, suspension or debarment, except, in each case, individually or in the aggregate, where such exclusion, suspension or debarment would not reasonably be expected to result in a Material Adverse Change. Neither the Company nor any of the Subsidiaries is a party to any corporate integrity agreements, monitoring agreements, consent decrees, settlement orders, or similar agreements with or imposed by any governmental or regulatory authority.

(ggg) Solvency. The Company is not as of the date hereof, and after giving effect to the offering and sale of the Shares, will not be Insolvent (as defined below). For purposes of this Section 2(ggg), “**Insolvent**” means, with respect to any person, (i) the present fair saleable value of such person’s assets is less than the amount required to pay such person’s total indebtedness, (ii) such person is unable to pay its debts and liabilities, subordinated, contingent or otherwise, as such debts and liabilities become absolute and matured, (iii) such person intends to incur or believes that it will incur debts that would be beyond its ability to pay as such debts mature or (iv) such person has unreasonably small capital with which to conduct the business in which it is engaged as such business is now conducted and is proposed to be conducted.

Any certificate signed by any officer or representative of the Company or any of the Subsidiaries and delivered to the Agent or counsel for the Agent in connection with an issuance of Shares shall be deemed a representation and warranty by the Company to the Agent as to the matters covered thereby on the date of such certificate.

The Company acknowledges that the Agent and, for purposes of the opinions to be delivered pursuant to Section 4(p) hereof, counsel to the Company and counsel to the Agent, will rely upon the accuracy and truthfulness of the foregoing representations and hereby consents to such reliance.

Section 3. ISSUANCE AND SALE OF COMMON SHARES

(a) Sale of Securities. On the basis of the representations, warranties and agreements herein contained, but subject to the terms and conditions herein set forth, the Company and the Agent agree that the Company may from time to time seek to sell Shares through the Agent, acting as sales agent, or directly to the Agent, acting as principal, as follows, with an aggregate Sales Price of up to the Maximum Program Amount, based on and in accordance with Issuance Notices as the Company may deliver, during the Agency Period.

(b) Mechanics of Issuances.

(i) Issuance Notice. Upon the terms and subject to the conditions set forth herein, on any Trading Day during the Agency Period on which the conditions set forth in Section 5(a) and Section 5(b) shall have been satisfied, the Company may exercise its right to request an issuance of Shares by delivering to the Agent an Issuance Notice; provided, however, that (A) in no event may the Company deliver an Issuance Notice to the extent that the sum of (x) the aggregate Sales Price of the requested Issuance Amount, plus (y) the aggregate Sales Price of all Shares issued under all previous Issuance Notices effected pursuant to this Agreement, would exceed the Maximum Program Amount; and (B) prior to delivery of any Issuance Notice, the period set forth for any previous Issuance Notice shall have expired or been terminated. An Issuance Notice shall be considered delivered on the Trading Day that it is received by e-mail to the persons set forth in Schedule A hereto and confirmed by the Company by telephone (including a voicemail message to the persons so identified), with the understanding that, with adequate prior written notice, each of the Company and the Agent may modify the list of such persons from time to time.

(ii) Agent Efforts. Upon the terms and subject to the conditions set forth in this Agreement, upon the receipt of an Issuance Notice, the Agent will use its commercially reasonable efforts consistent with its normal sales and trading practices to place the Shares with respect to which the Agent has agreed to act as sales agent, subject to, and in accordance with the information specified in, the Issuance Notice, unless the sale of the Shares described therein has been suspended, cancelled or otherwise terminated in accordance with the terms of this Agreement. For the avoidance of doubt, the parties to this Agreement may modify an Issuance Notice at any time provided they both agree in writing to any such modification.

(iii) Method of Offer and Sale. The Shares may be offered and sold (A) in privately negotiated transactions with the consent of the Company; (B) as block transactions; or (C) by any other method permitted by law deemed to be an “at the market offering” as defined in Rule 415(a)(4) under the Securities Act, including sales made directly on the Principal Market or sales made into any other existing trading market of the Common Shares. Nothing in this Agreement shall be deemed to require either party to agree to the method of offer and sale specified in the preceding sentence, and (except as specified in clauses (A) and (B) above) the method of placement of any Shares by the Agent shall be at the Agent’s discretion.

(iv) Confirmation to the Company. If acting as sales agent hereunder, the Agent will provide written confirmation to the Company no later than the opening of the next Trading Day following the Trading Day on which it has placed Shares hereunder setting forth the number of shares sold on such Trading Day, the corresponding Sales Price and the Issuance Price payable to the Company in respect thereof.

(v) Settlement. Each issuance of Shares will be settled on the applicable Settlement Date for such issuance of Shares and, subject to the provisions of Section 5, on or before each Settlement Date, the Company will, or will cause its transfer agent to, electronically transfer the Shares being sold by crediting the Agent or its designee's account at The Depository Trust Company through its Deposit/Withdrawal At Custodian (DWAC) System, or by such other means of delivery as may be mutually agreed upon by the parties hereto and, upon receipt of such Shares, which in all cases shall be freely tradable, transferable, registered shares in good deliverable form, the Agent will deliver, by wire transfer of immediately available funds, the related Issuance Price in same day funds delivered to an account designated by the Company prior to the Settlement Date. The Company may sell Shares to the Agent as principal at a price agreed upon by the parties at each relevant time Shares are sold pursuant to this Agreement (each, a "Time of Sale").

(vi) Suspension or Termination of Sales. Consistent with standard market settlement practices, the Company or the Agent may, upon notice to the other party hereto in writing or by telephone (confirmed immediately by verifiable email), suspend any sale of Shares, and the period set forth in an Issuance Notice shall immediately terminate; provided, however, that (A) such suspension and termination shall not affect or impair either party's obligations with respect to any Shares placed or sold hereunder prior to the receipt of such notice; (B) if the Company suspends or terminates any sale of Shares after the Agent confirms such sale to the Company, the Company shall still be obligated to comply with Section 3(b)(v) with respect to such Shares; and (C) if the Company defaults in its obligation to deliver Shares on a Settlement Date, the Company agrees that it will hold the Agent harmless against any loss, claim, damage or expense (including, without limitation, penalties, interest and reasonable legal fees and expenses), as incurred, arising out of or in connection with such default by the Company. The parties hereto acknowledge and agree that, in performing its obligations under this Agreement, the Agent may borrow Common Shares from stock lenders in the event that the Company has not delivered Shares to settle sales as required by subsection (v) above, and may use the Shares to settle or close out such borrowings. The Company agrees that no such notice shall be effective against the Agent unless it is made to the persons identified in writing by the Agent pursuant to Section 3(b)(i).

(vii) No Guarantee of Placement, Etc. The Company acknowledges and agrees that (A) there can be no assurance that the Agent will be successful in placing Shares; (B) the Agent will incur no liability or obligation to the Company or any other Person if it does not sell Shares; and (C) the Agent shall be under no obligation to purchase Shares on a principal basis pursuant to this Agreement, except as otherwise specifically agreed by the Agent and the Company.

(viii) Material Non-Public Information. Notwithstanding any other provision of this Agreement, the Company and the Agent agree that the Company shall not deliver any Issuance Notice to the Agent, and the Agent shall not be obligated to place any Shares, during any period in which the Company is in possession of material non-public information.

(c) Fees. As compensation for services rendered, the Company shall pay to the Agent, on the applicable Settlement Date, the Selling Commission for the applicable Issuance Amount (including with respect to any suspended or terminated sale pursuant to Section 3(b)(vi)) by the Agent deducting the Selling Commission from the applicable Issuance Amount. For the avoidance of doubt, the Company shall not be required to pay to the Agent any Selling Commission with respect to any Issuance Notice, except to the extent Shares are placed pursuant thereto.

(d) Expenses. The Company agrees to pay all costs, fees and expenses incurred in connection with the performance of its obligations hereunder and in connection with the transactions contemplated hereby,

including without limitation (i) all expenses incident to the issuance and delivery of the Shares (including all printing and engraving costs); (ii) all fees and expenses of the registrar and transfer agent of the Shares; (iii) all necessary issue, transfer and other stamp taxes in connection with the issuance and sale of the Shares; (iv) all fees and expenses of the Company's counsel, independent public or certified public accountants and other advisors; (v) all costs and expenses incurred in connection with the preparation, printing, filing, shipping and distribution of the Registration Statement (including financial statements, exhibits, schedules, consents and certificates of experts), the Prospectus, any Free Writing Prospectus (as defined below) prepared by or on behalf of, used by, or referred to by the Company, and all amendments and supplements thereto, and this Agreement; (vi) all filing fees, attorneys' fees and expenses incurred by the Company or the Agent in connection with qualifying or registering (or obtaining exemptions from the qualification or registration of) all or any part of the Shares for offer and sale under the state securities or blue sky laws or the provincial securities laws of Canada, and, if requested by the Agent, preparing and printing a "**Blue Sky Survey**" or memorandum and a "Canadian wrapper," and any supplements thereto, advising the Agent of such qualifications, registrations, determinations and exemptions; (vii) the reasonable and documented fees and disbursements of the Agent's counsel, including the reasonable and documented fees and expenses of counsel for the Agent in connection with, FINRA review, if any, and approval of the Agent's participation in the offering and distribution of the Shares; (viii) the filing fees incident to FINRA review, if any; (ix) the costs and expenses of the Company relating to investor presentations on any "road show" undertaken in connection with the marketing of the offering of the Shares, including, without limitation, expenses associated with the preparation or dissemination of any electronic road show, expenses associated with the production of road show slides and graphics, fees and expenses of any consultants engaged in connection with the road show presentations with the prior approval of the Company, travel and lodging expenses of the representatives, employees and officers of the Company and of the Agent and any such consultants, and the cost of any aircraft chartered in connection with the road show; and (x) the fees and expenses associated with listing the Shares on the Principal Market. The fees and disbursements of Agent's counsel pursuant to subsections (vi) and (vii) above shall not exceed (A) \$100,000 in connection with execution of this Agreement, (B) \$25,000 in connection with each Triggering Event Date involving the filing of an Annual Report on Form 10-K on which the Company is required to provide a certificate pursuant to Section 4(o) and (C) \$15,000 in connection with each other Triggering Event Date on which the Company is required to provide a certificate pursuant to Section 4(o).

Section 4. ADDITIONAL COVENANTS

The Company covenants and agrees with the Agent as follows, in addition to any other covenants and agreements made elsewhere in this Agreement:

(a) Exchange Act Compliance. During the Agency Period, the Company shall (i) file, on a timely basis, with the Commission all reports and documents required to be filed under Section 13, 14 or 15 of the Exchange Act in the manner and within the time periods required by the Exchange Act; and (ii) either (A) include in its quarterly reports on Form 10-Q and its annual reports on Form 10-K, a summary detailing, for the relevant reporting period, (1) the number of Shares sold through the Agent pursuant to this Agreement and (2) the net proceeds received by the Company from such sales or (B) prepare a prospectus supplement containing, or include in such other filing permitted by the Securities Act or Exchange Act (each an "**Interim Prospectus Supplement**"), such summary information and, at least once a quarter and subject to this Section 4, file such Interim Prospectus Supplement pursuant to Rule 424(b) under the Securities Act (and within the time periods required by Rule 424(b) and Rule 430B under the Securities Act).

(b) Securities Act Compliance. After the date of this Agreement, the Company shall promptly advise the Agent in writing: (i) of the receipt of any comments of, or requests for additional or supplemental information from, the Commission; (ii) of the time and date of any filing of any post-effective amendment to the Registration Statement, any Rule 462(b) Registration Statement or any amendment or supplement to the Prospectus or any

Free Writing Prospectus; (iii) of the time and date that any post-effective amendment to the Registration Statement or any Rule 462(b) Registration Statement becomes effective; and (iv) of the issuance by the Commission of any stop order suspending the effectiveness of the Registration Statement or any post-effective amendment thereto, any Rule 462(b) Registration Statement or any amendment or supplement to the Prospectus or of any order preventing or suspending the use of any Free Writing Prospectus or the Prospectus, or of any proceedings to remove, suspend or terminate from listing or quotation the Common Shares from any securities exchange upon which they are listed for trading or included or designated for quotation, or of the threatening or initiation of any proceedings for any of such purposes. If the Commission shall enter any such stop order at any time, the Company will use its best efforts to obtain the lifting of such order as soon as reasonably practicable. Additionally, the Company agrees that it shall comply with the provisions of Rule 424(b) and Rule 433, as applicable, under the Securities Act and will use its reasonable efforts to confirm that any filings made by the Company under such Rule 424(b) or Rule 433 were received in a timely manner by the Commission.

(c) Amendments and Supplements to the Prospectus and Other Securities Act Matters. If any event shall occur or condition exist as a result of which it is necessary to amend or supplement the Prospectus so that the Prospectus does not include an untrue statement of a material fact or omit to state a material fact necessary in order to make the statements therein, in light of the circumstances when the Prospectus is delivered to a purchaser, not misleading, or if in the opinion of the Agent or counsel for the Agent it is otherwise necessary to amend or supplement the Prospectus to comply with applicable law, including the Securities Act, the Company agrees (subject to Sections 4(d) and 4(f)) to promptly prepare, file with the Commission and furnish at its own expense to the Agent, amendments or supplements to the Prospectus so that the statements in the Prospectus as so amended or supplemented will not include an untrue statement of a material fact or omit to state a material fact necessary in order to make the statements therein, in light of the circumstances when the Prospectus is delivered to a purchaser, not misleading or so that the Prospectus, as amended or supplemented, will comply with applicable law including the Securities Act. Neither the Agent's consent to, or delivery of, any such amendment or supplement shall constitute a waiver of any of the Company's obligations under Sections 4(d) and 4(f); provided, however, that the only remedy the Agent shall have with respect to the failure by the Company to make such filing (other than the Agent's rights under Section 3(d) or Section 6 hereof) shall be to cease making sales under this Agreement until such amendment or supplement is filed. Notwithstanding the foregoing, the Company shall not be required to file such amendment or supplement if there is no pending Issuance Notice and the Company believes that it is in its best interest not to file such amendment or supplement.

(d) Agent's Review of Proposed Amendments and Supplements. Prior to amending or supplementing the Registration Statement (including any registration statement filed under Rule 462(b) under the Securities Act) or the Prospectus (excluding any amendment or supplement through incorporation of any report filed under the Exchange Act), insofar as such proposed amendment or supplement relates to the Shares or the transactions contemplated hereby, the Company shall furnish to the Agent for review, a reasonable amount of time prior to the proposed time of filing or use thereof, a copy of each such proposed amendment or supplement, and the Company shall not file or use any such proposed amendment or supplement without the Agent's prior consent, which shall not be unreasonably withheld, conditioned or delayed, and to file with the Commission within the applicable period specified in Rule 424(b) under the Securities Act any prospectus required to be filed pursuant to such Rule.

(e) Use of Free Writing Prospectus. Neither the Company nor the Agent has prepared, used, referred to or distributed, or will prepare, use, refer to or distribute, without the other party's prior written consent, any "written communication" that constitutes a "free writing prospectus" as such terms are defined in Rule 405 under the Securities Act with respect to the offering contemplated by this Agreement (any such free writing prospectus being referred to herein as a "**Free Writing Prospectus**").

(f) Free Writing Prospectuses. The Company shall furnish to the Agent for review, a reasonable amount of time prior to the proposed time of filing or use thereof, a copy of each proposed Free Writing Prospectus or any amendment or supplement thereto to be prepared by or on behalf of, used by, or referred to by the Company, insofar as such proposed Free Writing Prospectus or amendment or supplement relates to the Shares or the transactions contemplated hereby, and the Company shall not file, use or refer to any proposed Free Writing Prospectus or any amendment or supplement thereto without the Agent's consent, which shall not be unreasonably withheld, conditioned or delayed. The Company shall furnish to the Agent, without charge, as many copies of any Free Writing Prospectus prepared by or on behalf of, or used by the Company, insofar as such proposed Free Writing Prospectus or amendment or supplement relates to the Shares or the transactions contemplated hereby, as the Agent may reasonably request. If at any time when a prospectus is required by the Securities Act (including, without limitation, pursuant to Rule 173(d)) to be delivered in connection with sales of the Shares (but in any event if at any time through and including the date of this Agreement) there occurred or occurs an event or development as a result of which any Free Writing Prospectus prepared by or on behalf of, used by, or referred to by the Company conflicted or would conflict with the information contained in the Registration Statement or included or would include an untrue statement of a material fact or omitted or would omit to state a material fact necessary in order to make the statements therein, in light of the circumstances prevailing at that subsequent time, not misleading, the Company shall promptly amend or supplement such Free Writing Prospectus to eliminate or correct such conflict or so that the statements in such Free Writing Prospectus as so amended or supplemented will not include an untrue statement of a material fact or omit to state a material fact necessary in order to make the statements therein, in light of the circumstances prevailing at such subsequent time, not misleading, as the case may be; *provided, however*, that prior to amending or supplementing any such Free Writing Prospectus, the Company shall furnish to the Agent for review, a reasonable amount of time prior to the proposed time of filing or use thereof, a copy of such proposed amended or supplemented Free Writing Prospectus and the Company shall not file, use or refer to any such amended or supplemented Free Writing Prospectus without the Agent's consent, which shall not be unreasonably withheld, conditioned or delayed.

(g) Filing of Agent Free Writing Prospectuses. The Company shall not take any action that would result in the Agent or the Company being required to file with the Commission pursuant to Rule 433(d) under the Securities Act a Free Writing Prospectus prepared by or on behalf of the Agent that the Agent otherwise would not have been required to file thereunder.

(h) Copies of Registration Statement and Prospectus. After the date of this Agreement through the last time that a prospectus is required by the Securities Act (including, without limitation, pursuant to Rule 173(d)) to be delivered in connection with sales of the Shares, the Company agrees to furnish the Agent with copies (which may be electronic copies) of the Registration Statement and each amendment thereto, and with copies (which may be electronic copies) of the Prospectus and each amendment or supplement thereto in the form in which it is filed with the Commission pursuant to the Securities Act or Rule 424(b) under the Securities Act, both in such quantities as the Agent may reasonably request from time to time; and, if the delivery of a prospectus is required under the Securities Act or under the blue sky or securities laws of any jurisdiction at any time on or prior to the applicable Settlement Date for any period set forth in an Issuance Notice in connection with the offering or sale of the Shares and if at such time any event has occurred as a result of which the Prospectus as then amended or supplemented would include an untrue statement of a material fact or omit to state any material fact necessary in order to make the statements therein, in light of the circumstances under which they were made when such Prospectus is delivered, not misleading, or, if for any other reason it is necessary during such same period to amend or supplement the Prospectus or to file under the Exchange Act any document incorporated by reference in the Prospectus in order to comply with the Securities Act or the Exchange Act, to notify the Agent and to request that the Agent suspend offers to sell Shares (and, if so notified, the Agent shall cease such offers as soon as practicable); and if the Company decides to amend or supplement the Registration Statement or the Prospectus as then amended or supplemented, to advise the Agent promptly by telephone (with confirmation in writing) and to

prepare and cause to be filed promptly with the Commission an amendment or supplement to the Registration Statement or the Prospectus as then amended or supplemented that will correct such statement or omission or effect such compliance; provided, however, that if during such same period the Agent is required to deliver a prospectus in respect of transactions in the Shares, the Company shall promptly prepare and file with the Commission such an amendment or supplement.

(i) Blue Sky Compliance. The Company shall cooperate with the Agent and counsel for the Agent to qualify or register the Shares for sale under (or obtain exemptions from the application of) the state securities or blue sky laws or Canadian provincial securities laws (or other foreign laws) of those jurisdictions designated by the Agent, shall comply with such laws and shall continue such qualifications, registrations and exemptions in effect so long as required for the distribution of the Shares. The Company shall not be required to qualify as a foreign corporation or to take any action that would subject it to general service of process in any such jurisdiction where it is not presently qualified or where it would be subject to taxation as a foreign corporation. The Company will advise the Agent promptly of the suspension of the qualification or registration of (or any such exemption relating to) the Shares for offering, sale or trading in any jurisdiction or any initiation or threat of any proceeding for any such purpose, and in the event of the issuance of any order suspending such qualification, registration or exemption, the Company shall use its best efforts to obtain the withdrawal thereof as soon as reasonably practicable.

(j) Earnings Statement. As soon as reasonably practicable, the Company will make generally available to its security holders and to the Agent an earnings statement (which need not be audited) covering a period of at least twelve months beginning with the first fiscal quarter of the Company occurring after the date of this Agreement which shall satisfy the provisions of Section 11(a) of the Securities Act and Rule 158 under the Securities Act; provided that the Company will be deemed to have furnished such statement to its security holders and the Agent to the extent they are filed on EDGAR or any successor system.

(k) Listing; Reservation of Shares. (a) The Company will maintain the listing of the Shares on the Principal Market; and (b) the Company will reserve and keep available at all times, free of preemptive rights, Shares for the purpose of enabling the Company to satisfy its obligations under this Agreement.

(l) Transfer Agent. The Company shall engage and maintain, at its expense, a registrar and transfer agent for the Shares.

(m) Due Diligence. During the term of this Agreement, the Company will reasonably cooperate with any reasonable due diligence review conducted by the Agent in connection with the transactions contemplated hereby, including, without limitation, providing information and making available documents and senior corporate officers, during normal business hours and at the Company's principal offices or virtually, as the Agent may reasonably request from time to time.

(n) Representations and Warranties. The Company acknowledges that each delivery of an Issuance Notice and each delivery of Shares on a Settlement Date shall be deemed to be (i) an affirmation to the Agent that the representations and warranties of the Company contained in or made pursuant to this Agreement are true and correct as of the date of such Issuance Notice or of such Settlement Date, as the case may be, as though made at and as of each such date, except as may be disclosed in the Prospectus (including any documents incorporated by reference therein and any supplements thereto); and (ii) an undertaking that the Company will advise the Agent if any of such representations and warranties will not be true and correct as of the Settlement Date for the Shares relating to such Issuance Notice, as though made at and as of each such date (except that such representations and warranties shall be deemed to relate to the Registration Statement and the Prospectus as amended and supplemented relating to such Shares).

(o) Deliverables at Triggering Event Dates; Certificates. The Company agrees that on or prior to the date of the first Issuance Notice and, during the term of this Agreement after the date of the first Issuance Notice, upon:

(i) the filing of the Prospectus or the amendment or supplement of any Registration Statement or Prospectus (other than a prospectus supplement relating solely to an offering of securities other than the Shares or a prospectus filed pursuant to Section 4(a)(ii)(B)), by means of a post-effective amendment, sticker or supplement, but not by means of incorporation of documents by reference into the Registration Statement or Prospectus;

(ii) the filing with the Commission of an annual report on Form 10-K or a quarterly report on Form 10-Q (including any Form 10-K/A or Form 10-Q/A containing amended financial information or a material amendment to the previously filed annual report on Form 10-K or quarterly report on Form 10-Q), in each case, of the Company; or

(iii) the filing with the Commission of a current report on Form 8-K of the Company (i) containing amended financial information (other than information “furnished” pursuant to Item 2.02 or 7.01 of Form 8-K or to provide disclosure pursuant to Item 8.01 of Form 8-K relating to reclassification of certain properties as discontinued operations in accordance with Statement of Financial Accounting Standards No. 144) and/or (ii) disclosing any material transaction requiring the filing of historical or pro forma financial statements under Item 9.01 of Form 8-K and subject to the guidance set forth in Section 2050.3 of the Financial Reporting Manual of the Commission, which is material to the offering of securities of the Company in the Agent’s reasonable discretion;

(any such event, a “**Triggering Event Date**”), the Company shall furnish the Agent (but in the case of clause (iii) above only if the Agent reasonably determines that the information contained in such current report on Form 8-K of the Company is material) with a certificate as of the Triggering Event Date, in the form and substance satisfactory to the Agent and its counsel, substantially similar to the form previously provided to the Agent and its counsel, modified, as necessary, to relate to the Registration Statement and the Prospectus as amended or supplemented, (A) confirming that the representations and warranties of the Company contained in this Agreement are true and correct, (B) confirming that the Company has performed all of its obligations hereunder to be performed on or prior to the date of such certificate and as to the matters set forth in Section 5(a)(iii) hereof, and (C) containing any other certification that the Agent shall reasonably request. The requirement to provide a certificate under this Section 4(o) shall be automatically waived for any Triggering Event Date occurring at a time when no Issuance Notice is pending or a suspension is in effect, which waiver shall continue until the earlier to occur of the date the Company delivers instructions for the sale of Shares hereunder (which for such calendar quarter shall be considered a Triggering Event Date) and the next occurring Triggering Event Date. Notwithstanding the foregoing, if the Company subsequently decides to sell Shares following a Triggering Event Date when a suspension was in effect and did not provide the Agent with a certificate under this Section 4(o), then before the Company delivers the instructions for the sale of Shares or the Agent sells any Shares pursuant to such instructions, the Company shall provide the Agent with a certificate in conformity with this Section 4(o) dated as of the date that the instructions for the sale of Shares are issued.

(p) Legal Opinions. On or prior to the date of the first Issuance Notice and on or prior to each Triggering Event Date with respect to which the Company is obligated to deliver a certificate pursuant to Section 4(o) for which no waiver is applicable and excluding the date of this Agreement, the Company shall cause to be furnished to the Agent a negative assurance letter and the written legal opinion of Gibson, Dunn & Crutcher LLP, counsel to the Company, a written legal opinion of Mintz, Levin, Cohn, Ferris, Glovsky and Popeo, P.C., intellectual property counsel to the Company, each dated the date of delivery, in form and substance reasonably

satisfactory to the Agent and its counsel, substantially similar to the form previously provided to the Agent and its counsel, modified, as necessary, to relate to the Registration Statement and the Prospectus as then amended or supplemented. In lieu of such opinions for subsequent periodic filings, in the discretion of the Agent, the Company may furnish a reliance letter from such counsel to the Agent, permitting the Agent to rely on a previously delivered opinion letter, modified as appropriate for any passage of time or Triggering Event Date (except that statements in such prior opinion shall be deemed to relate to the Registration Statement and the Prospectus as amended or supplemented as of such Triggering Event Date).

(q) Comfort Letter. On or prior to the date of the first Issuance Notice and on or prior to each Triggering Event Date with respect to which the Company is obligated to deliver a certificate pursuant to Section 4(o) for which no waiver is applicable and excluding the date of this Agreement, the Company shall cause PricewaterhouseCoopers LLC, the independent registered public accounting firm who has audited or reviewed the financial statements included or incorporated by reference in the Registration Statement, to furnish the Agent a comfort letter, dated the date of delivery, in form and substance reasonably satisfactory to the Agent and its counsel, substantially similar to the form previously provided to the Agent and its counsel; provided, however, that any such comfort letter will only be required on the Triggering Event Date specified to the extent that it contains financial statements filed with the Commission under the Exchange Act and incorporated or deemed to be incorporated by reference into a Prospectus. If requested by the Agent, the Company shall also cause a comfort letter to be furnished to the Agent on the date of occurrence of any material transaction or event requiring the filing of a current report on Form 8-K containing material amended financial information of the Company, including the restatement of the Company's financial statements; provided, the Company shall not be required deliver a comfort letter pursuant to this sentence if there is no pending Issuance Notice and shall not be required to so deliver a comfort letter until the earlier of the next "Triggering Event Date" or the next time the Company gives the Agent an Issuance Notice. The Company shall be required to furnish no more than one comfort letter hereunder per each filing of an annual report on Form 10-K or a quarterly report on Form 10-Q.

(r) Secretary's Certificate. On or prior to the date of the first Issuance Notice and on or prior to each Triggering Event Date with respect to which the Company is obligated to deliver a certificate pursuant to Section 4(o) for which no waiver is applicable, the Company shall furnish the Agent a certificate executed by the Secretary of the Company, signing in such capacity, dated the date of delivery (i) certifying that attached thereto are true and complete copies of the resolutions duly adopted by the Board of Directors of the Company (or a duly authorized committee thereof) authorizing the execution and delivery of this Agreement and the consummation of the transactions contemplated hereby (including, without limitation, the issuance of the Shares pursuant to this Agreement), which authorization shall be in full force and effect on and as of the date of such certificate, (ii) certifying and attesting to the office, incumbency, due authority and specimen signatures of each Person who executed this Agreement for or on behalf of the Company, and (iii) containing any other certification that the Agent shall reasonably request.

(s) Agent's Own Account; Clients' Account. The Company consents to the Agent trading, in compliance with applicable law, in the Common Shares for the Agent's own account and for the account of its clients at the same time as sales of the Shares occur pursuant to this Agreement.

(t) Investment Limitation. The Company shall not invest, or otherwise use the proceeds received by the Company from its sale of the Shares in such a manner as would require the Company or any of its subsidiaries to register as an investment company under the Investment Company Act.

(u) Market Activities. The Company has not taken, nor will it take, directly or indirectly, any action designed to or that might be reasonably expected to cause or result in stabilization or manipulation of the price of the Shares or any other reference security, whether to facilitate the sale or resale of the Shares or otherwise, and

the Company will, and shall cause each of its Affiliates to, comply with all applicable provisions of Regulation M. If the limitations of Rule 102 of Regulation M (“**Rule 102**”) do not apply with respect to the Shares or any other reference security pursuant to any exception set forth in Section (d) of Rule 102, then promptly upon notice from the Agent (or, if later, at the time stated in the notice), the Company will, and shall cause each of its Affiliates to, comply with Rule 102 as though such exception were not available but the other provisions of Rule 102 (as interpreted by the Commission) did apply. The Company shall promptly notify the Agent if it no longer meets the requirements set forth in Section (d) of Rule 102.

(v) Notice of Other Sale. Without the written consent of the Agent, the Company will not, directly or indirectly, offer to sell, sell, contract to sell, grant any option to sell or otherwise dispose of any Common Shares or securities convertible into or exchangeable for Common Shares (other than Shares hereunder), warrants or any rights to purchase or acquire Common Shares, or effect a reverse stock split, recapitalization, share consolidation, reclassification or similar transaction affecting the outstanding Common Shares, during the period beginning on the third Trading Day immediately prior to the date on which any Issuance Notice is delivered to the Agent hereunder and ending on the earlier of (A) the third Trading Day immediately following the Settlement Date with respect to Shares sold pursuant to such Issuance Notice and (B) the date an Issuance Notice is cancelled if no Shares have been sold pursuant to such Issuance Notice; and will not directly or indirectly enter into any other “at the market” or continuous equity transaction to offer to sell, sell, contract to sell, grant any option to sell or otherwise dispose of any Common Shares (other than the Shares offered pursuant to this Agreement) or securities convertible into or exchangeable for Common Shares, warrants or any rights to purchase or acquire, Common Shares prior to the termination of this Agreement; provided, however, that such restrictions will not be required in connection with the Company’s (i) offer, issuance or sale of Common Shares, options to purchase Common Shares, or Common Shares issuable upon the exercise of options or other equity awards pursuant to any employee or director share option, incentive or benefit plan, share purchase or ownership plan, long-term incentive plan, dividend reinvestment plan, inducement award under the rules of the Principal Market or other compensation plan of the Company or its subsidiaries, as in effect on the date of this Agreement or hereafter implemented, (ii) offer, issuance or sale of Common Shares issuable upon exchange, conversion or redemption of securities or the exercise or vesting of warrants, options or other equity awards outstanding at the date of this Agreement, and (iii) modification of any outstanding options, warrants or any rights to purchase or acquire Common Shares.

Section 5. CONDITIONS TO DELIVERY OF ISSUANCE NOTICES AND TO SETTLEMENT

(a) Conditions Precedent to the Right of the Company to Deliver an Issuance Notice and the Obligation of the Agent to Sell Shares. The right of the Company to deliver an Issuance Notice hereunder is subject to the satisfaction, on the date of delivery of such Issuance Notice, and the obligation of the Agent to use its commercially reasonable efforts to place Shares during the applicable period set forth in the Issuance Notice is subject to the satisfaction, on each Trading Day during the applicable period set forth in the Issuance Notice, of each of the following conditions:

(i) Accuracy of the Company’s Representations and Warranties; Performance by the Company. The representations and warranties of the Company contained in this Agreement are true and correct as of the date of the Issuance Notice (other than representations and warranties made as of a specific date that shall be true and correct as of such date), and the Company shall have delivered the certificate required to be delivered pursuant to Section 4(o) on or before the date on which delivery of such certificate is required pursuant to Section 4(o). The Company shall have performed, satisfied and complied with all covenants, agreements and conditions required by this Agreement to be performed, satisfied or complied with by the Company at or prior to such date, including, but not limited to, the covenants contained in Section 4(p), Section 4(q) and Section 4(r).

(ii) No Injunction. No statute, rule, regulation, executive order, decree, ruling or injunction shall have been enacted, entered, promulgated or endorsed by any court or governmental authority of competent jurisdiction or any self-regulatory organization having authority over the matters contemplated hereby that prohibits or directly and materially adversely affects any of the transactions contemplated by this Agreement, and no proceeding shall have been commenced that may have the effect of prohibiting or materially adversely affecting any of the transactions contemplated by this Agreement.

(iii) Material Adverse Changes. Except as disclosed in the Prospectus and the Time of Sale Information, (a) in the judgment of the Agent there shall not have occurred any Material Adverse Change; and (b) there shall not have occurred any downgrading, nor shall any notice have been given of any intended or potential downgrading or of any review for a possible change that does not indicate the direction of the possible change, in the rating accorded any securities of the Company or any of its subsidiaries by any “nationally recognized statistical rating organization” as such term is defined for purposes of Section 3(a)(62) of the Exchange Act.

(iv) No Suspension of Trading in or Delisting of Common Shares; Other Events. The trading of the Common Shares (including without limitation the Shares) shall not have been suspended by the Commission, the Principal Market or FINRA and the Common Shares (including without limitation the Shares) shall have been approved for listing or quotation on and shall not have been delisted from the Principal Market or any of their constituent markets. There shall not have occurred (and be continuing in the case of occurrences under clauses (i) and (ii) below) any of the following: (i) trading or quotation in any of the Company’s securities shall have been suspended or limited by the Commission or by the Principal Market or trading in securities generally on the Principal Market shall have been suspended or limited, or minimum or maximum prices shall have been generally established on any of such stock exchanges by the Commission or FINRA; (ii) a general banking moratorium shall have been declared by any federal or New York, authorities; or (iii) there shall have occurred any outbreak or escalation of national or international hostilities or any crisis or calamity, or any change in the United States’ or international financial markets, or any substantial change or development involving a prospective substantial change in United States’ or international political, financial or economic conditions, as in the judgment of the Agent is material and adverse and makes it impracticable to market the Shares in the manner and on the terms described in the Prospectus or to enforce contracts for the sale of securities.

(b) Documents Required to be Delivered on each Issuance Notice Date. The Agent’s obligation to use its commercially reasonable efforts to place Shares hereunder shall additionally be conditioned upon the delivery to the Agent on or before the Issuance Notice Date of a certificate in form and substance reasonably satisfactory to the Agent, executed by the Chief Executive Officer, President or Chief Financial Officer of the Company, to the effect that all conditions to the delivery of such Issuance Notice shall have been satisfied as at the date of such certificate (which certificate shall not be required if the foregoing representations shall be set forth in the Issuance Notice).

(c) No Misstatement or Material Omission. The Agent shall not have advised the Company that the Registration Statement, the Prospectus or the Time of Sale Information, or any amendment or supplement thereto, contains an untrue statement of fact that in the Agent’s reasonable opinion is material, or omits to state a fact that in the Agent’s reasonable opinion is material and is required to be stated therein or is necessary to make the statements therein not misleading.

(d) Agent Counsel Legal Opinion. Agent shall have received from Paul Hastings LLP, counsel for Agent, such opinion or opinions, on or before the date on which the delivery of the Company counsel legal opinion is required pursuant to Section 4(p), with respect to such matters as Agent may reasonably require, and

the Company shall have furnished to such counsel such documents as they reasonably request for enabling them to pass upon such matters.

Section 6. INDEMNIFICATION AND CONTRIBUTION

(a) Indemnification of the Agent. The Company agrees to indemnify and hold harmless the Agent, its officers and employees, and each person, if any, who controls the Agent within the meaning of the Securities Act or the Exchange Act against any loss, claim, damage, liability or expense, as incurred, to which the Agent or such officer, employee or controlling person may become subject, under the Securities Act, the Exchange Act, other federal or state statutory law or regulation, or the laws or regulations of foreign jurisdictions where Shares have been offered or sold or at common law or otherwise (including in settlement of any litigation), insofar as such loss, claim, damage, liability or expense (or actions in respect thereof as contemplated below) arises out of or is based upon (i) any untrue statement or alleged untrue statement of a material fact contained in the Registration Statement, or any amendment thereto, including any information deemed to be a part thereof pursuant to Rule 430B under the Securities Act, or the omission or alleged omission therefrom of a material fact required to be stated therein or necessary to make the statements therein not misleading; or (ii) any untrue statement or alleged untrue statement of a material fact contained in any Free Writing Prospectus that the Company has used, referred to or filed, or is required to file, pursuant to Rule 433(d) of the Securities Act or the Prospectus (or any amendment or supplement thereto), or the omission or alleged omission therefrom of a material fact necessary in order to make the statements therein, in light of the circumstances under which they were made, not misleading and to reimburse the Agent and each such officer, employee and controlling person for any and all documented expenses (including the reasonable and documented fees and disbursements of counsel chosen by the Agent) as such expenses are reasonably incurred by the Agent or such officer, employee or controlling person in connection with investigating, defending, settling, compromising or paying any such loss, claim, damage, liability, expense or action; provided, however, that the foregoing indemnity agreement shall not apply to any loss, claim, damage, liability or expense to the extent, but only to the extent, arising out of or based upon any untrue statement or alleged untrue statement or omission or alleged omission made in reliance upon and in conformity with written information furnished to the Company by the Agent expressly for use in the Registration Statement, any such Free Writing Prospectus or the Prospectus (or any amendment or supplement thereto), it being understood and agreed that the only such information furnished by the Agent to the Company consists of the statements in the first sentence of the ninth paragraph under the caption "Plan of Distribution" in the Prospectus (the "**Agent Information**"). The indemnity agreement set forth in this Section 6(a) shall be in addition to any liabilities that the Company may otherwise have.

(b) Indemnification of the Company, its Directors and Officers. The Agent agrees to indemnify and hold harmless the Company, each of its directors, each of its officers who signed the Registration Statement and each person, if any, who controls the Company within the meaning of the Securities Act or the Exchange Act against any loss, claim, damage, liability or expense, as incurred, to which the Company or any such director, officer or controlling person may become subject, under the Securities Act, the Exchange Act, other federal or state statutory law or regulation, or the laws or regulations of foreign jurisdictions where Shares have been offered or sold or at common law or otherwise (including in settlement of any litigation), and which arises out of or is based upon (i) any untrue statement or alleged untrue statement of a material fact contained in the Registration Statement, or any amendment thereto, including any information deemed to be a part thereof pursuant to Rule 430B under the Securities Act, or the omission or alleged omission therefrom of a material fact required to be stated therein or necessary to make the statements therein not misleading; or (ii) any untrue statement or alleged untrue statement of a material fact contained in any Free Writing Prospectus that the Company has used, referred to or filed, or is required to file, pursuant to Rule 433(d) of the Securities Act or the Prospectus (or any amendment or supplement thereto), or the omission or alleged omission therefrom of a material fact necessary in order to make the statements therein, in the light of the circumstances under which they were made, not

misleading; but, for each of (i) and (ii) above, only to the extent arising out of or based upon any untrue statement or alleged untrue statement or omission or alleged omission made in reliance upon and in conformity with written information furnished to the Company by the Agent expressly for use in the Registration Statement, any such Free Writing Prospectus or the Prospectus (or any amendment or supplement thereto), it being understood and agreed that only such information furnished by the Agent to the Company consists of the information set forth in the first sentence of the ninth paragraph under the caption "Plan of Distribution" in the Prospectus, and to reimburse the Company and each such director, officer and controlling person for any and all documented expenses (including the reasonable and documented fees and disbursements of counsel chosen by the Company) as such expenses are reasonably incurred by the Company or such officer, director or controlling person in connection with investigating, defending, settling, compromising or paying any such loss, claim, damage, liability, expense or action. The indemnity agreement set forth in this Section 6(b) shall be in addition to any liabilities that the Agent or the Company may otherwise have.

(c) Notifications and Other Indemnification Procedures. Promptly after receipt by an indemnified party under this Section 6 of notice of the commencement of any action, such indemnified party will, if a claim in respect thereof is to be made against an indemnifying party under this Section 6, notify the indemnifying party in writing of the commencement thereof, but the omission to so notify the indemnifying party will not relieve it from any liability which it may have to any indemnified party for contribution or otherwise than under the indemnity agreement contained in this Section 6 or to the extent it is not prejudiced as a proximate result of such failure. In case any such action is brought against any indemnified party and such indemnified party seeks or intends to seek indemnity from an indemnifying party, the indemnifying party will be entitled to participate in, and, to the extent that it shall elect, jointly with all other indemnifying parties similarly notified, by written notice delivered to the indemnified party promptly after receiving the aforesaid notice from such indemnified party, to assume the defense thereof with counsel reasonably satisfactory to such indemnified party; provided, however, if the defendants in any such action include both the indemnified party and the indemnifying party and the indemnified party shall have reasonably concluded that a conflict may arise between the positions of the indemnifying party and the indemnified party in conducting the defense of any such action or that there may be legal defenses available to it and/or other indemnified parties which are different from or additional to those available to the indemnifying party, the indemnified party or parties shall have the right to select separate counsel to assume such legal defenses and to otherwise participate in the defense of such action on behalf of such indemnified party or parties. Upon receipt of notice from the indemnifying party to such indemnified party of such indemnifying party's election so to assume the defense of such action and approval by the indemnified party of counsel, the indemnifying party will not be liable to such indemnified party under this Section 6 for any legal or other expenses subsequently incurred by such indemnified party in connection with the defense thereof unless (i) the indemnified party shall have employed separate counsel in accordance with the proviso to the preceding sentence (it being understood, however, that the indemnifying party shall not be liable for the fees and expenses of more than one separate counsel (together with local counsel), representing the indemnified parties who are parties to such action), which counsel (together with any local counsel) for the indemnified parties shall be selected by the indemnified party (in the case of counsel for the indemnified parties referred to in Section 6(a) and Section 6(b) above), (ii) the indemnifying party shall not have employed counsel reasonably satisfactory to the indemnified party to represent the indemnified party within a reasonable time after notice of commencement of the action or (iii) the indemnifying party has authorized in writing the employment of counsel for the indemnified party at the expense of the indemnifying party, in each of which cases the fees and expenses of counsel shall be at the expense of the indemnifying party and shall be paid as they are incurred.

(d) Settlements. The indemnifying party under this Section 6 shall not be liable for any settlement of any proceeding effected without its written consent, but if settled with such consent or if there be a final judgment for the plaintiff, the indemnifying party agrees to indemnify the indemnified party against any loss, claim, damage, liability or expense by reason of such settlement or judgment. Notwithstanding the foregoing sentence, if

at any time an indemnified party shall have requested an indemnifying party to reimburse the indemnified party for fees and expenses of counsel as contemplated by Section 6(c) hereof, the indemnifying party agrees that it shall be liable for any settlement of any proceeding effected without its written consent if (i) such settlement is entered into more than thirty (30) calendar days after receipt by such indemnifying party of the aforesaid request and (ii) such indemnifying party shall not have reimbursed the indemnified party in accordance with such request prior to the date of such settlement. No indemnifying party shall, without the prior written consent of the indemnified party, effect any settlement, compromise or consent to the entry of judgment in any pending or threatened action, suit or proceeding in respect of which any indemnified party is or could have been a party and indemnity was or could have been sought hereunder by such indemnified party, unless such settlement, compromise or consent includes an unconditional release of such indemnified party from all liability on claims that are the subject matter of such action, suit or proceeding.

(e) Contribution. If the indemnification provided for in this Section 6 is for any reason held to be unavailable to or otherwise insufficient to hold harmless an indemnified party in respect of any losses, claims, damages, liabilities or expenses referred to therein, then each indemnifying party shall contribute to the aggregate amount paid or payable by such indemnified party, as incurred, as a result of any losses, claims, damages, liabilities or expenses referred to therein (i) in such proportion as is appropriate to reflect the relative benefits received by the Company, on the one hand, and the Agent, on the other hand, from the offering of the Shares pursuant to this Agreement; or (ii) if the allocation provided by clause (i) above is not permitted by applicable law, in such proportion as is appropriate to reflect not only the relative benefits referred to in clause (i) above but also the relative fault of the Company, on the one hand, and the Agent, on the other hand, in connection with the statements or omissions which resulted in such losses, claims, damages, liabilities or expenses, as well as any other relevant equitable considerations. The relative benefits received by the Company, on the one hand, and the Agent, on the other hand, in connection with the offering of the Shares pursuant to this Agreement shall be deemed to be in the same respective proportions as the total gross proceeds from the offering of the Shares (before deducting expenses) received by the Company bear to the total Selling Commissions received by the Agent. The relative fault of the Company, on the one hand, and the Agent, on the other hand, shall be determined by reference to, among other things, whether any such untrue or alleged untrue statement of a material fact or omission or alleged omission to state a material fact relates to information supplied by the Company, on the one hand, or the Agent, on the other hand, and the parties' relative intent, knowledge, access to information and opportunity to correct or prevent such statement or omission.

The amount paid or payable by a party as a result of the losses, claims, damages, liabilities and expenses referred to above shall be deemed to include, subject to the limitations set forth in Section 6(c), any reasonable and documented legal or other fees or expenses reasonably incurred by such party in connection with investigating or defending any action or claim. The provisions set forth in Section 6(c) with respect to notice of commencement of any action shall apply if a claim for contribution is to be made under this Section 6(e); *provided, however*, that no additional notice shall be required with respect to any action for which notice has been given under Section 6(c) for purposes of indemnification.

The Company and the Agent agree that it would not be just and equitable if contribution pursuant to this Section 6(e) were determined by pro rata allocation or by any other method of allocation which does not take account of the equitable considerations referred to in this Section 6(e).

Notwithstanding the provisions of this Section 6(e), the Agent shall not be required to contribute any amount in excess of the Selling Commissions received by the Agent in connection with the offering contemplated hereby. No person guilty of fraudulent misrepresentation (within the meaning of Section 11(f) of the Securities Act) shall be entitled to contribution from any person who was not guilty of such fraudulent misrepresentation. For purposes of this Section 6(e), each officer and employee of the Agent and each person, if any, who controls the

Agent within the meaning of the Securities Act or the Exchange Act shall have the same rights to contribution as the Agent, and each director of the Company, each officer of the Company who signed the Registration Statement, and each person, if any, who controls the Company within the meaning of the Securities Act and the Exchange Act shall have the same rights to contribution as the Company.

Section 7. TERMINATION & SURVIVAL

(a) Term. Subject to the provisions of this Section 7, the term of this Agreement shall continue from the date of this Agreement until the end of the Agency Period, unless earlier terminated by the parties to this Agreement pursuant to this Section 7.

(b) Termination; Survival Following Termination.

(i) Either party may terminate this Agreement prior to the end of the Agency Period, by giving written notice as required by this Agreement, upon ten Trading Days' notice to the other party; provided that, (A) if the Company terminates this Agreement after the Agent confirms to the Company any sale of Shares, the Company shall remain obligated to comply with Section 3(b)(v) with respect to such Shares and (B) Section 2, Section 6, this Section 7 and Section 8 shall survive termination of this Agreement. If termination shall occur prior to the Settlement Date for any sale of Shares, such sale shall nevertheless settle in accordance with the terms of this Agreement.

(ii) In addition to the survival provision of Section 7(b)(i), the respective indemnities, agreements, representations, warranties and other statements of the Company, of its officers and of the Agent set forth in or made pursuant to this Agreement will remain in full force and effect, regardless of any investigation made by or on behalf of the Agent or the Company or any of its or their partners, officers or directors or any controlling person, as the case may be, and, anything herein to the contrary notwithstanding, will survive delivery of and payment for the Shares sold hereunder and any termination of this Agreement.

Section 8. MISCELLANEOUS

(a) Press Releases and Disclosure. The Company may issue a press release describing the material terms of the transactions contemplated hereby following the date of this Agreement, and may file with the Commission a Current Report on Form 8-K, with this Agreement attached as an exhibit thereto, describing the material terms of the transactions contemplated hereby, and the Company shall consult with the Agent prior to making such disclosures, and the parties hereto shall use all commercially reasonable efforts, acting in good faith, to agree upon a text for such disclosures that is reasonably satisfactory to all parties hereto. No party hereto shall issue thereafter any press release or like public statement (including, without limitation, any disclosure required in reports filed with the Commission pursuant to the Exchange Act, other than disclosure related to entry into this Agreement or related to periodic sales pursuant to this Agreement as required to be included in any reports filed with the Commission pursuant to the Securities Act or Exchange Act) related to this Agreement or any of the transactions contemplated hereby without the prior written approval of the other party hereto, except as may be necessary or appropriate in the reasonable opinion of the party seeking to make disclosure to comply with the requirements of applicable law or stock exchange rules. If any such press release or like public statement is so required, the party making such disclosure shall consult with the other party prior to making such disclosure, and the parties shall use all commercially reasonable efforts, acting in good faith, to agree upon a text for such disclosure that is reasonably satisfactory to all parties hereto.

(b) No Advisory or Fiduciary Relationship. The Company acknowledges and agrees that (i) the transactions contemplated by this Agreement, including the determination of any fees, are arm's-length

commercial transactions between the Company and the Agent, (ii) when acting as a principal under this Agreement, the Agent is and has been acting solely as a principal and is not the agent or fiduciary of the Company, or its stockholders, creditors, employees or any other party, (iii) the Agent has not assumed nor will assume an advisory or fiduciary responsibility in favor of the Company with respect to the transactions contemplated hereby or the process leading thereto (irrespective of whether the Agent has advised or is currently advising the Company on other matters) and the Agent does not have any obligation to the Company with respect to the transactions contemplated hereby except the obligations expressly set forth in this Agreement, (iv) the Agent and its Affiliates may be engaged in a broad range of transactions that involve interests that differ from those of the Company, and (v) the Agent has not provided any legal, accounting, regulatory or tax advice with respect to the transactions contemplated hereby and the Company has consulted its own legal, accounting, regulatory and tax advisors to the extent it deemed appropriate.

(c) Research Analyst Independence. The Company acknowledges that the Agent's research analysts and research departments are required to and should be independent from their respective investment banking divisions and are subject to certain regulations and internal policies, and as such the Agent's research analysts may hold views and make statements or investment recommendations and/or publish research reports with respect to the Company or the offering contemplated by this Agreement that differ from the views of their respective investment banking divisions. The Company understands that the Agent is a full service securities firm and as such from time to time, subject to applicable securities laws, may effect transactions for its own account or the account of its customers and hold long or short positions in debt or equity securities of the companies that may be the subject of the transactions contemplated by this Agreement.

(d) Notices. All communications hereunder shall be in writing and shall be mailed, hand delivered, sent via electronic mail (if applicable) or telecopied and confirmed to the parties hereto as follows:

If to the Agent:

Jefferies LLC
520 Madison Avenue
New York, NY 10022
Facsimile: (646) 786-5719
Attention: General Counsel

with a copy (which shall not constitute notice) to:

Paul Hastings LLP
The MetLife Building

200 Park Avenue

New York, New York 10166
Attention: Siavosh Salimi and Ryan Brewer

If to the Company:

X4 Pharmaceuticals, Inc.
61 North Beacon Street, 4th Floor
Boston, Massachusetts 02134
Attention: David Kirske
Email: David.kirske@x4pharma.com

with a copy (which shall not constitute notice) to:

Gibson, Dunn & Crutcher LLP
One Embarcadero Center, Suite 2600
San Francisco, CA 94111
Attention: Ryan Murr, Branden Berns and Melanie Neary
E-mail: RMurr@gibsondunn.com; BBerns@gibsondunn.com; MNeary@gibsondunn.com

Any party hereto may change the address for receipt of communications by giving written notice to the others in accordance with this Section 8(d).

(e) Successors. This Agreement will inure to the benefit of and be binding upon the parties hereto, and to the benefit of the employees, officers and directors and controlling persons referred to in Section 6, and in each case their respective successors, and no other person will have any right or obligation hereunder. The term “successors” shall not include any purchaser of the Shares as such from the Agent merely by reason of such purchase.

(f) Partial Unenforceability. The invalidity or unenforceability of any Article, Section, paragraph or provision of this Agreement shall not affect the validity or enforceability of any other Article, Section, paragraph or provision hereof. If any Article, Section, paragraph or provision of this Agreement is for any reason determined to be invalid or unenforceable, there shall be deemed to be made such minor changes (and only such minor changes) as are necessary to make it valid and enforceable.

(g) Governing Law Provisions. This Agreement shall be governed by and construed in accordance with the internal laws of the State of New York applicable to agreements made and to be performed in such state. Any legal suit, action or proceeding arising out of or based upon this Agreement or the transactions contemplated hereby may be instituted in the federal courts of the United States of America located in the Borough of Manhattan in the City of New York or the courts of the State of New York in each case located in the Borough of Manhattan in the City of New York (collectively, the “**Specified Courts**”), and each party irrevocably submits to the exclusive jurisdiction (except for proceedings instituted in regard to the enforcement of a judgment of any such court, as to which such jurisdiction is non-exclusive) of such courts in any such suit, action or proceeding. Service of any process, summons, notice or document by mail to such party’s address set forth above shall be effective service of process for any suit, action or other proceeding brought in any such court. The parties irrevocably and unconditionally waive any objection to the laying of venue of any suit, action or other proceeding in the Specified Courts and irrevocably and unconditionally waive and agree not to plead or claim in any such court that any such suit, action or other proceeding brought in any such court has been brought in an inconvenient forum.

(h) General Provisions. This Agreement constitutes the entire agreement of the parties to this Agreement and supersedes all prior written or oral and all contemporaneous oral agreements, understandings and negotiations with respect to the subject matter hereof. This Agreement may be executed in two or more counterparts, each one of which shall be an original, with the same effect as if the signatures thereto and hereto were upon the same instrument, and may be delivered by facsimile transmission or by electronic delivery of a portable document format (PDF) file (including any electronic signature covered by the U.S. federal ESIGN Act of 2000, Uniform Electronic Transactions Act, the Electronic Signatures and Records Act or other applicable law, e.g., www.docuSign.com). This Agreement may not be amended or modified unless in writing by all of the parties hereto, and no condition herein (express or implied) may be waived unless waived in writing by each party whom the condition is meant to benefit. The Article and Section headings herein are for the convenience of the parties only and shall not affect the construction or interpretation of this Agreement.

[Signature Page Immediately Follows]

If the foregoing is in accordance with your understanding of our agreement, kindly sign and return to the Company the enclosed copies hereof, whereupon this instrument, along with all counterparts hereof, shall become a binding agreement in accordance with its terms.

Very truly yours,

X4 PHARMACEUTICALS, INC.

By: /s/ David Kirske

Name: David Kirske

Title: Chief Financial Officer

The foregoing Agreement is hereby confirmed and accepted by the Agent in New York, New York as of the date first above written.

JEFFERIES LLC

By: /s/ Donald Lynaugh

Name: Donald Lynaugh

Title: Managing Director

[Signature Page to Open Market Sale Agreement]

EXHIBIT A

Issuance Notice

[Date]

Jefferies LLC
520 Madison Avenue
New York, New York 10022

Attn: [_____]

Reference is made to the Open Market Sale Agreement between X4 Pharmaceuticals, Inc. (the “**Company**”) and Jefferies LLC (the “**Agent**”) dated as of May 6, 2026. The Company confirms that all conditions to the delivery of this Issuance Notice are satisfied as of the date hereof.

Date that the Registration Statement expires: [●], 2029

Date of Delivery of Issuance Notice (determined pursuant to Section 3(b)(i)):

—

Issuance Amount (equal to the total Sales Price for such Shares):

\$ _____

Number of days in selling period: ____

First date of selling period: ____

Last date of selling period: ____

Settlement Date(s) if other than standard T+1 settlement:

—

Floor Price Limitation: \$ _____ per share

Comments: ____

X4 PHARMACEUTICALS, INC.

By: ____
Name:
Title:

SCHEDULE A

Notice Parties

The Company

David Kirske

Mitch Buckley

The Agent

Michael Magarro

SCHEDULE B

1. X4 Therapeutics, Inc.
2. X4 Pharmaceuticals (Austria) GmbH
3. X4 Pharmaceuticals Securities Corporation

Exhibit 4.1

X4 PHARMACEUTICALS, INC.

Debt Securities

Indenture

Dated as of , 202

[],

as Trustee

CROSS-REFERENCE TABLE

This Cross-Reference Table is not a part of the Indenture

TIA Section	Indenture Section
310(a)(1)	7.10
(a)(2)	7.10
(a)(3)	N.A.
(a)(4)	N.A.
(b)	7.08; 7.10; 12.02
311(a)	7.11
(b)	7.11
(c)	N.A.
312(a)	2.05
(b)	12.03
(c)	12.03
313(a)	7.06
(b)(1)	N.A.
(b)(2)	7.06
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(d)	7.06
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(b)	N.A.
(c)(1)	12.04
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(c)(3)	N.A.
(d)	N.A.
(e)	12.05
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(b)	7.05; 12.02
(c)	7.01(a)
(d)	7.01(c)
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(a)(1)(B)	6.04
(a)(2)	N.A.
(b)	6.07
317(a)(1)	6.08
(a)(2)	6.09
(b)d	2.04
318(a)	12.01

N.A. means Not Applicable.

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SIGNATURES

EXHIBIT A – Form of Security

INDENTURE dated as of _____, 2022, (the “**Base Indenture**”), by and among **X4 PHARMACEUTICALS, INC.**, a Delaware corporation (the “**Company**”) and [], as trustee (the “**Trustee**”).

Each party agrees as follows for the benefit of the other party and for the equal and ratable benefit of the Holders of the Company’s debt securities issued under this Base Indenture:

ARTICLE ONE DEFINITIONS AND INCORPORATION BY REFERENCE

Section 1.01 Definitions.

“**Affiliate**” means, when used with reference to a specified person, any Person directly or indirectly controlling or controlled by or under direct or indirect common control with the Person specified.

“**Agent**” means any Registrar, Paying Agent or co-Registrar or agent for service of notices and demands.

“**Authorizing Resolution**” means a resolution adopted by the Board of Directors or by an Officer or committee of Officers pursuant to Board delegation authorizing a Series of Securities.

“**Bankruptcy Law**” means Title 11 of the United States Code, as amended, or any similar federal or state law for the relief of debtors.

“**Board of Directors**” means the Board of Directors of the Company or any duly authorized committee thereof.

“**Capital Stock**” means, with respect to any Person, any and all shares, interests, participations or other equivalents (however designated) of or in such Person’s capital stock or other equity interests.

“**Company**” means the party named as such in this Indenture until a successor replaces it pursuant to the Indenture and thereafter means the successor.

“**control**” means, when used with respect to any Person, the power to direct the management and policies of such Person, directly or indirectly, whether through the ownership of voting securities, by contract or otherwise; and the terms “controlling” and “controlled” have meanings correlative to the foregoing.

“**Default**” means any event, act or condition that is, or after notice or the passage of time or both would be, an Event of Default.

“**Definitive Security**” means a certificated Security registered in the name of the Securityholder thereof.

“**Depository**” means, with respect to Securities of any Series which the Company shall determine will be issued in whole or in part as a Global Security, DTC, another clearing agency, or any successor registered as a clearing agency under the Exchange Act, and any other applicable U.S. or foreign statute or regulation, which, in each case, shall be designated by the Company pursuant to Section 2.01.

“**Dollars**” and “**\$**” mean United States Dollars.

“**DTC**” means The Depository Trust Company, New York, New York.

“**Exchange Act**” means the Securities Exchange Act of 1934, as amended.

“**Foreign Currency**” means any currency, currency unit or composite currency, including, without limitation, the Euro, issued by the government of one or more countries other than the United States of America or by any recognized confederation or association of such governments.

“**GAAP**” means generally accepted accounting principles set forth in the accounting standards codification of the Financial Accounting Standards Board or in such other statements by such or any other entity as may be approved by a significant segment of the accounting profession of the United States, as in effect on the date of this Base Indenture.

“**Global Security**” means, with respect to any Series of Securities, a Security executed by the Company and delivered by the Trustee to the Depository or pursuant to the Depository’s instruction, all in accordance with the Indenture, which shall be registered in the name of the Depository or its nominee.

“**Government Obligations**” means securities which are (i) direct obligations of the United States or the other government or governments in the confederation which issued the Foreign Currency in which the principal of or any interest on the Security of the applicable Series shall be payable, in each case for the payment of which its full faith and credit is pledged or (ii) obligations of a Person controlled or supervised by and acting as an agency or instrumentality of the United States or such other government or governments, in each case the payment of which is unconditionally guaranteed as a full faith and credit obligation by the United States or such other government or governments, which, in either case are not callable or redeemable at the option of the issuer or issuers thereof, and shall also include a depository receipt issued by a bank or trust company as custodian with respect to any such Government Obligations or a specific payment of interest on or principal of any such Government Obligation held by such custodian for the account of the holder of a depository receipt; *provided* that (except as required by law) such custodian is not authorized to make any deduction from the amount payable to the holder of such depository receipt from any amount received by the custodian in respect of the Government Obligation or the specific payment of interest on or principal of the Government Obligation evidenced by such depository receipt.

“**Holder**” or “**Securityholder**” means the Person in whose name a Security is registered on the Registrar’s books.

“**Indenture**” means this Base Indenture as amended or supplemented from time to time, including pursuant to any Authorizing Resolution or supplemental indenture pertaining to any Series, and including, for all purposes of this instrument and any such Authorizing Resolution or supplemental indenture, the provisions of the TIA that are deemed to be a part of and govern this Base Indenture and any such Authorizing Resolution or supplemental indenture, respectively.

“**Issue Date**” means, with respect to any Series of Securities, the date on which the Securities of such Series are originally issued under this Indenture.

“**NYUCC**” means the New York Uniform Commercial Code, as in effect from time to time.

“**Officer**” means the Chairman of the Board, the President, any Vice President, the Treasurer, the Controller or the Secretary of the Company.

“**Officers’ Certificate**” means a certificate signed by two Officers or by an Officer and an Assistant Treasurer or an Assistant Secretary of the Company.

“**Opinion of Counsel**” means a written opinion, in form and substance reasonably satisfactory to the Trustee, from legal counsel. The counsel may be an employee of or counsel to the Company. Each such opinion shall include the statements provided for in Section 12.05 if and to the extent required by the provisions of such Section.

“**Person**” means any individual, corporation, partnership, limited liability company, joint venture, incorporated or unincorporated association, joint stock company, trust, unincorporated organization or government or any agency or political subdivision thereof.

“**principal**” of a debt security means the principal of the security *plus*, when appropriate, the premium, if any, on the security.

“**Property**” of any Person means all types of real, personal, tangible, intangible or mixed property owned by such Person, whether or not included in the most recent consolidated balance sheet of such Person and its Subsidiaries under GAAP.

“**SEC**” means the Securities and Exchange Commission or any successor agency performing the duties now assigned to it under the TIA.

“**Securities**” means any Securities that are issued under this Base Indenture.

“**Securities Act**” means the Securities Act of 1933, as amended.

“**Series**” means a series of Securities established under this Base Indenture.

“**Significant Subsidiary**” means any Subsidiary of the Company which would constitute a “significant subsidiary” as defined in Rule 1-02 of Regulation S-X under the Securities Act and the Exchange Act.

“**Subsidiary**” of any Person means any corporation or other entity of which a majority of the Capital Stock having ordinary voting power to elect a majority of the board of directors of such entity or other persons performing similar functions is at the time directly or indirectly owned or controlled by such Person.

“**TIA**” means the Trust Indenture Act of 1939, as in effect from time to time, except as otherwise provided herein.

“**Trustee**” means the party named as such in this Base Indenture until a successor replaces it pursuant to this Base Indenture and thereafter means the successor serving hereunder; *provided, however*, that if at any time there is more than one such Person, “Trustee” as used with respect to the Securities of any Series shall mean only the Trustee with respect to Securities of that Series.

“**Trust Officer**” means, when used with respect to the Trustee, any officer within the corporate trust department of the Trustee, including any vice president, assistant vice president, assistant secretary, senior associate, associate, trust officer or any other officer of the Trustee who customarily performs functions similar to those performed by the Persons who at the time shall be such officers or to whom any corporate trust matter is referred because of such person’s knowledge of and familiarity with the particular subject and who shall have direct responsibility for the administration of this Indenture.

“**United States**” means the United States of America.

Section 1.02 Other Definitions.

Term	Defined in Section
Agent Members	2.15
Base Indenture	Preamble
Business Day	12.07
Covenant Defeasance	8.01
Custodian	6.01
Event of Default	6.01
Legal Defeasance	8.01
Legal Holiday	12.07
Paying Agent	2.03
Payment Default	6.01
Registrar	2.03
Security Register	2.03
Successor	5.01

Section 1.03 Incorporation by Reference of Trust Indenture Act.

Whenever this Indenture refers to a provision of the TIA, the provision is incorporated by reference in and made a part of this Indenture. The following TIA terms used in this Indenture have the following meanings:

“Commission” means the SEC.

“indenture securities” means the Securities of a particular Series.

“indenture security holder” means a Securityholder.

“indenture to be qualified” means this Indenture.

“indenture trustee” or “institutional trustee” means the Trustee.

“obligor” on the indenture securities means the Company or any other obligor on the Securities of a Series.

All other TIA terms used in this Indenture that are defined by the TIA, defined by TIA reference to another statute or defined by SEC rule have the meanings so assigned to them.

Section 1.04 Rules of Construction.

Unless the context otherwise requires:

- (1) a term has the meaning assigned to it herein;
- (2) an accounting term not otherwise defined has the meaning assigned to it in accordance with GAAP and all accounting determinations shall be made in accordance with GAAP;
- (3) “or” is not exclusive and “including” means “including without limitation”;
- (4) words in the singular include the plural, and in the plural include the singular;

- (5) “herein,” “hereof” and “hereunder,” and other words of similar import, refer to this Indenture as a whole (including any Authorizing Resolution or supplemental indenture relating to the relevant Series) and not to any particular Article, Section or other subdivision;
- (6) all exhibits are incorporated by reference herein and expressly made a part of this Indenture; and
- (7) any transaction or event shall be considered “permitted by” or made “in accordance with” or “in compliance with” this Indenture or any particular provision thereof if such transaction or event is not expressly prohibited by this Indenture or such provision, as the case may be.

ARTICLE TWO
THE SECURITIES

Section 2.01 Form and Dating.

The aggregate principal amount of Securities that may be issued under this Base Indenture is unlimited. The Securities may be issued from time to time in one or more Series. Each Series shall be created by an Authorizing Resolution or a supplemental indenture that establishes the terms of the Series, which may include the following:

- (1) the title of the Series (which shall distinguish the Securities of such Series from all other Securities);
- (2) the aggregate principal amount (or any limit on the aggregate principal amount) of the Series and, if any Securities of a Series are to be issued at a discount from their face amount, the method of computing the accretion of such discount;
- (3) the interest rate or method of calculation of the interest rate;
- (4) the date from which interest will accrue;
- (5) the record dates for interest payable on Securities of the Series;
- (6) the dates when, places where and manner in which principal and interest are payable;
- (7) the Registrar and Paying Agent;
- (8) the terms of any mandatory (including any sinking fund requirements) or optional redemption by the Company;
- (9) the terms of any redemption at the option of Holders;
- (10) the permissible denominations in which Securities of such Series are issuable, if different from \$2,000 and multiples of \$1,000 in excess thereof;
- (11) whether Securities of such Series will be issued in registered or bearer form and the terms of any such forms of Securities;

- (12) whether the 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 different from those contained in this Base Indenture, upon which such Global Security or Securities may be exchanged in whole or in part for Definitive Securities; the Depositary for such Global Security or Securities; and the form of any legend or legends, if any, to be borne by any such Global Security or Securities in addition to or in lieu of the legends referred to in Section 2.15;
- (13) the currency or currencies (including any composite currency) in which principal or interest or both may be paid;
- (14) if payments of principal or interest may be made in a currency other than that in which Securities of such Series are denominated, the manner for determining such payments, including the time and manner of determining the exchange rate between the currency in which such Securities are denominated and the currency in which such Securities or any of them may be paid, and any deletions from or modifications of or additions to the terms of this Indenture to provide for or to facilitate the issuance of Securities denominated or payable, at the election of the Company or a Holder thereof or otherwise, in a Foreign Currency;
- (15) provisions for electronic issuance of Securities or issuance of Securities of such Series in uncertificated form;
- (16) any Events of Default, covenants and/or defined terms in addition to or in lieu of those set forth in this Base Indenture;
- (17) whether and upon what terms Securities of such Series may be defeased or discharged if different from the provisions set forth in this Base Indenture;
- (18) the form of the Securities of such Series, which, unless the Authorizing Resolution or supplemental indenture otherwise provides, shall be in the form of Exhibit A;
- (19) any terms that may be required by or advisable under applicable law;
- (20) the percentage of the principal amount of the Securities of such Series which is payable if the maturity of the Securities of such Series is accelerated in the case of Securities issued at a discount from their face amount;
- (21) whether Securities of such Series will or will not have the benefit of guarantees and the Company's Subsidiaries that will be the initial guarantors of such Series and, if applicable, the terms and conditions upon which such guarantees may be subordinated to other indebtedness of the respective guarantors;

- (22) whether the Securities of such Series are senior or subordinated debt securities, and if subordinated debt securities, the terms of such subordination;
- (23) whether the Securities of the Series will be convertible into or exchangeable for other Securities, common shares or other securities of any kind of the Company or another obligor, and, if so, the terms and conditions upon which such Securities will be so convertible or exchangeable, including the initial conversion or exchange price or rate or the method of calculation, how and when the conversion price or exchange ratio may be adjusted, whether conversion or exchange is mandatory, at the option of the holder or at the Company's option, the conversion or exchange period, and any other provision in relation thereto; and
- (24) any other terms in addition to or different from those contained in this Base Indenture applicable to such Series.

All Securities of one Series need not be issued at the same time and, unless otherwise provided, a Series may be reopened for issuances of additional Securities of such Series pursuant to an Authorizing Resolution, an Officers' Certificate or in any indenture supplemental hereto.

The creation and issuance of a Series and the authentication and delivery thereof are not subject to any conditions precedent.

Section 2.02 Execution and Authentication.

One Officer shall sign the Securities for the Company by manual or facsimile signature.

If an Officer whose signature is on a Security no longer holds that office at the time the Trustee authenticates the Security, the Security shall nevertheless be valid.

A Security shall not be valid until the Trustee manually signs the certificate of authentication on the Security. The signature shall be conclusive evidence that the Security has been authenticated under this Base Indenture.

At any time and from time to time after the execution and delivery of this Indenture, the Company may deliver Securities of any series executed by the Company to the Trustee for authentication. Each Security shall be dated the date of its authentication. The Trustee shall authenticate Securities for original issue upon receipt of, and shall be fully protected in relying upon:

- (a) An order to the Trustee signed by an officer of the Company directing the Trustee to authenticate the Securities;
- (b) a copy of the resolution or resolutions of the Board of Directors in or pursuant to which the terms and form of the Securities were established, certified by the Secretary or an Assistant Secretary of the Company to have been duly adopted by the Board of Directors and to be in full force and effect as of the date of such certificate, and if the terms and form of such Securities are established by an Officers' Certificate pursuant to general authorization of the Board of Directors, such Officers' Certificate;
- (c) an Officers' Certificate of the Company delivered in accordance with Section 12.04; and
- (d) an Opinion of Counsel delivered in accordance with Section 12.04.

The Trustee shall have the right to decline to authenticate and deliver any Securities under this Section if the Trustee, being advised by counsel, determines that such action may not lawfully be taken or if the Trustee in good faith shall determine that such action would expose the Trustee to personal liability to existing Holders.

Section 2.03 Registrar and Paying Agent.

The Company shall maintain an office or agency where Securities may be presented for registration of transfer or where Securities of a Series that are convertible or exchangeable may be surrendered for conversion or exchange (“**Registrar**”), an office or agency where Securities may be presented for payment (“**Paying Agent**”) and an office or agency where notices and demands to or upon the Company in respect of the Securities and this Indenture may be served. The Registrar shall keep a register of the Securities and of their transfer and exchange (the “**Security Register**”). The Company may have one or more co-Registrars and one or more additional paying agents. The term “Paying Agent” includes any additional paying agent.

The Company shall enter into an appropriate agency agreement with any Agent not a party to this Base Indenture. The agreement shall implement the provisions of this Indenture that relate to such Agent. The Company shall promptly notify the Trustee in writing of the name and address of any such Agent and the Trustee shall have the right to inspect the Securities Register at all reasonable times to obtain copies thereof, and the Trustee shall have the right to rely upon such register as to the names and addresses of the Holders and the principal amounts and certificate numbers thereof. If the Company fails to maintain a Registrar or Paying Agent or fails to give the foregoing notice, the Trustee shall act as such.

The Company initially appoints the Trustee as Registrar and Paying Agent.

Section 2.04 Paying Agent to Hold Money in Trust.

Each Paying Agent shall hold in trust for the benefit of Securityholders and the Trustee all money held by the Paying Agent for the payment of principal of or interest on the Securities, and shall notify the Trustee of any default by the Company in making any such payment. If the Company or a Subsidiary acts as Paying Agent, it shall segregate the money and hold it as a separate trust fund. The Company at any time may require a Paying Agent to pay all money held by it to the Trustee. Upon doing so the Paying Agent shall have no further liability for the money.

Section 2.05 Securityholder Lists.

The Trustee shall preserve in as current a form as is reasonably practicable the most recent list available to it of the names and addresses of Securityholders. If the Trustee is not the Registrar, the Company shall furnish to the Trustee at least five (5) Business Days before each semiannual interest payment date and at such other times as the Trustee may request in writing a list in such form and as of such date as the Trustee may reasonably require of the names and addresses of Securityholders.

Section 2.06 Transfer and Exchange.

Where a Security is presented to the Registrar or a co-Registrar with a request to register a transfer, the Registrar shall register the transfer as requested if the requirements of Section 8-401(a) of the NYUCC are met and the other provisions of this Section 2.06 are satisfied. Where Securities are presented to the Registrar or a co-Registrar with a request to exchange them for an equal principal amount of Securities of other denominations, the Registrar shall make the exchange as requested if the same requirements are met. To permit transfers and exchanges, the Trustee shall authenticate Securities at the Registrar’s request. The Registrar need not transfer or exchange any Security selected for redemption or repurchase, except the unredeemed or repurchased part thereof if the Security is redeemed or repurchased in part, or transfer or exchange any Securities for a period of 15 days before a selection of Securities to be redeemed or repurchased. Any exchange or transfer shall be without charge, except that the Company may require payment of a sum sufficient to cover any tax or other governmental charge that may be

imposed in relation thereto except in the case of exchanges pursuant to 2.09, 3.06, or 10.05 not involving any transfer.

Any Holder of a Global Security shall, by acceptance of such Global Security, agree that transfers of beneficial interests in such Global Security may be effected only through a book entry system maintained by the Holder of such Global Security (or its agent), and that ownership of a beneficial interest in the Security shall be required to be reflected in a book entry.

Section 2.07 Replacement Securities.

If the Holder of a Security claims that the Security has been lost, destroyed, mutilated or wrongfully taken, the Company shall issue and execute a replacement security and, upon written request of any Officer of the Company, the Trustee shall authenticate such replacement Security, *provided*, in the case of a lost, destroyed or wrongfully taken Security, that the requirements of Section 8-405 of the NYUCC are met. If any such lost, destroyed, mutilated or wrongfully taken Security shall have matured or shall be about to mature, the Company may, instead of issuing a substitute Security therefor, pay such Security without requiring (except in the case of a mutilated Security) the surrender thereof. An indemnity bond must be sufficient in the judgment of the Company and the Trustee to protect the Company, the Trustee and any Agent from any loss which any of them may suffer if a Security is replaced, including the acquisition of such Security by a bona fide purchaser. The Company and the Trustee may charge for its expenses in replacing a Security.

Section 2.08 Outstanding Securities.

Securities outstanding at any time are all Securities authenticated by the Trustee except for those cancelled by it and those described in this Section. A Security does not cease to be outstanding because the Company or one of its Affiliates holds the Security.

If a Security is replaced pursuant to Section 2.07, it ceases to be outstanding unless the Trustee receives proof satisfactory to it that the replaced Security is held by a “protected purchaser” (as such term is defined in the NYUCC).

If the Paying Agent holds on a redemption date, purchase date or maturity date money sufficient to pay Securities payable on that date, then on and after that date such Securities cease to be outstanding and interest on them ceases to accrue.

Subject to the foregoing provisions of this Section, each Security delivered under this Indenture upon registration of transfer of or in exchange for or in lieu of any other Security shall carry the rights to interest accrued and unpaid, and to accrue, which were carried by such other Security.

Section 2.09 Temporary Securities.

Until Definitive Securities are ready for delivery, the Company may prepare and the Trustee shall authenticate temporary Securities. Temporary Securities shall be substantially in the form of Definitive Securities but may have variations that the Company considers appropriate for temporary Securities. Without unreasonable delay, the Company shall prepare and, upon surrender for cancellation of the temporary Security, the Company shall execute and the Trustee shall authenticate Definitive Securities in exchange for temporary Securities. Until so exchanged, the temporary Securities shall in all respects be entitled to the same benefits under this Indenture as Definitive Securities authenticated and delivered hereunder.

Section 2.10 Cancellation.

The Company at any time may deliver Securities to the Trustee for cancellation. The Registrar and Paying Agent shall forward to the Trustee any Securities surrendered to them for registration of transfer, exchange, redemption, purchase or payment. The Trustee and no one else shall cancel and dispose of such cancelled or

tendered securities, or retain in accordance with its standard retention policy, all Securities surrendered for registration of transfer, exchange, redemption, purchase, payment or cancellation. Unless the Authorizing Resolution or supplemental indenture so provides, the Company may not issue new Securities to replace Securities that it has previously paid or delivered to the Trustee for cancellation.

Section 2.11 Defaulted Interest.

If the Company defaults in a payment of interest on the Securities of any Series, it shall pay the defaulted interest *plus* any interest payable on the defaulted interest to the persons who are Securityholders of such Series on a subsequent special record date. The Company shall fix such special record date and a payment date which shall be reasonably satisfactory to the Trustee. At least 15 days before such special record date, the Company shall mail to each Securityholder of the relevant Series a notice that states the record date, the payment date and the amount of defaulted interest to be paid. On or before the date such notice is mailed, the Company shall deposit with the Paying Agent money sufficient to pay the amount of defaulted interest to be so paid. The Company may pay defaulted interest in any other lawful manner if, after notice given by the Company to the Trustee of the proposed payment, such manner of payment shall be deemed practicable by the Trustee.

Section 2.12 Treasury Securities.

In determining whether the Holders of the required principal amount of Securities of a Series have concurred in any direction, waiver, consent or notice, Securities owned by the Company or any of its Affiliates shall be considered as though they are not outstanding, except that for the purposes of determining whether the Trustee shall be protected in relying on any such direction, waiver or consent, only Securities which a Trust Officer of the Trustee actually knows are so owned shall be so considered.

Section 2.13 CUSIP/ISIN Numbers.

The Company in issuing the Securities of any Series may use a “CUSIP” and/or “ISIN” or other similar number, and if so, the Trustee shall use the CUSIP and/or ISIN or other similar number in notices of redemption or exchange as a convenience to Holders of such Securities; *provided* that no representation is hereby deemed to be made by the Trustee as to the correctness or accuracy of any such CUSIP and/or ISIN or other similar number printed in the notice or on such Securities, and that reliance may be placed only on the other identification numbers printed on such Securities. The Company shall promptly notify the Trustee of any change in any CUSIP and/or ISIN or other similar number.

Section 2.14 Deposit of Moneys.

Prior to 11:00 a.m., New York City time, on each interest payment date and maturity date with respect to each Series of Securities, the Company shall have deposited with the Paying Agent in immediately available funds money in the applicable currency sufficient to make cash payments due on such interest payment date or maturity date, as the case may be, in a timely manner which permits the Paying Agent to remit payment to the Holders of such Series on such interest payment date or maturity date, as the case may be.

Section 2.15 Book-Entry Provisions for Global Security.

(a) Any Global Security of a Series initially shall (i) be registered in the name of the Depositary or the nominee of such Depositary, (ii) be delivered to the Trustee as custodian for such Depositary and (iii) bear any required legends.

Members of, or participants in, the Depositary (“**Agent Members**”) shall have no rights under this Indenture with respect to any Global Security held on their behalf by the Depositary, or the Trustee as its custodian, or under the Global Security, and the Depositary may be treated by the Company, the Trustee and any agent of the Company or the Trustee as the absolute owner of the Global Security for all purposes whatsoever. Notwithstanding the foregoing, nothing herein shall prevent the Company, the Trustee or any agent of the Company or the Trustee

from giving effect to any written certification, proxy or other authorization furnished by the Depositary or impair, as between the Depositary and its Agent Members, the operation of customary practices governing the exercise of the rights of a Holder of any Security.

(b) Transfers of any Global Security shall be limited to transfers in whole, but not in part, to the Depositary, its successors or their respective nominees. Interests of beneficial owners in the Global Security may be transferred or exchanged for Definitive Securities in accordance with the rules and procedures of the Depositary. In addition, Definitive Securities shall be transferred to all beneficial owners in exchange for their beneficial interests in a Global Security if (i) the Depositary notifies the Company that it is unwilling or unable to continue as Depositary for the Global Security or the Depositary has ceased to be a “clearing agency” registered under the Exchange Act, and a successor depository is not appointed by the Company within 90 days of such notice, or (ii) the Company elects, at any time in its sole discretion, to discontinue use of the system of book entry transfer through any Depositary. Any Security that is held in the form of a Global Security and that is exchanged pursuant to clause (i) above shall be so exchanged in whole and not in part, and any Security that is held in the form of a Global Security and that is exchanged pursuant to clause (ii) above may be exchanged in whole or from time to time in part as directed by the Company.

(c) In connection with any transfer or exchange of a portion of the beneficial interest in any Global Security to beneficial owners pursuant to paragraph (b), the Registrar shall (if one or more Definitive Securities are to be issued) reflect on its books and records the date and a decrease in the principal amount of the Global Security in an amount equal to the principal amount of the beneficial interest in the Global Security to be transferred, and the Company shall execute, and the Trustee shall authenticate and deliver, one or more Definitive Securities of like Series and amount.

(d) In connection with the transfer of an entire Global Security to beneficial owners pursuant to paragraph (b), the Global Security shall be deemed to be surrendered to the Trustee for cancellation, and the Company shall execute, and the Trustee shall authenticate and deliver, to each beneficial owner identified by the Depositary in exchange for its beneficial interest in the Global Security, an equal aggregate principal amount of Definitive Securities of the same Series in authorized denominations.

(e) The Holder of any Global Security may grant proxies and otherwise authorize any person, including Agent Members and persons that may hold interests through Agent Members, to take any action which a Holder is entitled to take under this Indenture or the Securities of such Series.

(f) Unless otherwise provided in the Authorizing Resolution or supplemental indenture for a particular Series of Securities, each Global Security of such Series shall bear legends in substantially the following forms:

“THIS GLOBAL SECURITY IS HELD BY THE DEPOSITARY (AS DEFINED IN THE INDENTURE GOVERNING THIS SECURITY) OR ITS NOMINEE IN CUSTODY FOR THE BENEFIT OF THE HOLDERS OF BENEFICIAL INTERESTS HEREIN, AND IS NOT TRANSFERABLE TO ANY PERSON UNDER ANY CIRCUMSTANCES EXCEPT THAT (I) THE TRUSTEE MAY MAKE ANY SUCH NOTATIONS HEREON AS MAY BE REQUIRED PURSUANT TO THE INDENTURE, (II) THIS GLOBAL SECURITY MAY BE EXCHANGED IN WHOLE BUT NOT IN PART PURSUANT TO SECTION 2.06 AND SECTION 2.15 OF THE INDENTURE, (III) THIS GLOBAL SECURITY MAY BE DELIVERED TO THE TRUSTEE FOR CANCELLATION PURSUANT TO THE INDENTURE AND (IV) THIS GLOBAL SECURITY MAY BE TRANSFERRED TO A SUCCESSOR DEPOSITARY WITH THE PRIOR WRITTEN CONSENT OF THE COMPANY.”

“UNLESS AND UNTIL IT IS EXCHANGED IN WHOLE OR IN PART FOR SECURITIES IN DEFINITIVE FORM, THIS SECURITY MAY NOT BE TRANSFERRED EXCEPT AS A WHOLE BY THE DEPOSITARY TO A NOMINEE OF THE DEPOSITARY OR BY A NOMINEE OF THE DEPOSITARY TO THE DEPOSITARY OR TO ANOTHER NOMINEE OF THE DEPOSITARY OR BY THE DEPOSITARY OR ANY SUCH NOMINEE TO A SUCCESSOR DEPOSITARY OR A NOMINEE OF SUCH SUCCESSOR DEPOSITARY. UNLESS THIS CERTIFICATE IS PRESENTED BY AN AUTHORIZED REPRESENTATIVE OF THE DEPOSITARY TRUST COMPANY, A NEW YORK

CORPORATION (“DTC”), TO ISSUER OR ITS AGENT FOR REGISTRATION OF TRANSFER, EXCHANGE, OR PAYMENT, ANY CERTIFICATE ISSUED IS REGISTERED IN THE NAME OF CEDE & CO. OR IN SUCH OTHER NAME AS IS REQUESTED BY AN AUTHORIZED REPRESENTATIVE OF DTC (AND ANY PAYMENT IS MADE TO CEDE & CO. OR TO SUCH OTHER ENTITY AS IS REQUESTED BY AN AUTHORIZED REPRESENTATIVE OF DTC), ANY TRANSFER, PLEDGE, OR OTHER USE HEREOF FOR VALUE OR OTHERWISE BY OR TO ANY PERSON IS WRONGFUL INASMUCH AS THE REGISTERED OWNER HEREOF, CEDE & CO., HAS AN INTEREST HEREIN.”

Section 2.16 No Duty to Monitor.

The Trustee shall have no obligation or duty to monitor, determine or inquire as to compliance with any restrictions on transfer imposed under this Indenture or under applicable law with respect to any transfer of any interest in any Security (including any transfers between or among Agent Members or beneficial owners of interests in any Global Security) other than to require delivery of such certificates and other documentation or evidence as are expressly required by, and to do so if and when expressly required by the terms of, this Indenture, and to examine the same to determine substantial compliance as to form with the express requirements hereof.

Neither the Trustee nor any Agent shall have any responsibility for any actions taken or not taken by the Depository.

**ARTICLE THREE
REDEMPTION**

Section 3.01 Notices to Trustee.

Securities of a Series that are redeemable prior to maturity shall be redeemable in accordance with their terms and, unless the Authorizing Resolution or supplemental indenture provides otherwise, in accordance with this Article Three.

If the Company wants to redeem Securities pursuant to Paragraph 4 of the Securities, it shall notify the Trustee in writing of the redemption date and the principal amount of Securities to be redeemed. Any such notice may be cancelled at any time prior to notice of such redemption being mailed to Holders. Any such cancelled notice shall be void and of no effect.

If the Company wants to credit any Securities previously redeemed, retired or acquired against any redemption pursuant to Paragraph 5 of the Securities, it shall notify the Trustee of the amount of the credit and it shall deliver any Securities not previously delivered to the Trustee for cancellation with such notice.

The Company shall give each notice provided for in this Section 3.01 at least 30 days before the notice of any such redemption is to be delivered to Holders (unless a shorter notice shall be satisfactory to the Trustee).

Section 3.02 Selection of Securities to be Redeemed.

If fewer than all of the Securities of a Series are to be redeemed, the Trustee (or depository, as applicable) shall select the Securities to be redeemed by lot, pro rata, or such other method the Trustee (or depository, as applicable) considers fair and appropriate and in a manner that complies with applicable requirements of the Depository. The Trustee (or depository, as applicable) shall make the selection from Securities outstanding not previously called for redemption and shall promptly notify the Company of the serial numbers or other identifying attributes of the Securities so selected. The Trustee (or depository, as applicable) may select for redemption portions of the principal of Securities that have denominations larger than the minimum denomination for the Series. Securities and portions of them it selects shall be in amounts equal to a permissible denomination for the Series.

Provisions of this Indenture that apply to Securities called for redemption also apply to portions of Securities called for redemption.

Unless otherwise provided in the Authorizing Resolution or supplemental indenture relating to a Series, if any Security selected for partial redemption is converted into or exchanged for the Company's Capital Stock or other securities, cash or other property in part before termination of the conversion or exchange right with respect to the portion of the Security so selected, the converted portion of such Security shall be deemed (so far as may be) to be the portion selected for redemption. Securities which have been converted or exchanged during a selection of Securities to be redeemed shall be treated by the Trustee as outstanding for the purpose of such selection.

Section 3.03 Notice of Redemption.

At least 30 days but not more than 60 days before a redemption date, the Company shall mail a notice of redemption by first-class mail, postage prepaid, to each Holder of Securities to be redeemed.

The notice shall identify the Securities to be redeemed and shall state:

- (1) the redemption date;
- (2) the redemption price or the formula pursuant to which such price will be calculated;
- (3) if any Security is being redeemed in part, the portion of the principal amount of such Security to be redeemed and that, after the redemption date, upon surrender of such Security, a new Security or Securities in principal amount equal to the unredeemed portion shall be issued upon cancellation of the original Security;
- (4) in the case of Securities of a Series that are convertible or exchangeable into shares of the Company's Capital Stock or other securities, cash or other property, the conversion or exchange price or rate, the date or dates on which the right to convert or exchange the principal of the Securities of such Series to be redeemed will commence or terminate and the place or places where such Securities may be surrendered for conversion or exchange;
- (5) the name and address of the Paying Agent;
- (6) that Securities called for redemption must be surrendered to the Paying Agent to collect the redemption price;
- (7) that interest on Securities called for redemption ceases to accrue on and after the redemption date;

- (8) that the Securities are being redeemed pursuant to the mandatory redemption or the optional redemption provisions, as applicable; and
- (9) the CUSIP number and/or ISIN or other similar number used to identify the Securities, that no representation is hereby deemed to be made by the Trustee as to the correctness or accuracy of any such CUSIP and/or ISIN or other similar number printed in the notice or on such Securities, and that reliance may be placed only on the other identification numbers printed on such Securities.

At the Company's request, the Trustee shall give the notice of redemption in the Company's name and at its expense; *provided, however*, that the Company shall deliver to the Trustee at least 15 days prior to the date on which notice of redemption is to be mailed or such shorter period as may be satisfactory to the Trustee, an Officers' Certificate requesting that the Trustee give such notice and setting forth the information to be stated in such notice as provided in the preceding paragraph.

Section 3.04 Effect of Notice of Redemption.

Once notice of redemption is mailed, Securities called for redemption become due and payable on the redemption date and at the redemption price as set forth in the notice of redemption, which notice, and which obligation to redeem such Securities, may, at the Company's discretion, be subject to one or more conditions precedent as set forth in such notice. Upon surrender to the Paying Agent, such Securities shall be paid at the redemption price, *plus* accrued and unpaid interest to the redemption date.

Section 3.05 Deposit of Redemption Price.

On or before the redemption date, the Company shall deposit with the Paying Agent immediately available funds in the applicable currency sufficient to pay the redemption price of and accrued interest on all Securities to be redeemed on that date.

Section 3.06 Securities Redeemed in Part.

Upon surrender of a Security that is redeemed in part, the Company shall execute and the Trustee shall authenticate for each Holder a new Security of the same Series equal in principal amount to the unredeemed portion of the Security surrendered.

**ARTICLE FOUR
COVENANTS**

Section 4.01 Payment of Securities.

The Company shall pay the principal of, premium, if any, and interest on a Series on the dates, in the currency and in the manner provided in the Securities of the Series. An installment of principal, premium, if any, or interest shall be considered paid on the date it is due if the Paying Agent holds on that date money in the applicable currency designated for and sufficient to pay the installment.

Section 4.02 Maintenance of Office or Agency.

The Company shall maintain the office or agency required under Section 2.03. The Company shall give prior written notice to the Trustee of the location, and any change in the location, of such office or agency. If at any time the Company shall fail to maintain any such required office or agency or shall fail to furnish the Trustee with the address thereof, such presentations, surrenders, notices and demands may be made or served at the address of the Trustee.

Section 4.03 Reports.

At any time when the Company is subject to the reporting requirements of Section 13 or 15(d) of the Exchange Act, the Company shall file with the Trustee, within fifteen (15) days after it actually files the same with the SEC (regardless of when the same is required to be filed with the SEC), each annual, quarterly or current report, information or proxy statement other report which the Company is required to file with the SEC pursuant to Section 13 or 15(d) of the Exchange Act; *provided, however*, that the Company shall not be required to file or deliver to the Trustee any material for which the Company has sought and received, or is seeking, confidential treatment by the SEC; and, *provided further*, that the Company shall be deemed to have filed such information with the Trustee if the Company has filed such information on the SEC's EDGAR system (or any successor system) and such information is publicly available. The Company also shall comply with the other provisions of TIA Section 314(a). The Trustee does not have the duty to review such information, documents or reports, is not considered to have notice of the content of such information, documents or reports and does not have a duty to verify the accuracy of such information, documents or reports.

Section 4.04 Compliance Certificate.

The Company shall deliver to the Trustee within 120 days after the end of each fiscal year of the Company an Officers' Certificate stating whether or not the signers know of any continuing Default by the Company in performing any of its obligations under this Indenture. If they do know of such a Default, the certificate shall describe the Default. In addition, the Company will notify the Trustee within 5 business days upon the Company's knowledge of a Default.

Section 4.05 Waiver of Stay, Extension or Usury Laws.

The Company covenants (to the extent that it may lawfully do so) that it will not at any time insist upon, plead, or in any manner whatsoever claim or take the benefit or advantage of, any stay or extension law or any usury law or other law that would prohibit or forgive the Company from paying all or any portion of the principal of or interest on the Securities of any Series as contemplated herein, wherever enacted, now or at any time hereafter in force, or which may affect the covenants or the performance of this Indenture; and (to the extent that it may lawfully do so) the Company expressly waives all benefit or advantage of any such law, and covenants that it will not hinder, delay or impede the execution of any power herein granted to the Trustee, but will suffer and permit the execution of every such power as though no such law had been enacted.

ARTICLE FIVE SUCCESSOR CORPORATION

Section 5.01 When Company May Merge, etc.

The Company will not consolidate or merge with or into, or sell, lease, convey or otherwise dispose of all or substantially all of its assets (including by way of liquidation or dissolution), to any Person (in each case other than in a transaction in which the Company is the survivor of a consolidation or merger, or the transferee in a sale, lease, conveyance or other disposition) unless:

- (1) the Person formed by or surviving such consolidation or merger (if other than the Company), or to which such sale, lease, conveyance or other disposition will be made (collectively, the "**Successor**") assumes by supplemental indenture in a form reasonably satisfactory to the Trustee all of the obligations of the Company under the Securities, as the case may be, and the Indenture, and
- (2) immediately after giving effect to such transaction, no Default or Event of Default has occurred and is continuing.

The foregoing provisions shall not apply to a transaction the purpose of which is to change the state of incorporation of the Company.

Upon any such consolidation, merger, sale, lease, conveyance or other disposition, the Successor will be substituted for the Company under the Indenture. The Successor may then exercise every power and right of the Company under this Indenture, and except in the case of a lease, the Company will be released from all of its liabilities and obligations in respect of the Securities and the Indenture. If the Company leases all or substantially all of its assets, the Company will not be released from its obligations to pay the principal of and interest, if any, on the Securities.

ARTICLE SIX DEFAULTS AND REMEDIES

Section 6.01 Events of Default.

An “**Event of Default**” with respect to a Series occurs upon the occurrence of any of the following:

- (1) the failure by the Company to pay interest on any Security of such Series when the same becomes due and payable and the continuance of any such failure for a period of 30 days;
- (2) the failure by the Company to pay the principal of any Security of such Series when the same becomes due and payable at maturity, upon acceleration, redemption or otherwise;
- (3) the failure by the Company to comply with any of its agreements or covenants in, or provisions of, the Securities of such Series or this Indenture (as they relate thereto) and such failure continues for the period and after the notice specified below (except in the case of a default with respect to Article Five (or any other provision specified in the applicable supplemental indenture or Authorizing Resolution), which will constitute an Event of Default with notice but without passage of time);
- (4) the Company or any Subsidiary that is a Significant Subsidiary pursuant to or within the meaning of any Bankruptcy Law:
 - (A) commences a voluntary case,
 - (B) consents to the entry of an order for relief against it in an involuntary case,
 - (C) consents to the appointment of a Custodian of it or for all or substantially all of its Property, or
 - (D) makes a general assignment for the benefit of its creditors;

- (5) a court of competent jurisdiction enters an order or decree under any Bankruptcy Law that:
- (A) is for relief against the Company or any Subsidiary that is a Significant Subsidiary as debtor in an involuntary case,
 - (B) appoints a Custodian of the Company or any Subsidiary that is a Significant Subsidiary or a Custodian for all or substantially all of the Property of the Company, or
 - (C) orders the liquidation of the Company or any Subsidiary that is a Significant Subsidiary,
- and the order or decree remains unstayed and in effect for 60 days.

A Default as described in subclause (3) above will not be deemed an Event of Default until the Trustee notifies the Company, or the Holders of at least 25 percent in principal amount of the then outstanding Securities of the applicable Series notify the Company and the Trustee, of the Default and (except in the case of a default with respect to Article Five (or any other provision specified in the applicable supplemental indenture or Authorizing Resolution)) the Company does not cure the Default within 60 days after receipt of the notice. The notice must specify the Default, demand that it be remedied and state that the notice is a "Notice of Default." If such a Default is cured within such time period, it ceases to exist, without any action by the Trustee or any other Person.

The term "**Custodian**" means any receiver, trustee, assignee, liquidator, custodian or similar official under any Bankruptcy Law.

Section 6.02 Acceleration

If an Event of Default (other than an Event of Default with respect to the Company resulting from subclause (4) or (5) above), shall have occurred and be continuing under the Indenture, the Trustee by notice to the Company, or the Holders of at least 25 percent in principal amount of the Securities of the applicable Series then outstanding by notice to the Company and the Trustee, may declare all Securities of such Series to be due and payable immediately. Upon such declaration of acceleration, the amounts due and payable on the Securities of such Series will be due and payable immediately. If an Event of Default with respect to the Company specified in subclauses (4) or (5) above occurs, all amounts due and payable on the Securities of such Series will ipso facto become and be immediately due and payable without any declaration, notice or other act on the part of the Trustee and the Company or any Holder.

Holders of a majority in principal amount of the then outstanding Securities of such Series may rescind an acceleration with respect to such Series and its consequence (except an acceleration due to nonpayment of principal or interest) if the rescission would not conflict with any judgment or decree and if all existing Events of Default (other than the non-payment of accelerated principal) have been cured or waived.

No such rescission shall extend to or shall affect any subsequent Event of Default, or shall impair any right or power consequent thereon.

Section 6.03 Other Remedies

If an Event of Default on a Series occurs and is continuing, the Trustee may pursue any available remedy by proceeding at law or in equity to collect the payment of principal of or interest on the Series or to enforce the performance of any provision in the Securities or this Indenture applicable to the Series.

The Trustee may maintain a proceeding even if it does not possess any of the Securities or does not produce any of them in the proceeding. A delay or omission by the Trustee or any Securityholder in exercising any right or remedy accruing upon an Event of Default shall not impair the right or remedy or constitute a waiver of or acquiescence in the Event of Default. No remedy is exclusive of any other remedy. All available remedies are cumulative.

Section 6.04 Waiver of Existing Defaults.

Subject to Section 10.02, the Holders of a majority in principal amount of the outstanding Securities of a Series on behalf of all the Holders of the Series by notice to the Trustee may waive an existing Default on such Series and its consequences. When a Default is waived, it is cured and stops continuing, and any Event of Default arising therefrom shall be deemed to have been cured; but no such waiver shall extend to any subsequent or other Default or impair any right consequent thereon.

Section 6.05 Control by Majority.

The Holders of a majority in principal amount of the outstanding Securities of a Series may 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 it with respect to such Series. The Trustee, however, may refuse to follow any direction (i) that conflicts with law or this Indenture, (ii) that, subject to Section 7.01, the Trustee determines is unduly prejudicial to the rights of other Securityholders, (iii) that would involve the Trustee in personal liability, if there shall be reasonable grounds for believing that adequate indemnity against such liability is not reasonably assured to it, or (iv) if the Trustee shall not have been provided with indemnity satisfactory to it.

Section 6.06 Limitation on Suits.

A Securityholder of a Series may not pursue any remedy with respect to this Indenture or the Securities of a Series unless:

- (1) the Holder gives to the Trustee written notice of a continuing Event of Default on the Series;
- (2) the Holders of at least 25% in principal amount of the outstanding Securities of the Series make a written request to the Trustee to pursue the remedy;
- (3) such Holder or Holders offer to the Trustee indemnity satisfactory to the Trustee against any loss, liability or expense;
- (4) the Trustee does not comply with the request within 60 days after receipt of the request and the offer of indemnity; and
- (5) no written request inconsistent with such written request shall have been given to the Trustee pursuant to this Section 6.06.

A Securityholder may not use this Indenture to prejudice the rights of another Holder of Securities of the same Series or to obtain a preference or priority over another Holder of Securities of the same Series (it being understood that the Trustee does not have an affirmative duty to ascertain whether or not such actions or forbearances by such Holder are unduly prejudicial to another Holder).

Section 6.07 Rights of Holders to Receive Payment and Convert.

Notwithstanding any other provision of this Indenture, the right of any Holder to receive payment of principal of, premium, if any, and interest on any Security, on or after the respective due dates expressed in the Security, or to bring suit for the enforcement of any such payment on or after such respective dates, is absolute and unconditional and shall not be impaired or affected without the consent of the Holder. Notwithstanding anything to the contrary in this Indenture or the Securities, the right of any Holder of Securities to convert such Securities in accordance with this Indenture, or to bring suit for the enforcement of such right, shall not be impaired or affected without the consent of the Holder.

Section 6.08 Collection Suit by Trustee.

If an Event of Default in payment of interest or principal specified in Section 6.01(1) or (2) occurs and is continuing, the Trustee may recover judgment in its own name and as trustee of an express trust against the Company for the whole amount of principal and interest remaining unpaid.

Section 6.09 Trustee May File Proofs of Claim.

The Trustee may file such proofs of claim and other papers or documents as may be necessary or advisable in order to have the claims of the Trustee (including any claim for the reasonable compensation, expenses, disbursements, and advances of the Trustee, its agents and counsel) and the Securityholders allowed in any judicial proceedings relative to the Company or its creditors or Property, and unless prohibited by applicable law or regulation, may vote on behalf of the Holders in any election of a Custodian, and shall be entitled and empowered to collect and receive any moneys or other Property payable or deliverable on any such claims and to distribute the same and any Custodian in any such judicial proceeding is hereby authorized by each Securityholder to make such payments to the Trustee. Nothing herein shall be deemed to authorize the Trustee to authorize or consent to or vote for or accept or adopt on behalf of any Securityholder any plan of reorganization, arrangement, adjustment or composition affecting the Securities or the rights of any Holder or to authorize the Trustee to vote in respect of the claim of any Securityholder except as aforesaid for the election of the Custodian.

Section 6.10 Priorities.

If the Trustee collects any money pursuant to this Article with respect to Securities of any Series, it shall pay out the money in the following order:

- First:* to the Trustee for amounts due under Section 7.07;
- Second:* to Securityholders of the Series for amounts due and unpaid on the Series for principal and interest, ratably, without preference or priority of any kind, according to the amounts due and payable on the Series for principal and interest, respectively; and
- Third:* to the Company or as a court of competent jurisdiction shall direct.

The Trustee may fix a record date and payment date for any payment to Securityholders pursuant to this Section 6.10.

Section 6.11 Undertaking for Costs.

In any suit for the enforcement of any right or remedy under this Indenture or in any suit against the Trustee for any action taken or omitted by it as Trustee, a court in its discretion may require the filing by any party litigant in the suit of an undertaking to pay the costs of the suit, and the court in its discretion may assess reasonable costs, including reasonable attorneys' fees and expenses, against any party litigant in the suit, having the due regard to the merits and good faith of the claims or defenses made by the party litigant. This Section does not apply to a suit by the Trustee, a suit by a Holder pursuant to Section 6.07 or a suit by Holders of more than 10% in principal amount of the Series.

ARTICLE SEVEN TRUSTEE

Section 7.01 Duties of Trustee.

(a) If an Event of Default has occurred and is continuing with respect to Securities of any Series, the Trustee shall, prior to the receipt of directions from the Holders of a majority in principal amount of the Securities of the Series, exercise its rights and powers and use the same degree of care and skill in their exercise as a prudent man would exercise or use under the circumstances in the conduct of his own affairs.

(b) Except during the continuance of an Event of Default:

(1) The Trustee need perform only those duties that are specifically set forth in this Indenture and no others and no implied covenants or obligations shall be read into this Indenture against the Trustee.

(2) In the absence of bad faith on its part, the Trustee may conclusively rely, as to the truth of the statements and the correctness of the opinions expressed therein, upon certificates or opinions furnished to the Trustee and conforming to the requirements of this Indenture. The Trustee, however, in the case of certificates or opinions specifically required by any provision hereof to be furnished to it, shall examine the certificates and opinions to determine whether or not they conform to the requirements of this Indenture but need not confirm or investigate the accuracy of mathematical calculations or other facts or matters stated therein.

(c) The Trustee may not be relieved from liability for its own negligent action, its own negligent failure to act or its own willful misconduct, except that:

(1) This paragraph does not limit the effect of paragraph (b) of this Section.

(2) The Trustee shall not be liable for any error of judgment made in good faith by a Trust Officer, unless it is proved that the Trustee was negligent in ascertaining the pertinent facts.

(3) The Trustee shall not be liable with respect to any action it takes or omits to take in good faith in accordance with a direction received by it pursuant to Section 6.05 or any other direction of the Holders permitted hereunder.

(d) Every provision of this Indenture that in any way relates to the Trustee is subject to paragraphs (a), (b) and (c) of this Section.

(e) The Trustee may refuse to perform any duty or exercise any right or power unless it receives indemnity satisfactory to it against any loss, liability or expense.

(f) The Trustee shall not be liable for interest on any money received by it except as the Trustee may agree with the Company. Money held in trust by the Trustee need not be segregated from other funds except to the extent required by law.

(g) None of the provisions contained in this Indenture shall require the Trustee to expend or risk its own funds or otherwise incur financial liability in the performance of any of its duties or in the exercise of any of its rights or powers, if there shall be reasonable grounds for believing that the repayment of such funds or adequate indemnity against such liability is not reasonably assured to it.

Section 7.02 Rights of Trustee.

Subject to Section 7.01:

(a) The Trustee may conclusively rely and shall be fully protected in acting or refraining from acting on any document, resolution, certificate, instrument, report, or direction believed by it to be genuine and to have been signed or presented by the proper person. The Trustee need not investigate any fact or matter stated in the document, resolution, certificate, instrument, report, or direction.

(b) Before the Trustee acts or refrains from acting, it may require an Officers' Certificate or an Opinion of Counsel or both, which shall conform to Sections 12.04 and 12.05 hereof and containing such other statements as the Trustee reasonably deems necessary to perform its duties hereunder. The Trustee shall not be liable for any action it takes or omits to take in good faith in reliance on the Officers' Certificate, Opinion of Counsel or any other direction of the Company permitted hereunder.

(c) The Trustee may act through agents and shall not be responsible for the misconduct or negligence of any agent appointed with due care.

(d) The Trustee shall not be liable for any action taken, suffered or omitted by it in good faith and believed by it to be authorized or within the discretion or rights or powers conferred upon it by this Indenture.

(e) The Trustee may consult with counsel of its selection, and the advice of such counsel or any Opinion of Counsel as to matters of law shall be full and complete authorization and protection in respect of any action taken, omitted or suffered by it hereunder in good faith and in accordance with the advice or opinion of such counsel.

(f) Unless otherwise specifically provided in the Indenture, any demand, request, direction or notice from the Company shall be sufficient if signed by an Officer of the Company.

(g) For all purposes under this Indenture, the Trustee shall not be deemed to have notice or knowledge of any Event of Default unless written notice of any Event of Default is received by the Trustee at its address specified in Section 12.02 hereof and such notice references the Securities generally, the Company and this Indenture.

(h) The Trustee shall be under no obligation to exercise any of the rights or powers vested in it by this Indenture at the request or direction of any of the Holders pursuant to this Indenture, unless such Holders shall have offered to the Trustee security or indemnity reasonably satisfactory to the Trustee against the costs, expenses and liabilities which might be incurred by it in compliance with such request or direction.

(i) The Trustee shall not be bound to make any investigation into the facts or matters stated in any resolution, certificate, statement, instrument, opinion, report, notice, request, direction, consent, order, bond, debenture, note, other evidence of indebtedness or other paper or document, but the Trustee, in its discretion, may make such further inquiry or investigation into such facts or matters as it may see fit, and, if the Trustee shall determine to make such further inquiry or investigation, it shall be entitled to examine the books, records and premises of the Company, personally or by agent or attorney at the sole cost of the Company and shall incur no liability or additional liability of any kind by reason of such inquiry or investigation.

(j) In no event shall the Trustee be responsible or liable for special, indirect, or consequential loss or damage of any kind whatsoever (including, but not limited to, loss of profit) irrespective of whether the Trustee has been advised of the likelihood of such loss or damage and regardless of the form of action.

(k) The rights, privileges, protections, immunities and benefits given to the Trustee, including, without limitation, its right to be indemnified, are extended to, and shall be enforceable by, the Trustee in each of its capacities hereunder, and each agent, custodian and other Person employed to act hereunder.

(l) The Trustee may request that the Company deliver a certificate setting forth the names of individuals and/or titles of officers authorized at such time to take specified actions pursuant to this Indenture.

(m) In no event shall the Trustee be responsible or liable for any failure or delay in the performance of its obligations hereunder arising out of or caused by, directly or indirectly, forces beyond its control, including, without limitation, strikes, work stoppages, accidents, acts of war or terrorism, civil or military disturbances, nuclear or natural catastrophes or acts of God, and interruptions, loss or malfunctions of utilities, communications or computer (software and hardware) services; it being understood that the Trustee shall use reasonable efforts which are consistent with accepted practices in the banking industry to resume performance as soon as practicable under the circumstances.

Section 7.03 Individual Rights of Trustee.

The Trustee in its individual or any other capacity may become the owner or pledgee of Securities and may otherwise deal with the Company or its affiliates with the same rights it would have if it were not Trustee. Any Agent may do the same with like rights. The Trustee, however, must comply with Sections 7.10 and 7.11.

Section 7.04 Trustee's Disclaimer.

The Trustee makes no representation as to the validity or adequacy of this Indenture, the Securities or of any prospectus used to sell the Securities of any Series; it shall not be accountable for the Company's use of the proceeds from the Securities; it shall not be accountable for any money paid to the Company, or upon the Company's direction, if made under and in accordance with any provision of this Indenture; it shall not be responsible for the use or application of any money received by any Paying Agent other than the Trustee; and it shall not be responsible for any statement of the Company in this Indenture or in the Securities other than its certificate of authentication.

Section 7.05 Notice of Defaults.

If a Default on a Series occurs and is continuing and if it is known to the Trustee, the Trustee shall deliver to each Securityholder of the Series notice of the Default (which shall specify any uncured Default known to it) within 90 days after the Trustee obtains such knowledge. Except in the case of a default in payment of principal of or interest on a Series, the Trustee may withhold the notice if and so long as the board of directors of the Trustee, the executive or any trust committee of such directors and/or responsible officers of the Trustee in good faith determine(s) that withholding the notice is in the interests of Holders of the Series.

Section 7.06 Reports by Trustee to Holders.

Within 60 days after each May 15 beginning with the May 15 following the date of this Base Indenture, the Trustee shall mail to each Securityholder a brief report dated as of such May 15 that complies with TIA § 313(a) (but if no event described in TIA § 313(1) through (8) has occurred within the twelve months preceding the reporting date no report in relation thereto need be transmitted). The Trustee also shall comply with TIA § 313(b).

A copy of each report at the time of its mailing to Securityholders shall be delivered to the Company and filed by the Trustee with the SEC and each national securities exchange on which the Securities are listed. The Company agrees to notify the Trustee of each national securities exchange on which the Securities are listed.

Section 7.07 Compensation and Indemnity.

The Company shall pay to the Trustee from time to time reasonable compensation for its services subject to any written agreement between the Trustee and the Company (which compensation shall not be limited by any provision of law in regard to the compensation of a trustee of an express trust). The Company shall reimburse the Trustee upon request for all reasonable out-of-pocket expenses incurred by it. Such expenses shall include the reasonable compensation and expenses of the Trustee's agents and counsel. The Company shall indemnify the Trustee, its officers, directors, employees and agents and hold it harmless against any loss, liability or expense incurred or made by or on behalf of it in connection with the administration of this Indenture or the trust hereunder and its duties hereunder including the costs and expenses of defending itself against or investigating any claim in the premises. The Trustee shall notify the Company promptly of any claim of which it has received written notice and for which it may seek indemnity. The Company need not reimburse any expense or indemnify against any loss or liability incurred by the Trustee through the Trustee's, or its officers', directors', or employees' negligence or willful misconduct.

Unless otherwise provided in any supplemental indenture or Authorizing Resolution relating to any Series, to ensure the Company's payment obligations in this Section, the Trustee shall have a claim prior to the Securities of all Series on all money or Property held or collected by the Trustee, except that held in trust to pay principal of or interest on particular Securities. When the Trustee incurs expenses or renders services in connection with an Event of Default specified in Section 6.01 or in connection with Article Six hereof, the expenses (including the reasonable fees and expenses of its counsel) and the compensation for services in connection therewith are to constitute expenses of administration under any Bankruptcy Law. Section 7.07 shall survive the discharge of the Indenture or resignation of Trustee.

Section 7.08 Replacement of Trustee.

The Trustee may resign with respect to Securities of any or all Series by so notifying the Company. The Holders of a majority in principal amount of the outstanding Securities (or of the relevant Series) may remove the Trustee by so notifying the removed Trustee in writing and may appoint a successor trustee with the Company's consent. Such resignation or removal shall not take effect until the appointment by the Securityholders of the relevant Series or the Company as hereinafter provided of a successor trustee and the acceptance of such appointment by such successor trustee. The Company may remove the Trustee and any Securityholder may petition any court of competent jurisdiction for the removal of the Trustee and the appointment of a successor trustee for any or no reason, including if:

- (1) the Trustee fails to comply with Section 7.10 after written request by the Company or any bona fide Securityholder who has been a Securityholder for at least six months;
- (2) the Trustee is adjudged a bankrupt or an insolvent;
- (3) a receiver or other public officer takes charge of the Trustee or its Property; or
- (4) the Trustee becomes incapable of acting.

If the Trustee resigns or is removed or if a vacancy exists in the office of Trustee for any reason, the Company shall promptly appoint a successor trustee with respect to the Securities of the relevant Series. If a successor trustee does not take office within 30 days after the retiring Trustee resigns or is removed, the retiring Trustee at the expense of the Company, the Company or any Holder may petition any court of competent jurisdiction for the appointment of a successor trustee.

A successor trustee shall deliver a written acceptance of its appointment to the retiring Trustee and to the Company. Immediately after that, the retiring Trustee shall, upon payment of its charges hereunder, transfer all

Property held by it as Trustee to the successor trustee, the resignation or removal of the retiring Trustee shall become effective, and the successor trustee shall have all the rights, powers and duties of the Trustee under this Indenture. A successor trustee shall mail notice of its succession to each Securityholder.

Section 7.09 Successor Trustee by Merger, etc.

If the Trustee consolidates with, merges with or into or converts into, or transfers all or substantially all of its corporate trust business to, another corporation, the successor corporation without any further act shall be the successor trustee.

Section 7.10 Eligibility; Disqualification.

This Indenture shall always have a Trustee who satisfies the requirements of TIA § 310(a)(1). The Trustee shall have a combined capital and surplus of at least \$10,000,000 as set forth in its most recent published annual report of condition. The Trustee shall comply with TIA § 310(b).

Section 7.11 Preferential Collection of Claims Against Company.

The Trustee shall comply with TIA § 311(a), excluding any creditor relationship listed in TIA § 311(b). A Trustee who has resigned or been removed shall be subject to TIA § 311(a) to the extent indicated therein.

**ARTICLE EIGHT
DISCHARGE OF INDENTURE**

Section 8.01 Defeasance upon Deposit of Moneys or Government Obligations.

(a) The Company may, at its option and at any time, elect to have either paragraph (b) or paragraph (c) below be applied to the outstanding Securities of any Series upon compliance with the applicable conditions set forth in paragraph (d).

(b) Upon the Company's exercise under paragraph (a) of the option applicable to this paragraph (b) with respect to any Series, the Company shall be deemed to have been released and discharged from its obligations with respect to the outstanding Securities of the Series on the date the applicable conditions set forth below are satisfied (hereinafter, "**Legal Defeasance**"). For this purpose, such Legal Defeasance means that the Company shall be deemed to have paid and discharged the entire indebtedness represented by the outstanding Securities of a Series, which shall thereafter be deemed to be "outstanding" only for the purposes of the Sections and matters under this Indenture referred to in (i) and (ii) below, and the Company shall be deemed to have satisfied all its other obligations under such Securities and this Indenture insofar as such Securities are concerned, except for the following which shall survive until otherwise terminated or discharged hereunder: (i) the rights of Holders of outstanding Securities of a Series to receive solely from the trust fund described in paragraph (d) below and as more fully set forth in such paragraph, payments in respect of the principal of and interest on such Securities when such payments are due and (ii) obligations listed in Section 8.02, subject to compliance with this Section 8.01. The Company may exercise its option under this paragraph (b) with respect to a Series notwithstanding the prior exercise of its option under paragraph (c) below with respect to the Securities of the Series.

(c) Upon the Company's exercise under paragraph (a) of the option applicable to this paragraph (c) with respect to a Series, the Company shall be released and discharged from the obligations under any covenant contained in Article Five, Sections 4.03 and any other covenant contained in or referenced in the Authorizing Resolution or supplemental indenture relating to such Series (to the extent such release and discharge shall not be prohibited thereby), on and after the date the conditions set forth below are satisfied (hereinafter, "**Covenant Defeasance**"), and the Securities of such Series shall thereafter be deemed to be not "outstanding" for the purpose of any direction, waiver, consent or declaration or act of Holders (and the consequences of any thereof) in connection with such covenants, but shall continue to be deemed "outstanding" for all other purposes hereunder. For this purpose, such

Covenant Defeasance means that, with respect to the outstanding Securities of a Series, the Company may omit to comply with and shall have no liability in respect of any term, condition or limitation set forth in the covenants described in the preceding sentence, whether directly or indirectly, by reason of any reference elsewhere herein to any such covenant or by reason of any reference in any such covenant to any other provision herein or in any other document and such omission to comply shall not constitute a Default or an Event of Default under Section 6.01(3) or otherwise, but, except as specified above, the remainder of this Indenture and such Securities shall be unaffected thereby.

(d) The following shall be the conditions to application of either paragraph (b) or paragraph (c) above to the outstanding Securities of the applicable Series:

(1) The Company shall have irrevocably deposited in trust with the Trustee (or another qualifying trustee), pursuant to an irrevocable trust and security agreement in form and substance reasonably satisfactory to the Trustee, money in the currency in which the Securities of such Series are payable or Government Obligations or a combination thereof in such amounts and at such times as are sufficient, in the opinion of a nationally recognized firm of independent public accountants, to pay the principal of and interest on the outstanding Securities of such Series to maturity or redemption; *provided, however*, that the Trustee (or other qualifying trustee) shall have received an irrevocable written order from the Company instructing the Trustee (or other qualifying trustee) to apply such money or the proceeds of such Government Obligations to said payments with respect to the Securities of such Series to maturity or redemption;

(2) No Default or Event of Default (other than a Default or Event of Default resulting from non-compliance with any covenant from which the Company is released upon effectiveness of such Legal Defeasance or Covenant Defeasance pursuant to paragraph (b) or (c) hereof, as applicable) shall have occurred and be continuing on the date of such deposit or result therefrom;

(3) (i) In the event the Company elects paragraph (b) hereof, the Company shall deliver to the Trustee an Opinion of Counsel in the United States, in form and substance reasonably satisfactory to the Trustee, to the effect that (A) the Company has received from, or there has been published by, the Internal Revenue Service a ruling or (B) since the Issue Date pertaining to such Series, there has been a change in the applicable federal income tax law, in either case to the effect that, and based thereon such Opinion of Counsel shall state that, or (ii) in the event the Company elects paragraph (c) hereof, the Company shall deliver to the Trustee an Opinion of Counsel in the United States, in form and substance reasonably satisfactory to the Trustee, to the effect that, in the case of clauses (i) and (ii), and subject to customary assumptions and exclusions, Holders of the Securities of such Series will not recognize income, gain or loss for federal income tax purposes as a result of such deposit and the defeasance contemplated hereby and will be subject to federal income tax in the same amounts and in the same manner and at the same times as would have been the case if such deposit and defeasance had not occurred;

(4) The Company shall have delivered to the Trustee an Officers' Certificate, stating that the deposit under clause (1) was not made by the Company with the intent of preferring the Holders of the Securities of such Series over any other creditors of the Company or with the intent of defeating, hindering, delaying or defrauding any other creditors of the Company or others;

(5) The Company shall have delivered to the Trustee an Opinion of Counsel (subject to customary assumptions and qualifications) to the effect that, assuming no intervening bankruptcy of the Company between the date of deposit and the 91st day following the deposit and assuming that no Holder is an "insider" of the Company under applicable Bankruptcy Law, after the 91st day following the deposit, the trust funds shall not be subject to the effect of Section 547 of the United States Bankruptcy Code or any analogous New York State law provision; and

(6) The Company has delivered to the Trustee an Officers' Certificate and an Opinion of Counsel, each stating that all conditions precedent specified herein relating to the defeasance contemplated by this Section 8.01 have been complied with.

In the event all or any portion of the Securities of a Series are to be redeemed through such irrevocable trust, the Company must make arrangements satisfactory to the Trustee, at the time of such deposit, for the giving of the notice of such redemption or redemptions by the Trustee in the name and at the expense of the Company.

(e) In addition to the Company's rights above under this Section 8.01, the Company may terminate all of its obligations under this Indenture with respect to a Series, when:

(1) All Securities of such Series theretofore authenticated and delivered (other than Securities which have been destroyed, lost or stolen and which have been replaced or paid as provided in Section 2.07 and Securities for whose payment money has theretofore been deposited in trust or segregated and held in trust by the Company and thereafter repaid to the Company or discharged from such trust) have been delivered to the Trustee for cancellation or all such Securities not theretofore delivered to the Trustee for cancellation (A) have become due and payable, (B) will become due and payable at maturity within one year or (C) are to be called for redemption within one year under arrangements satisfactory to the Trustee for the giving of notice of redemption by the Trustee in the name, and at the expense, of the Company, and in each such case, the Company has irrevocably deposited or caused to be deposited with the Trustee (or another qualifying trustee) as trust funds in trust solely for that purpose an amount of money in the currency in which the Securities of such Series are payable or Government Obligations or a combination thereof sufficient, in the opinion of a nationally recognized firm of independent public accountants, to pay and discharge the entire indebtedness on the Securities of such Series not theretofore delivered to the Trustee for cancellation, for principal of and interest on the Securities of such Series, on the date of such deposit or to the maturity or redemption date, as the case may be;

(2) The Company has paid or caused to be paid all other sums payable hereunder by the Company;

(3) The Company has delivered irrevocable instructions to the Trustee (or such other qualifying trustee), to apply the deposited money toward the payment of the Securities of such Series at maturity or redemption, as the case may be; and

(4) The Company has delivered to the Trustee an Officers' Certificate and an Opinion of Counsel, stating that all conditions precedent specified in this Section 8.01(e) relating to the satisfaction and discharge of this Indenture have been complied with.

Section 8.02 Survival of the Company's Obligations.

Notwithstanding the satisfaction and discharge of this Indenture under Section 8.01, the Company's obligations in Paragraph 8 of the Securities and Sections 2.03 through 2.07, 4.01, 7.07, 7.08, 8.04 and 8.05, however, shall survive until the Securities of an applicable Series are no longer outstanding. Thereafter, the Company's obligations in Paragraph 8 of the Securities of such Series and Sections 7.07, 8.04 and 8.05 shall survive (as they relate to such Series) such satisfaction and discharge.

Section 8.03 Application of Trust Money.

The Trustee shall hold in trust money or Government Obligations deposited with it pursuant to Section 8.01. It shall apply the deposited money and the money from Government Obligations in accordance with this Indenture to the payment of principal of and interest on the Securities of the defeased Series.

Section 8.04 Repayment to the Company.

The Trustee and the Paying Agent shall promptly pay to the Company upon request any excess money or securities held by them at any time. The Trustee and the Paying Agent shall pay to the Company upon request any money held by them for the payment of principal or interest that remains unclaimed for two years, *provided, however*, that the Trustee or such Paying Agent, before being required to make any such repayment, may at the expense of the Company cause to be published once in a newspaper of general circulation in the City of New York or mail to each such Holder notice that such money remains unclaimed and that, after a date specified therein, which shall not be less than 30 days from the date of such publication or mailing, any unclaimed balance of such money

then remaining will be repaid to the Company. After payment to the Company, Securityholders entitled to the money must look to the Company for payment as general creditors unless applicable abandoned property law designates another person and all liability of the Trustee or such Paying Agent with respect to such money shall cease.

Section 8.05 Reinstatement.

If the Trustee is unable to apply any money or Government Obligations in accordance with Section 8.01 by reason of any legal proceeding or by reason of any order or judgment of any court or governmental authority enjoining, restraining or otherwise prohibiting such application, the Company's obligations under this Indenture and the Securities relating to the Series shall be revived and reinstated as though no deposit had occurred pursuant to Section 8.01 until such time as the Trustee is permitted to apply all such money or Government Obligations in accordance with Section 8.01; *provided, however*, that (a) if the Company has made any payment of interest on or principal of any Securities of the Series because of the reinstatement of its obligations hereunder, the Company shall be subrogated to the rights of the Holders of such Securities to receive such payment from the money or Government Obligations held by the Trustee and (b) unless otherwise required by any legal proceeding or any order or judgment of any court or governmental authority, the Trustee shall return all such money or Government Obligations to the Company promptly after receiving a written request therefor at any time, if such reinstatement of the Company's obligations has occurred and continues to be in effect.

ARTICLE NINE RESERVED

ARTICLE TEN AMENDMENTS, SUPPLEMENTS AND WAIVERS

Section 10.01 Without Consent of Holders.

The Company and the Trustee may amend or supplement this Indenture or the Securities of a Series without notice to or consent of any Securityholder of such Series:

- (1) to cure any ambiguity, omission, defect or inconsistency;
- (2) to comply with Article Five;
- (3) to provide that specific provisions of this Indenture shall not apply to a Series not previously issued or to make a change to specific provisions of this Indenture that only applies to any Series not previously issued or to additional Securities of a Series not previously issued;
- (4) to create a Series and establish its terms;
- (5) to provide for uncertificated Securities in addition to or in place of certificated Securities;
- (6) to release a guarantor in respect of any Series which, in accordance with the terms of this Indenture applicable to the particular Series, ceases to be liable in respect of its guarantee;

- (7) to add a guarantor in respect of any Series;
- (8) to secure any Series;
- (9) to add to the covenants of the Company for the benefit of the Holders or surrender any right or power conferred upon the Company;
- (10) to appoint a successor trustee with respect to the Securities;
- (11) to comply with requirements of the SEC in order to effect or maintain the qualification of this Indenture under the TIA;
- (12) to make any other change that does not adversely affect the rights of Securityholders; and
- (13) to conform the provisions of the Indenture to the final offering memorandum or prospectus in respect of any Series.

After an amendment under this Section 10.01 becomes effective, the Company shall mail notice of such amendment to the Securityholders.

Section 10.02 With Consent of Holders.

The Company and the Trustee may amend or supplement any provision of the Securities of a Series or of this Indenture relating to such Series without notice to any Securityholder of such Series but with the written consent of the Holders of at least a majority in principal amount of the outstanding Securities of such Series (including consents obtained in connection with a purchase of, or tender offer or exchange offer for, Securities of such Series). Each such Series shall vote as a separate class. The Holders of a majority in principal amount of the outstanding Securities of any Series may waive compliance by the Company with any provision of the Securities of such Series or of this Indenture relating to such Series without notice to any Securityholder (including any waiver granted in connection with a purchase of, or tender offer or exchange offer for, Securities of such Series). Without the consent of each Holder of a Security the terms of which are directly amended, supplemented or waived, however, an amendment, supplement or waiver, including a waiver pursuant to Section 6.04, may not (with respect to any Securities of such Series held by a non-consenting Holder):

- (1) reduce the amount of Securities of the relevant Series whose Holders must consent to an amendment, supplement or waiver;
- (2) reduce the rate of or extend the time for payment of interest, including defaulted interest, on any Security;

(3) reduce the principal of or extend the fixed maturity of any Security or alter the provisions (including related definitions) with respect to redemption of any Security pursuant to Article Three hereof or with

respect to any obligations on the part of the Company to offer to purchase or to redeem Securities of a Series pursuant to the Authorizing Resolution or supplemental indenture pertaining to such Series in a manner adverse to Holders;

(4) make any change that adversely affects any right of a Holder to convert or exchange any Security into or for shares of the Company's Capital Stock or other securities, cash or other property in accordance with the terms of such Security;

(5) modify the ranking or priority of the Securities of the relevant Series or any guarantee thereof;

(6) release any guarantor of any Series from any of its obligations under its guarantee or this Indenture otherwise than in accordance with the terms of this Indenture;

(7) make any change in Sections 6.04, 6.07 or this Section 10.02, except to increase the percentage required for modification or waiver or to provide for consent of each affected Holder of Securities of such Series;

(8) waive a continuing Default or Event of Default in the payment of the principal of or interest on any Security; or

(9) make any Security payable at a place or in money other than that stated in the Security, or impair the right of any Securityholder to bring suit as permitted by Section 6.07.

An amendment of a provision included solely for the benefit of one or more Series does not affect the interests of Securityholders of any other Series.

It shall not be necessary for the consent of the Holders under this Section to approve the particular form of any proposed supplement, but it shall be sufficient if such consent approves the substance thereof.

Section 10.03 Compliance with Trust Indenture Act.

Every amendment to or supplement of this Indenture or any Securities shall comply with the TIA as then in effect.

Section 10.04 Revocation and Effect of Consents.

A consent to an amendment, supplement or waiver by a Holder shall bind the Holder and every subsequent Holder of a Security or portion of a Security that evidences the same debt as the consenting Holder's Security, even if notation of the consent is not made on any Security. Unless otherwise provided in the consent or the consent solicitation statement or other document describing the terms of the consent, any Holder or subsequent Holder may revoke the consent as to its Security or portion of a Security. Any revocation of a consent by the Holder of a Security or any such subsequent Holder shall be effective only if the Trustee receives the notice of revocation before the date on which the Trustee receives an Officers' Certificate from the Company certifying that the requisite number of consents have been received.

The Company may, but shall not be obligated to, fix a record date for the purpose of determining the Holders of Securities of any Series entitled to consent to any amendment, supplement or waiver, which record date shall be at least 10 days prior to the first solicitation of such consent. If a record date is fixed, and if Holders otherwise have a right to revoke their consent under the consent or the consent solicitation statement or other document describing the terms of the consent, then notwithstanding the second to last sentence of the immediately preceding paragraph, those Persons who were Holders at such record date (or their duly designated proxies), and only those Persons, shall be entitled to revoke any consent previously given, whether or not such Persons continue to be Holders after such record date. No such consent shall be valid or effective for more than 90 days after such record date.

An amendment, supplement or waiver with respect to a Series becomes effective upon the (i) receipt by the Company or the Trustee of the requisite consents, (ii) satisfaction of any conditions to effectiveness as set forth in this Indenture or any indenture supplemental hereto containing such amendment, supplement or waiver and (iii) execution of such amendment, supplement or waiver (or the related supplemental indenture) by the Company and the Trustee. After an amendment, supplement or waiver with respect to a Series becomes effective, it shall bind every Holder of such Series, unless it makes a change described in any of clauses (1) through (9) of Section 10.02, in which case, the amendment, supplement or waiver shall bind a Holder of a Security of such Series only if it has consented to such amendment, supplement or waiver and every subsequent Holder of a Security or portion of a Security that evidences the same debt as the consenting Holder's Security; *provided* that no such waiver shall impair or affect the right of any Holder to receive payment of principal of and interest on a Security, on or after the respective due dates expressed in such Security, or to bring suit for the enforcement of any such payment on or after such respective dates without the consent of such Holder.

Section 10.05 Notation on or Exchange of Securities.

If an amendment, supplement or waiver changes the terms of a Security, the Company may require the Holder of the Security to deliver it to the Trustee, at which time the Trustee shall place an appropriate notation on the Security about the changed terms and return it to the Holder. Alternatively, if the Company or the Trustee so determines, the Company in exchange for the Security shall issue and the Trustee shall authenticate a new Security that reflects the changed terms.

Section 10.06 Trustee to Sign Amendments, etc.

Subject to Section 7.02(b), the Trustee shall sign any amendment, supplement or waiver authorized pursuant to this Article if the amendment, supplement or waiver does not adversely affect the rights, duties, liabilities or immunities of the Trustee. If it does, the Trustee may but need not sign it. In signing or refusing to sign such amendment or supplemental indenture, the Trustee shall be provided with and shall be fully protected in relying upon, an Officers' Certificate and an Opinion of Counsel as conclusive evidence that such amendment, supplement or waiver is authorized or permitted by this Indenture, and (solely with respect to such Opinion of Counsel) that it will be valid and binding upon the Company and enforceable in accordance with its terms.

ARTICLE ELEVEN SECURITIES IN FOREIGN CURRENCIES

Section 11.01 Applicability of Article.

Whenever this Indenture provides for (i) any action by, or the determination of any of the rights of, Holders of Securities of any Series in which not all of such Securities are denominated in the same currency, or (ii) any distribution to Holders of Securities, in the absence of any provision to the contrary pursuant to this Indenture or the Securities of any particular Series, any amount in respect of any Security denominated in a Foreign Currency shall be treated for any such action or distribution as that amount of Dollars that could be obtained for such amount on such reasonable basis of exchange and as of the record date with respect to Securities of such Series (if any) for such action, determination of rights or distribution (or, if there shall be no applicable record date, such other date reasonably proximate to the date of such action, determination of rights or distribution) as the Company may specify in a written notice to the Trustee or, in the absence of such written notice, as the Trustee may determine.

ARTICLE TWELVE MISCELLANEOUS

Section 12.01 Trust Indenture Act Controls.

If any provision of this Indenture limits, qualifies or conflicts with another provision which is required to be included in this Indenture by the TIA, the required provision shall control.

Section 12.02 Notices.

Any order, consent, notice or communication shall be sufficiently given if in writing and delivered in person or mailed by first class mail, postage prepaid, addressed as follows:

if to the Company:

[]

if to the Trustee:

[]

The Company or the Trustee by notice to the other may designate additional or different addresses for subsequent notices or communications.

Any notice or communication mailed to a Securityholder shall be mailed to him by first class mail at his address as it appears on the registration books of the Registrar and shall be sufficiently given to him if so mailed within the time prescribed.

Failure to mail a notice or communication to a Securityholder or any defect in it shall not affect its sufficiency with respect to other Securityholders. If a notice or communication is mailed in the manner provided above, it is duly given, whether or not the addressee receives it except that notice to the Trustee shall only be effective upon receipt thereof by the Trustee.

If the Company mails notice or communications to the Securityholders, it shall mail a copy to the Trustee at the same time.

In addition to the foregoing, the Trustee agrees to accept and act upon notice, instructions or directions pursuant to this Indenture sent by unsecured e-mail, facsimile transmission or other similar unsecured electronic methods. If the party elects to give the Trustee e-mail or facsimile instructions (or instructions by a similar electronic method) and the Trustee in its discretion elects to act upon such instructions, the Trustee's understanding of such instructions shall be deemed controlling. The Trustee shall not be liable for any losses, costs or expenses arising directly or indirectly from the Trustee's reliance upon and compliance with such instructions notwithstanding such instructions conflict or are inconsistent with a subsequent written instruction. The party providing electronic instructions agrees to assume all risks arising out of the use of such electronic methods to submit instructions and directions to the Trustee, including without limitation the risk of the Trustee acting on unauthorized instructions, and the risk of interception and misuse by third parties.

Section 12.03 Communications by Holders with Other Holders.

Securityholders may communicate pursuant to TIA § 312(b) with other Securityholders with respect to their rights under this Indenture or the Securities. The Company, the Trustee, the Registrar and anyone else shall have the protection of TIA § 312(c).

Section 12.04 Certificate and Opinion as to Conditions Precedent.

Upon any request or application by the Company to the Trustee to take any action under this Indenture, the Company shall furnish to the Trustee:

- (1) an Officers' Certificate (which shall include the statements set forth in Section 12.05) stating that, in the opinion of the signers, all conditions precedent, if any, provided for in this Indenture relating to the proposed action have been complied with; and

- (2) an Opinion of Counsel (which shall include the statements set forth in Section 12.05) stating that, in the opinion of such counsel, all such conditions precedent, if any, provided for in this Indenture relating to the proposed action or inaction, have been complied with.

Any Officers' Certificate may be based, and may state that it is so based, insofar as it relates to legal matters, upon a certificate or opinion of, or representations by, internal or external legal counsel. Any Opinion of Counsel may be based, and may state that it is so based, insofar as it relates to factual matters, upon a certificate or opinion of, or representations by, an Officer or Officers of the Company or any guarantor stating that the information with respect to such factual matters is known to the Company or such guarantor, unless such counsel knows that the certificate or opinion or representations with respect to such matters are erroneous.

Section 12.05 Statements Required in Certificate or Opinion.

Each certificate or opinion with respect to compliance with a condition or covenant provided for in this Indenture shall include:

- (1) a statement that the person making such certificate or opinion has read such covenant or condition;
- (2) a brief statement as to the nature and scope of the examination or investigation upon which the statements or opinions contained in such certificate or opinion are based;
- (3) a statement that, in the opinion of such person, he has made such examination or investigation as is necessary to enable him to express an informed opinion as to whether or not such covenant or condition has been complied with; and
- (4) a statement as to whether or not, in the opinion of such person, such condition or covenant has been complied with.

Section 12.06 Rules by Trustee and Agents.

The Trustee may make reasonable rules for action by or a meeting of Securityholders. The Registrar or Paying Agent may make reasonable rules for its functions.

Section 12.07 Legal Holidays.

A “**Legal Holiday**” is a Saturday, a Sunday, a legal holiday or a day on which banking institutions in New York, New York are not required to be open. If a payment date is a Legal Holiday, payment may be made on the next succeeding day that is not a Legal Holiday, and no interest shall accrue for the intervening period. If this Indenture provides for a time period that ends or requires performance of any non-payment obligation by a day that is not a Business Day, then such time period shall instead be deemed to end on, and such obligation shall instead be performed by, the next succeeding Business Day. A “**Business Day**” is any day other than a Legal Holiday.

Section 12.08 Governing Law.

The laws of the State of New York shall govern this Indenture and the Securities of each Series.

Section 12.09 No Adverse Interpretation of Other Agreements.

This Indenture may not be used to interpret another indenture, loan or debt agreement of the Company or a Subsidiary. Any such indenture, loan or debt agreement may not be used to interpret this Indenture.

Section 12.10 No Recourse Against Others.

All liability described in Paragraph 12 of the Securities of any director, officer, employee or stockholder, as such, of the Company is, to the fullest extent permitted by applicable law, waived and released.

Section 12.11 Successors and Assigns.

All covenants and agreements of the Company in this Indenture and the Securities shall bind its successors and assigns. All agreements of the Trustee in this Indenture shall bind its successors and assigns.

Section 12.12 Duplicate Originals.

The parties may sign any number of copies of this Indenture. Each signed copy shall be an original, but all of them together represent the same agreement.

Section 12.13 Severability.

In case any one or more of the provisions contained in this Indenture or in the Securities of a Series shall for any reason be held to be invalid, illegal or unenforceable in any respect, such invalidity, illegality or unenforceability shall not affect any other provisions of this Indenture or of such Securities.

Section 12.14 Waiver of Jury Trial.

EACH OF THE COMPANY AND THE TRUSTEE HEREBY IRREVOCABLY WAIVES, TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, ANY AND ALL RIGHT TO TRIAL BY JURY IN ANY LEGAL PROCEEDING ARISING OUT OF OR RELATING TO THIS INDENTURE, THE SECURITIES OR THE TRANSACTION CONTEMPLATED HEREBY.

SIGNATURES

IN WITNESS WHEREOF, the parties have caused this Indenture to be duly executed, all as of the date first above written.

**X4 PHARMACEUTICALS,
INC.**

By: _____

Name:

Title:

[], as Trustee

By: _____

Name:

Title:

EXHIBIT A

No.

CUSIP/ISIN No.:

[Title of Security]

X4 PHARMACEUTICALS, INC.
a Delaware corporation

promises to pay to or registered assigns the principal sum of [Dollars]* on .

Interest Payment Dates: and

Record Dates: and

Authenticated: Dated:

**X4 PHARMACEUTICALS,
INC.**

By: _____

Name:
Title:

[],

as Trustee, certifies that this is one of the Securities referred to in the within mentioned Indenture.

By: _____
Authorized Signatory

* Or other currency. Insert corresponding provisions on reverse side of Security in respect of foreign currency denomination or interest payment requirement.

X4 PHARMACEUTICALS, INC.

[Title of Security]

X4 PHARMACEUTICALS, INC., a Delaware corporation (together with its successors and assigns, the “**Company**”), issued this Security under an Indenture dated as of (as amended, modified or supplemented from time to time in accordance therewith, the “**Base Indenture**”), as supplemented by the Supplemental Indenture dated as of (the “**Supplemental Indenture**” and together with the Base Indenture, the “**Indenture**”), by and among the Company and [], as trustee (in such capacity, the “**Trustee**”), to which reference is hereby made for a statement of the respective rights, obligations, duties and immunities thereunder of the Company, the Trustee and the Holders and of the terms upon which the Securities are, and are to be, authorized and delivered. All terms used in this Security that are defined in the Indenture shall have the meanings assigned to them therein.

1. Interest. The Company promises to pay interest on the principal amount of this Security at the rate per annum shown above. The Company will pay interest semiannually on and of each year, commencing , , until the principal is paid or made available for payment. Interest on the Securities will accrue from the most recent date to which interest has been paid or duly provided for or, if no interest has been paid, from . Interest will be computed on the basis of a 360-day year of twelve 30-day months.

2. Method of Payment. The Company will pay interest on the Securities (except defaulted interest, if any, which will be paid on such special payment date to Holders of record on such special record date as may be fixed by the Company) to the persons who are registered Holders of Securities at the close of business on the [Insert record dates] immediately preceding the interest payment date. Holders must surrender Securities to a Paying Agent to collect principal payments. The Company will pay principal and interest in money of [Insert applicable country or currency] that at the time of payment is legal tender for payment of public and private debts.

3. Paying Agent and Registrar. Initially, the Trustee will act as Paying Agent and Registrar. The Company may change or appoint any Paying Agent, Registrar or co-Registrar without notice. The Company or any of its Subsidiaries or any of their Affiliates may act as Paying Agent, Registrar or co-Registrar.

4. Optional Redemption.¹ The Company may redeem the Securities at any time on or after , in whole or in part, at the following redemption prices (expressed as a percentage of their principal amount) together with interest accrued and unpaid to the date fixed for redemption:

If redeemed during the twelve-month period commencing on and ending on in each of the following years	Percentage

[Insert provisions relating to redemption at option of Holders, if any]

Notice of redemption will be mailed at least 30 days but not more than 60 days before the redemption date to each Holder of Securities to be redeemed at its registered address. Securities in denominations larger than ² may be redeemed in part. On and after the redemption date interest ceases to accrue on Securities or portions of them called for redemption, *provided* that if the Company shall default in the payment of such Securities

¹ If applicable.

² Insert applicable denominations and multiples.

at the redemption price together with accrued interest, interest shall continue to accrue at the rate borne by the Securities.

5. Mandatory Redemption.³ The Company shall redeem []% of the aggregate principal amount of Securities originally issued under the Indenture on each of [], which redemptions are calculated to retire []% of the Securities originally issued prior to maturity. Such redemptions shall be made at a redemption price equal to 100% of the principal amount thereof, together with accrued interest to the redemption date. The Company may reduce the principal amount of Securities to be redeemed pursuant to this Paragraph 5 by the principal amount of any Securities previously redeemed, retired or acquired, otherwise than pursuant to this Paragraph 5, that the Company has delivered to the Trustee for cancellation and not previously credited to the Company's obligations under this Paragraph 5. Each such Security shall be received and credited for such purpose by the Trustee at the redemption price and the amount of such mandatory redemption payment shall be reduced accordingly.

6. Denominations, Transfer, Exchange. The Securities are in registered form only without coupons in denominations of ⁴ and integral multiples of in excess thereof.⁵ A Holder may transfer or exchange Securities by presentation of such Securities to the Registrar or a co-Registrar with a request to register the transfer or to exchange them for an equal principal amount of Securities of other denominations. The Registrar may require a Holder, among other things, to furnish appropriate endorsements and transfer documents and to pay any taxes and fees required by law or permitted by the Indenture. The Registrar need not transfer or exchange any Security selected for redemption or purchase, except the unredeemed or unpurchased part thereof if the Security is redeemed or purchased in part, or transfer or exchange any Securities for a period of 15 days before a selection of Securities to be redeemed or purchased.

7. Persons Deemed Owners. The registered Holder of this Security shall be treated as the owner of it for all purposes.

8. Unclaimed Money. Subject to any applicable abandoned property law, the Trustee and the Paying Agent shall pay to the Company upon written request any money held by them for the payment of principal or interest that remains unclaimed for two years, and thereafter, Holders entitled to the money must look to the Company for payment as general creditors.

9. Amendment, Supplement, Waiver. Subject to certain exceptions, the Indenture or the Securities of a Series may be amended or supplemented with the consent of the Holders of at least a majority in principal amount of the outstanding Securities of such Series and any past default or compliance with any provision relating to any Series of the Securities may be waived in a particular instance with the consent of the Holders of a majority in principal amount of the outstanding Securities of such Series.⁶ Without the consent of any Securityholder, the Company and the Trustee may amend or supplement the Indenture or the Securities in certain respects as specified in the Indenture.

10. Successor Corporation. When a successor corporation assumes all the obligations of its predecessor under the Securities and the Indenture, the predecessor corporation will be released from those obligations.

11. Trustee Dealings With Company. Subject to certain limitations imposed by the TIA, the Trustee under the Indenture, in its individual or any other capacity, may make loans to, accept deposits from, and perform services for the Company or its affiliates, and may otherwise deal with the Company or its affiliates, as if it were not Trustee, including owning or pledging the Securities.

12. No Recourse Against Others. A director, officer, employee or stockholder, as such, of the Company shall not have any liability for any obligations of the Company under the Securities or the Indenture or for any claim

³ If applicable.

⁴ Insert applicable denominations and multiples.

⁵ Insert applicable denominations and multiples.

⁶ If different terms apply, insert a brief summary thereof.

based on, in respect of or by reason of, such obligations or their creation. Each Holder by accepting a Security waives and releases all such liability. The waiver and release are part of the consideration for the issue of the Securities. The waiver may not be effective to waive liabilities under the federal securities laws.

13. Discharge of Indenture. The Indenture contains certain provisions pertaining to defeasance and discharge, which provisions shall for all purposes have the same effect as if set forth herein.

14. Authentication. This Security shall not be valid until an authorized signatory of the Trustee signs the certificate of authentication on the other side of this Security.

15. Abbreviations. Customary abbreviations may be used in the name of a Holder or an assignee, such as: TEN COM (= tenants in common), TEN ENT (= tenants by the entireties), JT TEN (= joint tenants with right of survivorship and not as tenants in common), CUST (= custodian), and U/G/M/A (= Uniform Gift to Minors Act).

16. GOVERNING LAW. THIS SECURITY SHALL BE GOVERNED BY, AND CONSTRUED IN ACCORDANCE WITH, THE LAWS OF THE STATE OF NEW YORK.

17. CUSIP and ISIN Numbers. Pursuant to a recommendation promulgated by the Committee on Uniform Security Identification Procedures, the Company has caused CUSIP and ISIN numbers to be printed on the Securities and has directed the Trustee to use CUSIP and ISIN numbers in notices of repurchase as a convenience to Holders. No representation is made as to the accuracy of such numbers either as printed on the Securities or as contained in any notice of repurchase and reliance may be placed only on the other identification numbers placed thereon.

18. Copies. The Company will furnish to any Holder upon written request and without charge a copy of the Indenture and the applicable Authorizing Resolution or supplemental indenture. Requests may be made to: X4 PHARMACEUTICALS, Inc., [], Attention: [Chief Financial Officer].

ASSIGNMENT FORM

If you the Holder want to assign this Security, fill in the form below:

I or we assign and transfer this Security to (insert assignee's social security or tax ID number)

(Print or type assignee's name, address, and zip code)

and irrevocably appoint agent to transfer this Security on the books of the Company. The agent may substitute another to act for him.

Date: _____

Your signature
(Sign exactly as your name appears on the other side of this Security)

Signature Guarantee:

May 6, 2026

Exhibit 5.1

X4 Pharmaceuticals, Inc.
61 North Beacon Street, 4th Floor
Boston, Massachusetts 02134

Re: X4 Pharmaceuticals, Inc.
Registration Statement on Form S-3

Ladies and Gentlemen:

We have acted as counsel to X4 Pharmaceuticals, Inc., a Delaware corporation (the “Company”), in connection with the preparation and filing with the Securities and Exchange Commission (the “Commission”) of a Registration Statement on Form S-3 (the “Registration Statement”) under the Securities Act of 1933, as amended (the “Securities Act”), relating to the registration under the Securities Act and the proposed issuance and sale from time to time pursuant to Rule 415 under the Securities Act, together or separately and in one or more series (if applicable) of:

- (i) the Company’s debt securities (the “Debt Securities”);
- (ii) shares of the Company’s common stock, par value \$0.001 per share (the “Common Stock”);
- (iii) shares of the Company’s preferred stock, par value \$0.001 per share (the “Preferred Stock”);
- (iv) warrants for the purchase of Debt Securities, Common Stock, or Preferred Stock (the “Warrants”); and
- (v) units of the Company comprised of any combination of Debt Securities, Common Stock, Preferred Stock, or Warrants (the “Units”).

The Debt Securities, Common Stock, Preferred Stock, Warrants, and Units are collectively referred to herein as the “Securities.” The Debt Securities are to be issued under an indenture substantially in the form attached to the Registration Statement (the “Base Indenture”).

In arriving at the opinions expressed below, we have examined originals, or copies certified or otherwise identified to our satisfaction as being true and complete copies of the originals, of the form of the Base Indenture, forms of the Debt Securities, specimen Common Stock certificates, and such other documents, corporate records, certificates of officers of the Company and of public officials and other instruments as we have deemed necessary or advisable to enable us to render these opinions. In our examination, we have

assumed the genuineness of all signatures, the legal capacity and competency of all natural persons, the authenticity of all documents submitted to us as originals and the conformity to original documents of all documents submitted to us as copies. As to any facts material to these opinions, we have relied to the extent we deemed appropriate and without independent investigation upon statements and representations of officers and other representatives of the Company and others.

We have assumed without independent investigation that:

(i) at the time any Securities are sold pursuant to the Registration Statement (the “Relevant Time”), the Registration Statement and any supplements and amendments thereto (including post-effective amendments) will be effective and will comply with all applicable laws;

(ii) at the Relevant Time, a prospectus supplement will have been prepared and filed with the Commission describing the Securities offered thereby and all related documentation and will comply with all applicable laws;

(iii) all Securities will be issued and sold in the manner stated in the Registration Statement and the applicable prospectus supplement;

(iv) at the Relevant Time, all corporate or other action required to be taken by the Company to duly authorize each proposed issuance of Securities and any related documentation (including (i) the due reservation of any shares of Common Stock or Preferred Stock for issuance upon exercise, conversion or exchange of any Securities for Common Stock or Preferred Stock (a “Convertible Security”), and (ii) the execution (in the case of certificated Securities), delivery and performance of the Securities and any related documentation referred to in paragraphs 1 through 5 below) shall have been duly completed and shall remain in full force and effect;

(v) upon issuance of any Common Stock or Preferred Stock, including upon exercise, conversion or exchange of any Convertible Security, the total number of shares of Common Stock or Preferred Stock issued and outstanding will not exceed the total number of shares of Common Stock or Preferred Stock, as applicable, that the Company is then authorized to issue under its certificate of incorporation and other relevant documents;

(vi) in the case of Debt Securities, at the Relevant Time, the relevant trustee shall have been qualified under the Trust Indenture Act of 1939, as amended (the “TIA”), a Statement of Eligibility of the Trustee on Form T-1 shall have been properly filed with the Commission and the relevant Base Indenture shall have been duly executed and delivered by the Company and all other parties thereto and duly qualified under the TIA;

(vii) at the Relevant Time, a definitive purchase, underwriting or similar agreement and any other necessary agreement with respect to any Securities offered or issued will have been duly authorized by all necessary corporate or other action of the Company or any relevant trust and duly executed and delivered by the Company or any relevant trust and the other parties thereto.

Based on the foregoing and in reliance thereon, and subject to the assumptions, exceptions, qualifications and limitations set forth herein, we are of the opinion that:

1. With respect to any Debt Securities when:

- a. the terms and conditions of such Debt Securities have been duly established by supplemental indenture or officers' certificate in accordance with the terms and conditions of the relevant Base Indenture,
- b. any such supplemental indenture has been duly executed and delivered by the Company and the relevant trustee (together with the relevant Base Indenture, the "Indenture"), and
- c. such Debt Securities have been executed (in the case of certificated Debt Securities), delivered and authenticated in accordance with the terms of the applicable Indenture and issued and sold for the consideration set forth in the applicable definitive purchase, underwriting or similar agreement,

such Debt Securities will be legal, valid and binding obligations of the Company, enforceable against the Company in accordance with their respective terms.

2. With respect to any shares of Preferred Stock, when:

- a. the certificate of designations relating to such Preferred Stock has been duly executed and filed with the Office of the Secretary of State of the State of Delaware,
- b. such shares have been issued either (i) in accordance with the applicable definitive purchase, underwriting or similar agreement and for the consideration therefor provided for therein or (ii) upon exercise, conversion or exchange of any Convertible Security and for any additional consideration specified in such Convertible Security or the instrument governing such Convertible Security providing for such conversion or exercise, which consideration (including any consideration paid for such Convertible Security), on a per-share basis,

shall in either event not be less than the par value of the Preferred Stock, and

- c. any such Convertible Security was previously validly issued and is fully paid and non-assessable (in the case of an equity Security) or is a legal, valid and binding obligation of the Company, enforceable against the Company in accordance with its terms,

such shares of Preferred Stock will be validly issued, fully paid and non-assessable.

3. With respect to shares of Common Stock, when:

- a. such shares of Common Stock have been duly executed (in the case of certificated shares) and delivered either (i) in accordance with the applicable definitive purchase, underwriting or similar agreement for the consideration provided for therein, or (ii) upon conversion or exercise of any Convertible Security, in accordance with the terms of such Convertible Security or the instrument governing such Convertible Security providing for such conversion or exercise, and for any additional consideration specified therein, which consideration (including any consideration paid for such Convertible Security), on a per-share basis, shall in either event not be less than the par value of the Common Stock, and
- b. any such Convertible Security was previously validly issued and is fully paid and non-assessable (in the case of an equity Security) or is a legal, valid and binding obligation of the Company, enforceable against the Company in accordance with its terms,

such shares of Common Stock will be validly issued, fully paid and non-assessable.

4. With respect to any Warrants, when:

- a. the warrant agreement relating to such Warrants (the "Warrant Agreement"), if any, has been duly executed and delivered by the Company and each other party thereto,
- b. the terms of the Warrants have been established in accordance with the Warrant Agreement, if any, and the applicable definitive purchase, underwriting or similar agreement, and
- c. the Warrants have been duly executed (in the case of certificated Warrants) and delivered in accordance with the Warrant Agreement, if

any, and the applicable definitive purchase, underwriting or similar agreement for the consideration provided for therein,

such Warrants will be legal, valid and binding obligations of the Company, enforceable against the Company in accordance with their terms.

5. With respect to any Units, when:

- a. the unit agreement relating to the Units (the “Unit Agreement”), if any, has been duly executed and delivered by the Company and each other party thereto,
- b. the terms of the Units have been duly established in accordance with the Unit Agreement, if any, and the applicable definitive purchase, underwriting or similar agreement, and
- c. the Units have been duly executed (in the case of certificated Units) and delivered in accordance with the Unit Agreement, if any, and the applicable definitive purchase, underwriting or similar agreement for the consideration provided for therein,

the Units will be legal, valid and binding obligations of the Company, enforceable against the Company in accordance with their terms.

The opinions expressed above are subject to the following exceptions, qualifications, limitations and assumptions:

A. We render no opinion herein as to matters involving the laws of any jurisdiction other than the State of New York and the United States of America and, for purposes of paragraphs 2 and 3 above, the Delaware General Corporation Law. We are not admitted to practice in the State of Delaware; however, we are generally familiar with the Delaware General Corporation Law as currently in effect and have made such inquiries as we consider necessary to render the opinions contained in paragraphs 2 and 3 above. This opinion is limited to the effect of the current state of the laws of the State of New York, the United States of America and, to the limited extent set forth above, the laws of the State of Delaware and the facts as they currently exist. We assume no obligation to revise or supplement this opinion in the event of future changes in such laws or the interpretations thereof or such facts.

B. The opinions above with respect to the Indenture, the Debt Securities, the Warrants, the Warrant Agreement, the Units and the Unit Agreement (collectively, the “Documents”) are each subject to (i) the effect of any bankruptcy, insolvency, reorganization, moratorium, arrangement or similar laws affecting the rights and remedies of creditors’ generally, including without limitation the effect of statutory

or other laws regarding fraudulent transfers or preferential transfers and (ii) general principles of equity, including without limitation concepts of materiality, reasonableness, good faith and fair dealing and the possible unavailability of specific performance, injunctive relief or other equitable remedies regardless of whether enforceability is considered in a proceeding in equity or at law.

C. We express no opinion regarding the effectiveness of (i) any waiver of stay, extension or usury laws; (ii) provisions relating to indemnification, exculpation or contribution, to the extent such provisions may be held unenforceable as contrary to public policy or federal or state securities laws; (iii) any provision in any Document waiving the right to object to venue in any court; (iv) any agreement to submit to the jurisdiction of any Federal court; or (v) any waiver of the right to jury trial.

D. To the extent relevant to our opinions in paragraphs 4 and 5 and not covered by our opinions in paragraphs 1, 2, and 3, we have assumed that any securities underlying, comprising or issuable upon exchange, conversion or exercise of any Warrants or Units are validly issued, fully paid and non-assessable (in the case of an equity security) or a legal, valid and binding obligation of the issuer thereof, enforceable against such issuer in accordance with its terms.

You have informed us that you intend to issue Securities from time to time on a delayed or continuous basis, and we understand that prior to issuing any Securities pursuant to the Registration Statement (i) you will advise us in writing of the terms thereof, and (ii) you will afford us an opportunity to (x) review the operative documents pursuant to which such Securities are to be issued or sold (including the applicable offering documents), and (y) file such supplement or amendment to this opinion (if any) as we may reasonably consider necessary or appropriate.

We consent to the filing of this opinion as an exhibit to the Registration Statement, and we further consent to the use of our name under the caption "Legal Matters" in the Registration Statement and the prospectus that forms a part thereof. In giving these consents, we do not thereby admit that we are within the category of persons whose consent is required under Section 7 of the Securities Act or the rules and regulations of the Commission promulgated thereunder.

Very truly yours,

/s/ Gibson, Dunn & Crutcher LLP

May 6, 2026

Exhibit 5.2

X4 Pharmaceuticals, Inc.
61 North Beacon Street, 4th Floor
Boston, Massachusetts 02134

Re: *X4 Pharmaceuticals, Inc.*
Registration Statement on Form S-3

Ladies and Gentlemen:

We have examined the Registration Statement on Form S-3 (the “Registration Statement”), of X4 Pharmaceuticals, Inc., a Delaware corporation (the “Company”), filed with the Securities and Exchange Commission (the “Commission”) pursuant to the Securities Act of 1933, as amended (the “Securities Act”), and the prospectus supplement thereto filed on May 6, 2026 (the “Prospectus Supplement”), in connection with the offering by the Company of up to \$75,000,000 of shares of the Company’s common stock, par value \$0.001 per share (the “Shares”).

In arriving at the opinion expressed below, we have examined originals, or copies certified or otherwise identified to our satisfaction as being true and complete copies of the originals, of specimen Common Stock certificates and such other documents, corporate records, certificates of officers of the Company and of public officials and other instruments as we have deemed necessary or advisable to enable us to render the opinions set forth below. In our examination, we have assumed without independent investigation the genuineness of all signatures, the legal capacity and competency of all natural persons, the authenticity of all documents submitted to us as originals and the conformity to original documents of all documents submitted to us as copies. We have further assumed that all offers and sales of the Shares will comply with the minimum offering price and pricing formula set forth in the authorization of the offering and sale of the Shares by the Company’s Board of Directors (or a duly authorized committee thereof).

Based upon the foregoing, and subject to the assumptions, exceptions, qualifications and limitations set forth herein, we are of the opinion that the Shares, when issued against payment therefor as set forth in the Registration Statement and the Prospectus Supplement thereto, will be validly issued, fully paid and non-assessable.

We consent to the filing of this opinion as an exhibit to the Registration Statement, and we further consent to the use of our name under the caption “Legal Matters” in the Registration Statement and the Prospectus Supplement. In giving these consents, we do not thereby admit that we are within the category of persons whose consent is required under Section 7 of the Securities Act or the Rules and Regulations of the Commission.

Very truly yours,

/s/ Gibson, Dunn & Crutcher LLP

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We hereby consent to the incorporation by reference in this Registration Statement on Form S-3 of X4 Pharmaceuticals, Inc. of our report dated March 17, 2026 relating to the financial statements, which appears in X4 Pharmaceuticals, Inc.'s Annual Report on Form 10-K for the year ended December 31, 2025. We also consent to the reference to us under the heading "Experts" in such Registration Statement.

/s/ PricewaterhouseCoopers LLP
Boston, Massachusetts
May 6, 2026