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**UNITED STATES  
SECURITIES AND EXCHANGE COMMISSION**

Washington, D.C. 20549

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**FORM 8-K**

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**CURRENT REPORT  
Pursuant to Section 13 or 15(d)  
of the Securities Exchange Act of 1934**

**Date of Report (Date of earliest event reported): October 14, 2020**

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**X4 PHARMACEUTICALS, INC.**

(Exact name of registrant as specified in its charter)

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**Delaware**  
(State or other jurisdiction  
of incorporation)

**001-38295**  
(Commission  
File Number)

**27-3181608**  
(IRS Employer  
Identification No.)

**61 North Beacon Street, 4th Floor**  
**Boston, Massachusetts**  
(Address of principal executive offices)

**02134**  
(Zip Code)

**(857) 529-8300**  
(Registrant's telephone number, including area code)

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Check the appropriate box below if the Form 8-K filing is intended to simultaneously satisfy the filing obligation of the registrant under any of the following provisions:

- Written communications pursuant to Rule 425 under the Securities Act (17 CFR 230.425)
- Soliciting material pursuant to Rule 14a-12 under the Exchange Act (17 CFR 240.14a-12)
- Pre-commencement communications pursuant to Rule 14d-2(b) under the Exchange Act (17 CFR 240.14d-2(b))
- Pre-commencement communications pursuant to Rule 13e-4(c) under the Exchange Act (17 CFR 240.13e-4(c))

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

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
<b>Common Stock, par value \$0.001 per share</b>	<b>XFOR</b>	<b>The Nasdaq Stock Market LLC</b>

Indicate by check mark whether the registrant is an emerging growth company as defined in Rule 405 of the Securities Act of 1933 (230.405 of this chapter) or Rule 12b-2 of the Securities Exchange Act of 1934 (240.12b-2 of this chapter). Emerging growth company

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

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**Item 1.01 Entry into a Material Definitive Agreement.**

On October 14, 2020, X4 Pharmaceuticals, Inc. (the “Company”), entered into a common stock purchase agreement (the “Purchase Agreement”) with Aspire Capital Fund, LLC, an Illinois limited liability company (“Aspire Capital”), which provides that, upon the terms and subject to the conditions and limitations set forth therein, Aspire Capital is committed to purchase up to an aggregate of \$50.0 million of shares of the Company’s common stock at the Company’s request from time to time during the 36-month term of the Purchase Agreement. Concurrently with entry into the Purchase Agreement, the Company also entered into a registration rights agreement with Aspire Capital (the “Registration Rights Agreement”), pursuant to which the Company filed with the Securities and Exchange Commission (“SEC”) a prospectus supplement to the Company’s effective shelf registration statement on Form S-3 (File No. 333-242372), which registers the issuance and sale of the shares of common stock that the Company may offer to Aspire Capital from time to time under the Purchase Agreement.

Under the Purchase Agreement, on any trading day selected by the Company, the Company has the right, in its sole discretion, to present Aspire Capital with a purchase notice (each, a “Regular Purchase Notice”) directing Aspire Capital (as principal) to purchase up to 30,000 shares of the Company’s common stock (not to exceed \$1,000,000 worth of shares unless the Company and Aspire Capital agree otherwise) per business day, up to an aggregate of \$50.0 million of the Company’s common stock at a per share price (the “Purchase Price”) equal to the lesser of:

- the lowest sale price of the Company’s common stock on the Nasdaq Stock Market LLC (“Nasdaq”) on the date of sale; or
- the arithmetic average of the three (3) lowest closing sale prices for the Company’s common stock on Nasdaq during the ten (10) consecutive trading days ending on the trading day immediately preceding the purchase date.

In addition, on any date on which the Company submits a Regular Purchase Notice to Aspire Capital in an amount equal to 30,000 shares, the Company also has the right, in its sole discretion, to present Aspire Capital with a volume-weighted average price purchase notice (each, a “VWAP Purchase Notice”) directing Aspire Capital to purchase an amount of the Company’s common stock equal to up to 30% of the aggregate shares of the Company’s common stock traded on Nasdaq on the next trading day (the “VWAP Purchase Date”), subject to a maximum number of shares the Company may determine. The purchase price per share pursuant to such VWAP Purchase Notice is generally 97% of the volume-weighted average price for the Company’s common stock traded on Nasdaq on the VWAP Purchase Date.

The Purchase Agreement provides that the Company and Aspire Capital shall not effect any sales under the Purchase Agreement on any purchase date where the closing price of the Company’s common stock on Nasdaq is less than \$0.25. In addition, the Company may not sell more than an aggregate of 3,255,700 shares of its common stock under the Purchase Agreement unless it obtains stockholder approval of the sale of additional shares or if after giving effect to a sale of additional shares, the average price paid for all shares then-issued under the Purchase Agreement would be equal to or greater than \$6.76. There are no trading volume requirements or restrictions under the Purchase Agreement, and the Company will control the timing and amount of sales of the Company’s common stock to Aspire Capital. Aspire Capital has no right to require any sales by the Company but is obligated to make purchases from the Company as directed by the Company in accordance with the Purchase Agreement. There are no limitations on use of proceeds, financial or business covenants, restrictions on future financing transactions, rights of first refusal, participation rights, penalties or liquidated damages in the Purchase Agreement. The Purchase Agreement may be terminated by the Company at any time, at its discretion, without any cost to the Company. Aspire

Capital has agreed that neither it nor any of its agents, representatives and affiliates shall engage in any direct or indirect short-selling or hedging of the Company's common stock during any time prior to the termination of the Purchase Agreement. Management currently expects to use any proceeds received by the Company under the Purchase Agreement to develop the Company's product pipeline, for working capital and for general corporate purposes.

The foregoing description is not complete and is qualified in its entirety by reference to the full texts of the Purchase Agreement and the Registration Rights Agreement, copies of which are filed with as Exhibits 99.1 and 4.1, respectively, to this Current Report on Form 8-K and are incorporated herein by reference. The Company is filing the opinion of its counsel, Cooley LLP, relating to the legality of the shares of Common Stock offered and sold pursuant to the Purchase Agreement, as Exhibit 5.1 to this Current Report on Form 8-K.

This Current Report on Form 8-K contains forward-looking statements within the meaning of Private Securities Litigation Reform Act of 1995, as amended. These statements may be identified by the words "may," "will," "could," "would," "should," "expect," "plan," "anticipate," "intend," "believe," "estimate," "predict," "project," "potential," "continue," "target" or other similar terms or expressions that concern the Company's expectations, strategy, plans or intentions. Forward-looking statements include, without limitation, statements related to the potential future sale of shares of the Company's common stock, the price for such sales under the Purchase Agreement, and the Company's expected use of proceeds from such sales. Any forward-looking statements in this Current Report on Form 8-K are based on management's current expectations and beliefs. Actual events or results may differ materially from those expressed or implied by any forward-looking statements contained herein, including, without limitation, the risks and uncertainties described in the section entitled "Risk Factors" in the Company's Quarterly Report on Form 10-Q filed with the Securities and Exchange Commission (the "SEC") on August 4, 2020, and in subsequent filings the Company makes with the SEC from time to time. The Company undertakes no obligation to update the information contained in this Current Report on Form 8-K to reflect new events or circumstances, except as required by law.

## **Item 9.01 Financial Statements and Exhibits.**

### (d) Exhibits

<u>Exhibit No.</u>	<u>Description</u>
4.1	<a href="#"><u>Registration Rights Agreement, dated October 14, 2020, by and between X4 Pharmaceuticals, Inc. and Aspire Capital Fund, LLC.</u></a>
5.1	<a href="#"><u>Opinion of Cooley LLP.</u></a>
10.1	<a href="#"><u>Common Stock Purchase Agreement, dated October 14, 2020, by and between X4 Pharmaceuticals, Inc. and Aspire Capital Fund, LLC.</u></a>
23.1	<a href="#"><u>Consent of Cooley LLP (included in Exhibit 5.1).</u></a>
104	Cover Page Interactive Data File (formatted as Inline XBRL, and contained in Exhibit 101)

**SIGNATURES**

Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned hereunto duly authorized.

**X4 PHARMACEUTICALS, INC.**

Date: October 16, 2020

By: /s/ Derek Meisner  
Derek Meisner  
General Counsel

**REGISTRATION RIGHTS AGREEMENT**

**REGISTRATION RIGHTS AGREEMENT** (this “**Agreement**”), dated as of October 14, 2020, by and between **X4 PHARMACEUTICALS, INC.**, a Delaware corporation (the “**Company**”), and **ASPIRE CAPITAL FUND, LLC**, an Illinois limited liability company (together with its permitted assigns, the “**Buyer**”). Capitalized terms used herein and not otherwise defined herein shall have the respective meanings set forth in the Common Stock Purchase Agreement by and between the parties hereto, dated as of the date hereof (as amended, restated, supplemented or otherwise modified from time to time, the “**Purchase Agreement**”).

**WHEREAS:**

A. Upon the terms and subject to the conditions of the Purchase Agreement, the Company has agreed to issue to the Buyer, and the Buyer has agreed to purchase, up to Fifty Million Dollars (\$50,000,000) of the Company’s common stock, par value \$0.001 per share (the “**Common Stock**”), pursuant to Section 1 of the Purchase Agreement (such shares, the “**Purchase Shares**”); and

B. To induce the Buyer to enter into the Purchase Agreement, the Company has agreed to provide certain registration rights under the Securities Act of 1933, as amended, and the rules and regulations thereunder, or any similar successor statute (collectively, the “**1933 Act**”), and applicable state securities laws.

**NOW, THEREFORE**, in consideration of the promises and the mutual covenants contained herein and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Company and the Buyer hereby agree as follows:

## 1. DEFINITIONS.

As used in this Agreement, the following terms shall have the following meanings:

a. “**Person**” means any person or entity including any corporation, a limited liability company, an association, a partnership, an organization, a business, an individual, a governmental or political subdivision thereof or a governmental agency.

b. “**Prospectus**” means the base prospectus, including all documents incorporated therein by reference, included in any Registration Statement (as hereinafter defined), as it may be supplemented by a prospectus or the Prospectus Supplement (as hereinafter defined), in the form in which such prospectus and/or Prospectus Supplement have most recently been filed by the Company with the U.S. Securities and Exchange Commission (the “**SEC**”) pursuant to Rule 424(b) under the 1933 Act, together with any then issued “issuer free writing prospectus(es),” as defined in Rule 433 of the 1933 Act, relating to the Registrable Securities.

c. “**Register**,” “**registered**,” and “**registration**” refer to a registration effected by preparing and filing one or more registration statements of the Company under the 1933 Act and pursuant to Rule 415 under the 1933 Act or any successor rule providing for offering securities on a continuous basis (“**Rule 415**”), and the declaration or ordering of effectiveness of such registration statement(s) by the SEC.

d. “**Registrable Securities**” means the Purchase Shares that may from time to time be issued or issuable to the Buyer upon purchases of the Available Amount under the Purchase Agreement (without regard to any limitation or restriction on purchases) and any shares of capital stock issued or issuable with respect to the Purchase Shares or the Purchase Agreement as a result of any stock split, stock dividend, recapitalization, exchange or similar event, without regard to any limitation on purchases under the Purchase Agreement.

e. “**Registration Statement**” means the Shelf Registration Statement and any other registration statement of the Company, including any New Registration Statement (as hereinafter defined), as amended when it became effective, including all documents filed as part thereof or incorporated by reference therein, and including any information contained in a Prospectus subsequently filed with the SEC pursuant to Rule 424(b) under the 1933 Act or deemed to be a part of such registration statement pursuant to Rule 430B or 462(b) of the 1933 Act, covering only the sale of the Registrable Securities.

f. “**Shelf Registration Statement**” means the Company’s existing registration statement on Form S-3 (File No. 333-242372).

## 2. REGISTRATION.

a. Mandatory Registration. The Company shall within two (2) Business Days from the Commencement Date file with the SEC a prospectus supplement to the Shelf Registration Statement specifically relating to the Registrable Securities (the “**Prospectus Supplement**”). The Buyer and its counsel shall have had a reasonable opportunity to review and comment upon such Prospectus Supplement prior to its filing with the SEC. The Buyer shall furnish all information reasonably requested by the Company for inclusion therein. The Company shall use its reasonable best efforts to keep the Shelf Registration Statement (and/or a New Registration Statement as provided in Section 2(c)) effective pursuant to Rule 415 promulgated under the 1933 Act and available for sales of all of the Registrable Securities at all times until the earlier of (i) the Company no longer qualifies to make sales under the Shelf Registration Statement (which shall be understood to include the inability of the Company to immediately register sales of Registrable Securities to the Buyer under the Shelf Registration Statement or any New Registration Statement pursuant to General Instruction I.B.6 of Form S-3), (ii) the date on which the Company shall have sold all the Registrable Securities and no Available Amount remains under the Purchase Agreement, or (iii) the date on which the Purchase Agreement is terminated (the “**Registration Period**”). The Shelf Registration Statement (including any amendments or supplements thereto and prospectuses contained therein) shall 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, in light of the circumstances under which they were made, not misleading.

b. Rule 424 Prospectus. The Company shall, to the extent required by applicable securities regulations, from time to time file with the SEC, pursuant to Rule 424 promulgated under the 1933 Act, a prospectus, including any amendments or prospectus supplements thereto, to be used in connection with sales of the Registrable Securities under the Registration Statement. The Buyer and its counsel shall have two (2) Business Days to review and comment upon such prospectus prior to its filing with the SEC. The Buyer shall use its reasonable best efforts to comment upon such prospectus within two (2) Business Days from the date the Buyer receives the final version of such prospectus.

c. **Sufficient Number of Shares Registered.** In the event the number of shares available under the Shelf Registration Statement is insufficient to cover the Registrable Securities, the Company shall, to the extent necessary and permissible, amend the Shelf Registration Statement or file a new registration statement (a “**New Registration Statement**”), so as to cover all of such Registrable Securities as soon as reasonably practicable, but in any event not later than ten (10) Business Days after the necessity therefor arises. The Company shall use its reasonable best efforts to have such amendment and/or New Registration Statement become effective as soon as reasonably practicable following the filing thereof. In addition, in the event the Company has filed a New Registration Statement that has been declared effective by the SEC, such New Registration Statement may replace the Shelf Registration Statement and cover the Registrable Securities upon the filing of a prospectus supplement relating thereto covering the Registrable Securities, provided the Buyer and its counsel shall have had a reasonable opportunity to review and comment upon such prospectus supplement prior to its filing with the SEC.

### 3. RELATED OBLIGATIONS.

With respect to the Registration Statement and whenever any Registrable Securities are to be registered pursuant to Sections 2(a) and (c), including on the Shelf Registration Statement or on any New Registration Statement, the Company shall use its reasonable best efforts to effect the registration of the Registrable Securities in accordance with the intended method of disposition thereof and, pursuant thereto, the Company shall have the following obligations:

a. The Company shall prepare and file with the SEC such amendments (including post-effective amendments) and supplements to any Registration Statement and any Prospectus used in connection with such Registration Statement, as may be necessary to keep the Registration Statement effective at all times during the Registration Period, subject to Permitted Delays and Section 3(e) hereof and, during such period, comply with the provisions of the 1933 Act with respect to the disposition of all Registrable Securities of the Company covered by the Registration Statement until such time as all of such Registrable Securities shall have been disposed of in accordance with the intended methods of disposition by the seller or sellers thereof as set forth in such Registration Statement. Should the Company file a post-effective amendment to the Registration Statement, the Company will use its reasonable best efforts to have such filing declared effective by the SEC within thirty (30) consecutive Business Days following the date of filing, which such period shall be extended for an additional thirty (30) Business Days if the Company receives a comment letter from the SEC in connection therewith. If (i) there is material non-public information regarding the Company which the Company’s Board of Directors reasonably determines not to be in the Company’s best interest to disclose and which the Company is not otherwise required to disclose or (ii) there is a significant business opportunity (including, but not limited to, the acquisition or disposition of assets (other than in the ordinary course of business) or any merger, consolidation, tender offer or other similar transaction) available to the Company which the Company’s Board of Directors reasonably determines not to be in the Company’s best interest to disclose and which the Company would be required to disclose under a Registration Statement, then the Company may postpone or suspend filing or effectiveness of such Registration Statement or use of the prospectus under the Registration Statement for a period not to exceed thirty (30) consecutive days, provided that the Company may not postpone or suspend its obligation under this Section 3(a) for more than sixty (60) days in the aggregate during any twelve (12) month period (each, a “**Permitted Delay**”).

b. The Company shall submit to the Buyer for review and comment any disclosure in the Registration Statement, and all amendments and supplements thereto (other than prospectus supplements that consist only of a copy of a filed Form 10-K, Form 10-Q or Current Report on Form 8-K or any amendment as a result of the Company's filing of a document that is incorporated by reference into the Registration Statement), containing information provided by the Buyer for inclusion in such document and any descriptions or disclosure regarding the Buyer, the Purchase Agreement, including the transaction contemplated thereby, or this Agreement at least two (2) Business Days prior to their filing with the SEC, and not file any document in a form to which Buyer reasonably and timely objects, unless required by applicable securities regulations. Upon request of the Buyer, the Company shall provide to the Buyer all disclosure in the Registration Statement and all amendments and supplements thereto (other than prospectus supplements that consist only of a copy of a filed Form 10-K, Form 10-Q or Current Report on Form 8-K or any amendment as a result of the Company's filing of a document that is incorporated by reference into a Registration Statement) at least two (2) Business Days prior to their filing with the SEC, and not file any document in a form to which Buyer reasonably and timely objects, unless required by applicable securities regulations. The Buyer shall use its reasonable best efforts to comment upon the Registration Statement and any amendments or supplements thereto within two (2) Business Days from the date the Buyer receives the final version thereof. The Company shall furnish to the Buyer, without charge, any correspondence from the SEC or the staff of the SEC to the Company or its representatives relating to the Registration Statement.

c. Upon request of the Buyer, the Company shall furnish to the Buyer, (i) promptly after the same is prepared and filed with the SEC, at least one copy of the Registration Statement and any amendment(s) thereto, including all financial statements and schedules, all documents incorporated therein by reference and all exhibits, (ii) upon the effectiveness of any amendment(s) to a Registration Statement, a copy of the prospectus included in such Registration Statement and all amendments and supplements thereto (or such other number of copies as the Buyer may reasonably request) and (iii) such other documents, including copies of any preliminary or final prospectus, as the Buyer may reasonably request from time to time in order to facilitate the disposition of the Registrable Securities owned by the Buyer.

d. The Company shall use reasonable best efforts to (i) register and qualify, unless an exemption from registration and qualification is available, the Registrable Securities covered by a Registration Statement under such other securities or "blue sky" laws of such jurisdictions in the United States as the Buyer reasonably requests, (ii) subject to Permitted Delays, prepare and file in those jurisdictions, such amendments (including post-effective amendments) and supplements to such registrations and qualifications as may be necessary to maintain the effectiveness thereof during the Registration Period, (iii) take such other actions as may be necessary to maintain such registrations and qualifications in effect at all times during the Registration Period, and (iv) take all other actions reasonably necessary or advisable to qualify the Registrable Securities for sale in such jurisdictions; provided, however, that the Company shall not be required in connection therewith or as a condition thereto to (x) qualify to do business in any jurisdiction where it would not otherwise be required to qualify but for this Section 3(d), (y) subject itself to general taxation in any such jurisdiction, or (z) file a general consent to service of process in any such jurisdiction. The Company shall promptly notify the Buyer who holds Registrable Securities of the receipt by the Company of any notification with respect to the suspension of the registration or qualification of any of the Registrable Securities for sale under the securities or "blue sky" laws of any jurisdiction in the United States or its receipt of actual notice of the initiation or threat of any proceeding for such purpose.



e. Subject to Permitted Delays, as promptly as reasonably practicable after becoming aware of such event or facts, the Company shall notify the Buyer in writing if the Company has determined that the Prospectus included in any Registration Statement, as then in effect, includes an untrue statement of a material fact or omits 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, and as promptly as reasonably practical (taking into account the Company's good faith assessment of any adverse consequences to the Company and its stockholders of premature disclosure of such event or facts) prepare a prospectus supplement or amendment to such Registration Statement to correct such untrue statement or omission, and, upon the Buyer's request, deliver a copy of such prospectus supplement or amendment to the Buyer. In providing this notice to the Buyer, unless the Buyer consents to enter into a non-disclosure agreement with the Company, the Company shall not include any other information about the facts underlying the Company's determination and shall not in any way communicate any material nonpublic information about the Company or the Common Stock to the Buyer, and the Company shall be permitted to remove any such information from a draft prospectus supplement or amendment notwithstanding the Company's obligation to provide such documents to the Buyer in advance of filing with the SEC. The Company shall also promptly notify the Buyer in writing (i) when a prospectus or any prospectus supplement or post-effective amendment has been filed, and when a Registration Statement or any post-effective amendment has become effective (notification of such effectiveness shall be delivered to the Buyer by facsimile or e-mail on the same day of such effectiveness), (ii) of any request by the SEC for amendments or supplements to any Registration Statement or related prospectus or related information, and (iii) of the Company's reasonable determination that a post-effective amendment to a Registration Statement would be appropriate. In no event shall the delivery of a notice under this Section 3(e), or the resulting unavailability of a Registration Statement, without regard to its duration, for disposition of securities by Buyer be considered a breach by the Company of its obligations under this Agreement. The preceding sentence in this Section 3(e) does not limit whether an event of default has occurred as set forth in Section 9(a) of the Purchase Agreement.

f. The Company shall use its reasonable best efforts to prevent the issuance of any stop order or other suspension of effectiveness of any Registration Statement, or the suspension of the qualification of any Registrable Securities for sale in any jurisdiction and, if such an order or suspension is issued, to obtain the withdrawal of such order or suspension at the earliest practical time and to notify the Buyer of the issuance of such order and the resolution thereof or its receipt of actual notice of the initiation or threat of any proceeding for such purpose.

g. The Company shall (i) cause all the Registrable Securities to be listed on each securities exchange on which securities of the same class or series issued by the Company are then listed, if any, if the listing of such Registrable Securities is then permitted under the rules of such exchange, or (ii) secure designation and quotation of all the Registrable Securities if the Principal Market (as such term is defined in the Purchase Agreement) is an automated quotation system. The Company shall pay all fees and expenses in connection with satisfying its obligation under this Section.

h. The Company shall cooperate with the Buyer to facilitate the timely preparation and delivery of certificates or book-entry forms (not bearing any restrictive legend) representing the Registrable Securities to be offered pursuant to any Registration Statement and enable such certificates or book-entry forms to be in such denominations or amounts as the Buyer may reasonably request and registered in such names as the Buyer may request.

i. The Company shall at all times provide a transfer agent and registrar with respect to its Common Stock.

j. If reasonably requested by the Buyer, the Company shall (i) promptly incorporate in a prospectus supplement or post-effective amendment to the Registration Statement such information as the Buyer believes should be included therein relating to the sale and distribution of Registrable Securities, including, without limitation, information with respect to the number of Registrable Securities being sold, the purchase price being paid therefor and any other terms of the offering of the Registrable Securities; (ii) make all required filings of such prospectus supplement or post-effective amendment as promptly as practicable once notified of the matters to be incorporated in such prospectus supplement or post-effective amendment; and (iii) supplement or make amendments to any Registration Statement (including by means of any document incorporated therein by reference).

k. The Company shall use its reasonable best efforts to cause the Registrable Securities covered by any Registration Statement to be registered with or approved by such other governmental agencies or authorities in the United States as may be necessary to consummate the disposition of such Registrable Securities.

l. If reasonably requested by the Buyer at any time, the Company shall deliver to the Buyer a written confirmation of whether or not the effectiveness of such Registration Statement has lapsed at any time for any reason (including, without limitation, the issuance of a stop order) and whether or not the Registration Statement is currently effective and available to the Company for sale of all of the Registrable Securities.

m. The Company agrees to take all other reasonable actions as necessary and reasonably requested by the Buyer to expedite and facilitate disposition by the Buyer of Registrable Securities pursuant to any Registration Statement.

#### 4. OBLIGATIONS OF THE BUYER.

a. The Buyer has furnished to the Company in Exhibit A hereto such information regarding itself, the Registrable Securities held by it and the intended method of disposition of the Registrable Securities held by it as required to effect the registration of such Registrable Securities and shall execute such documents in connection with such registration as the Company may reasonably request. The Company shall notify the Buyer in writing of any other information the Company reasonably requires from the Buyer in connection with any Registration Statement hereunder, and the Buyer shall promptly furnish such information to the Company. The Buyer will as promptly as practicable notify the Company of any material change in the information set forth in Exhibit A, other than changes in its ownership of the Common Stock.

b. The Buyer agrees to cooperate with the Company as reasonably requested by the Company in connection with the preparation and filing of any amendments and supplements to any Registration Statement hereunder.

5. EXPENSES OF REGISTRATION.

All reasonable expenses of the Company, other than sales or brokerage commissions and fees and disbursements of counsel for the Buyer, incurred in connection with registrations, filings or qualifications pursuant to Sections 2 and 3, including, without limitation, all registration, listing and qualifications fees, printers and accounting fees, and fees and disbursements of counsel for the Company, shall be paid by the Company.

6. INDEMNIFICATION.

a. To the fullest extent permitted by law, the Company will, and hereby does, indemnify, hold harmless and defend the Buyer, each Person, if any, who controls the Buyer, the members, the directors, officers, partners, employees, agents, representatives of the Buyer and each Person, if any, who controls the Buyer within the meaning of the 1933 Act or the Securities Exchange Act of 1934, as amended (the “**1934 Act**”) (each, an “**Indemnified Person**”), against any third party losses, claims, damages, liabilities, judgments, fines, penalties, charges, costs, reasonable and documented attorneys’ fees, amounts paid in settlement (with the prior consent of the Company, such consent not to be unreasonably withheld) or reasonable and documented expenses, (collectively, “**Claims**”) reasonably incurred in investigating, preparing or defending any action, claim, suit, inquiry, proceeding, investigation or appeal taken from the foregoing by or before any court or governmental, administrative or other regulatory agency or body or the SEC, whether pending or threatened, whether or not an indemnified party is or may be a party thereto (“**Indemnified Damages**”), to which any of them may become subject insofar as such Claims (or actions or proceedings, whether commenced or threatened, in respect thereof) arise out of or are based upon: (i) any untrue statement or alleged untrue statement of a material fact in the Registration Statement or any post-effective amendment thereto or in any filing made in connection with the qualification of the offering under the securities or other “blue sky” laws of any jurisdiction in which Registrable Securities are offered (“**Blue Sky Filing**”), or the omission or alleged omission to state a material fact required to be stated therein or necessary to make the statements therein not misleading, (ii) any untrue statement or alleged untrue statement of a material fact contained in the final Prospectus or the omission or alleged omission to state therein any material fact necessary to make the statements made therein, in light of the circumstances under which the statements therein were made, not misleading, or (iii) any violation or alleged violation by the Company of the 1933 Act, the 1934 Act, any other law, including, without limitation, any state securities law, or any rule or regulation thereunder relating to the offer or sale of the Registrable Securities pursuant to the Registration Statement or any post-effective amendment thereto (the matters in the foregoing clauses (i) through (iii) being, collectively, “**Violations**”). The Company shall reimburse each Indemnified Person promptly as such expenses are incurred and are due and payable, for any reasonable and documented legal fees or other reasonable and documented expenses incurred by them in connection with investigating or defending any such Claim. Notwithstanding anything to the contrary contained herein, the indemnification agreement contained in this Section 6(a): (A) shall not apply to a Claim by an Indemnified Person arising out of or based upon a Violation which occurs in reliance upon and in conformity with information furnished in writing to the Company by the Buyer or such Indemnified Person expressly for use in connection with the preparation of the Registration Statement, the Prospectus or any such amendment thereof or supplement thereto, if such prospectus was timely made available by the Company; (B) with respect to any superseded prospectus, shall not inure to the benefit of any such person from whom the person asserting any such Claim purchased the Registrable Securities that are the subject thereof (or to the benefit of any other Indemnified Person) if the untrue statement or omission of material fact contained in the superseded prospectus was corrected in the revised prospectus, as then amended or supplemented, if such revised

prospectus was timely made available by the Company pursuant to Section 3(c) or Section 3(e), and the Indemnified Person was promptly advised in writing not to use the incorrect prospectus prior to the use giving rise to a violation; (C) shall not be available to the extent such Claim is based on a failure of the Buyer to deliver, or to cause to be delivered, the prospectus made available by the Company, if such prospectus was theretofore made available by the Company pursuant to Section 3(c) or Section 3(e); and (D) shall not apply to amounts paid in settlement of any Claim if such settlement is effected without the prior written consent of the Company, which consent shall not be unreasonably withheld. Such indemnity shall remain in full force and effect regardless of any investigation made by or on behalf of the Indemnified Person and shall survive the transfer of the Registrable Securities by the Buyer pursuant to Section 8.

b. In connection with the Registration Statement or Prospectus, the Buyer agrees to indemnify, hold harmless and defend, to the same extent and in the same manner as is set forth in Section 6(a), the Company, each of its directors, each of its officers who signed the Shelf Registration Statement or signs any New Registration Statement, each Person, if any, who controls the Company within the meaning of the 1933 Act or the 1934 Act (collectively and together with an Indemnified Person, an “**Indemnified Party**”), against any Claim or Indemnified Damages to which any of them may become subject, under the 1933 Act, the 1934 Act or otherwise, insofar as such Claim or Indemnified Damages arise out of or are based upon any Violation, in each case to the extent, and only to the extent, that such Violation occurs in reliance upon and in conformity with written information about the Buyer set forth on Exhibit A attached hereto or updated from time to time in writing by the Buyer and furnished to the Company by the Buyer expressly for inclusion in the Shelf Registration Statement or Prospectus or any New Registration Statement or from the failure of the Buyer to deliver or to cause to be delivered the prospectus made available by the Company, if such prospectus was timely made available by the Company pursuant to Section 3(c) or Section 3(e); and, subject to Section 6(d), the Buyer will reimburse any legal or other expenses reasonably incurred by them in connection with investigating or defending any such Claim; provided, however, that the indemnity agreement contained in this Section 6(b) and the agreement with respect to contribution contained in Section 7 shall not apply to amounts paid in settlement of any Claim if such settlement is effected without the prior written consent of the Buyer, which consent shall not be unreasonably withheld. Such indemnity shall remain in full force and effect and shall survive the transfer of the Registrable Securities by the Buyer pursuant to Section 8.

c. Promptly after receipt by an Indemnified Person or Indemnified Party under this Section 6 of notice of the commencement of any action or proceeding (including any governmental action or proceeding) involving a Claim, such Indemnified Person or Indemnified Party shall, if a Claim in respect thereof is to be made against any indemnifying party under this Section 6, deliver to the indemnifying party a written notice of the commencement thereof, and the indemnifying party shall have the right to participate in, and, to the extent the indemnifying party so desires, jointly with any other indemnifying party similarly noticed, to assume control of the defense thereof with counsel mutually satisfactory to the indemnifying party and the Indemnified Person or the Indemnified Party, as the case may be, and upon such notice, the indemnifying party shall not be liable to the Indemnified Person or Indemnified Party for any legal or other expenses subsequently incurred by the Indemnified Person or Indemnified Party in connection with the defense thereof; provided, however, that an Indemnified Person or Indemnified Party (together with all other Indemnified Persons and Indemnified Parties that may be represented without conflict by one counsel) shall have the right to retain its own counsel with the fees and expenses to be paid by the indemnifying party, if, in the reasonable opinion of counsel retained by the indemnifying party, the representation by such counsel of the Indemnified Person or Indemnified Party and the indemnifying party would be inappropriate due to actual or potential differing interests between such Indemnified Person or Indemnified Party and any other party represented by such counsel in such proceeding. The

Indemnified Party or Indemnified Person shall cooperate with the indemnifying party in connection with any negotiation or defense of any such action or claim by the indemnifying party and shall furnish to the indemnifying party all information reasonably available to the Indemnified Party or Indemnified Person which relates to such action or claim. The indemnifying party shall keep the Indemnified Party or Indemnified Person fully apprised as to the status of the defense or any settlement negotiations with respect thereto. No indemnifying party shall be liable for any settlement of any action, claim or proceeding effected without its written consent, provided, however, that the indemnifying party shall not unreasonably withhold, delay or condition its consent. No indemnifying party shall, without the consent of the Indemnified Party or Indemnified Person, consent to entry of any judgment or enter into any settlement or other compromise which does not include as an unconditional term thereof the giving by the claimant or plaintiff to such Indemnified Party or Indemnified Person of a release from all liability in respect to such claim or litigation. Following indemnification as provided for hereunder, the indemnifying party shall be subrogated to all rights of the Indemnified Party or Indemnified Person with respect to all third parties, firms or corporations relating to the matter for which indemnification has been made. The failure to deliver written notice to the indemnifying party within a reasonable time of the commencement of any such action shall not relieve such indemnifying party of any liability to the Indemnified Person or Indemnified Party under this Section 6, except to the extent that the indemnifying party is prejudiced in its ability to defend such action.

d. The indemnification required by this Section 6 shall be made by prompt payments of the amount thereof during the course of the investigation or defense, as and when reasonable and documented bills are received or Indemnified Damages are incurred by an Indemnified Person. Any person receiving a payment pursuant to this Section 6 which person is later determined to not be entitled to such payment shall return such payment (including reimbursement of expenses) to the person making it.

e. The indemnity agreements contained herein shall be in addition to (i) any cause of action or similar right of the Indemnified Party or Indemnified Person against the indemnifying party or others, and (ii) any liabilities the indemnifying party may be subject to pursuant to the law.

#### 7. CONTRIBUTION.

To the extent any indemnification by an indemnifying party is prohibited or limited by law, the indemnifying party agrees to make the maximum contribution with respect to any amounts for which it would otherwise be liable under Section 6 to the fullest extent permitted by law; provided, however, that: (i) no seller of Registrable Securities guilty of fraudulent misrepresentation (within the meaning of Section 11(f) of the 1933 Act) shall be entitled to contribution from any party who was not guilty of fraudulent misrepresentation; and (ii) contribution by any seller of Registrable Securities shall be limited in amount to the net amount of proceeds received by such seller from the sale of such Registrable Securities.

#### 8. ASSIGNMENT OF REGISTRATION RIGHTS.

The Company shall not assign this Agreement or any rights or obligations hereunder without the prior written consent of the Buyer; provided, however, that any transaction, whether by merger, reorganization, restructuring, consolidation, financing or otherwise, whereby the Company remains the surviving entity immediately after such transaction shall not be deemed an assignment. The Buyer may not assign its rights under this Agreement without the prior written consent of the Company.

9. AMENDMENT OF REGISTRATION RIGHTS.

Provisions of this Agreement may be amended and the observance thereof may be waived (either generally or in a particular instance and either retroactively or prospectively) only with the written consent of the Company and the Buyer.

10. MISCELLANEOUS.

a. Any notices, consents, waivers or other communications required or permitted to be given under the terms of this Agreement must be in writing and will be deemed to have been delivered: (i) upon receipt, when delivered personally; (ii) upon receipt, when sent by facsimile (provided confirmation of transmission is mechanically or electronically generated and kept on file by the sending party); (iii) upon receipt, when sent by electronic message (provided the recipient responds to the message and confirmation of both electronic messages are kept on file by the sending party); or (iv) one (1) Business Day after timely deposit with a nationally recognized overnight delivery service, in each case properly addressed to the party to receive the same. The addresses and facsimile numbers for such communications shall be:

If to the Company:

X4 Pharmaceuticals, Inc.  
61 North Beacon Street, 4<sup>th</sup> Floor  
Boston, MA 02134  
Telephone: 857-529-8300  
Attention: Derek Meisner  
Email: derek.meisner@x4pharma.com

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

Cooley LLP  
55 Hudson Yards  
New York, NY 10001  
Telephone: (212) 479-5000  
Facsimile: (212) 479-6275  
Attention: Daniel I. Goldberg  
Email: dgoldberg@cooley.com

If to the Buyer:

Aspire Capital Fund, LLC  
155 North Wacker Drive, Suite 1600  
Chicago, IL 60606  
Telephone: 312-658-0400  
Facsimile: 312-658-4005  
Attention: Steven G. Martin  
Email: smartin@aspirecapital.com

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

Morrison & Foerster LLP  
2000 Pennsylvania Avenue, NW, Suite 6000  
Washington, DC 20006  
Telephone: 202-778-1603  
Facsimile: 202-887-0763  
Attention: David M. Lynn, Esq.  
Email: dlynn@mofoco.com

or at such other address and/or facsimile number and/or to the attention of such other person as the recipient party has specified by written notice given to each other party at least one (1) Business Day prior to the effectiveness of such change. Written confirmation of receipt (A) given by the recipient of such notice, consent, waiver or other communication, (B) mechanically or electronically generated by the sender's facsimile machine containing the time, date, and recipient facsimile number, (C) electronically generated by the sender's electronic mail containing the time, date and recipient email address or (D) provided by a nationally recognized overnight delivery service, shall be rebuttable evidence of receipt in accordance with clause (i), (ii), (iii) or (iv) above, respectively. Any party to this Agreement may give any notice or other communication hereunder using any other means (including messenger service, ordinary mail or electronic mail), but no such notice or other communication shall be deemed to have been duly given unless it actually is received by the party for whom it is intended.

b. No failure or delay in the exercise of any power, right or privilege hereunder shall operate as a waiver thereof, nor shall any single or partial exercise of any such power, right or privilege preclude other or further exercise thereof or of any other right, power or privilege.

c. The corporate laws of the State of Delaware shall govern all issues concerning the relative rights of the Company and its stockholders. All other questions concerning the construction, validity, enforcement and interpretation of this Agreement shall be governed by the internal laws of the State of Illinois, without giving effect to any choice of law or conflict of law provision or rule (whether of the State of Illinois or any other jurisdictions) that would cause the application of the laws of any jurisdictions other than the State of Illinois. Each party hereby irrevocably submits to the exclusive jurisdiction of the state and federal courts sitting in the City of Chicago for the adjudication of any dispute hereunder or in connection herewith or with any transaction contemplated hereby or discussed herein, and hereby irrevocably waives, and agrees not to assert in any suit, action or proceeding, any claim that it is not personally subject to the jurisdiction of any such court, that such suit, action or proceeding is brought in an inconvenient forum or that the venue of such suit, action or proceeding is improper. Each party hereby irrevocably waives personal service of process and consents to process being served in any such suit, action or proceeding by mailing a copy thereof to such party at the address for such notices to it under this Agreement and agrees that such service shall constitute good and sufficient service of process and notice thereof. Nothing contained herein shall be deemed to limit in any way any right to serve process in any manner permitted by law. If any provision of this Agreement shall be invalid or unenforceable in any jurisdiction, such invalidity or unenforceability shall not affect the validity or enforceability of the remainder of this Agreement in that jurisdiction or the validity or enforceability of any provision of this Agreement in any other jurisdiction. **EACH PARTY HEREBY IRREVOCABLY WAIVES**

**ANY RIGHT IT MAY HAVE, AND AGREES NOT TO REQUEST, A JURY TRIAL FOR THE ADJUDICATION OF ANY DISPUTE HEREUNDER OR IN CONNECTION HERewith OR ARISING OUT OF THIS AGREEMENT OR ANY TRANSACTION CONTEMPLATED HEREBY.**

d. This Agreement, the Purchase Agreement and the other Transaction Documents constitute the entire understanding among the parties hereto with respect to the subject matter hereof and thereof. There are no restrictions, promises, warranties or undertakings, other than those set forth or referred to herein and therein. This Agreement, the Purchase Agreement and the other Transaction Documents supersede all other prior oral or written agreements between the Buyer, the Company, their affiliates and persons acting on their behalf with respect to the subject matter hereof and thereof.

e. Subject to the requirements of Section 8, this Agreement shall inure to the benefit of and be binding upon the permitted successors and assigns of each of the parties hereto.

f. The headings in this Agreement are for convenience of reference and shall not form part of, or affect the interpretation of, this Agreement.

g. This Agreement may be executed in two or more identical counterparts, all of which shall be considered one and the same agreement and shall become effective when counterparts have been signed by each party and delivered to the other party; provided that a facsimile or pdf (or other electronic reproduction of a) signature shall be considered due execution and shall be binding upon the signatory thereto with the same force and effect as if the signature were an original, not a facsimile or pdf (or other electronic reproduction of a) signature.

h. Each party shall do and perform, or cause to be done and performed, all such further acts and things, and shall execute and deliver all such other agreements, certificates, instruments and documents as the other party may reasonably request in order to carry out the intent and accomplish the purposes of this Agreement and the consummation of the transactions contemplated hereby.

i. The language used in this Agreement will be deemed to be the language chosen by the parties to express their mutual intent and no rules of strict construction will be applied against any party.

j. This Agreement is intended for the benefit of the parties hereto and their respective permitted successors and assigns, and is not for the benefit of, nor may any provision hereof be enforced by, any other Person.

\* \* \* \* \*



IN WITNESS WHEREOF, the parties have caused this Registration Rights Agreement to be duly executed as of day and year first above written.

**THE COMPANY:**

**X4 PHARMACEUTICALS, INC.**

By: /s/ Paula Ragan

Name: Paula Ragan, Ph.D.

Title: Chief Executive Officer

**BUYER:**

**ASPIRE CAPITAL FUND, LLC**

**BY: ASPIRE CAPITAL PARTNERS, LLC**

**BY: SGM HOLDINGS CORP.**

By: /s/ Steven G. Martin

Name: Steven G. Martin

Title: President

**EXHIBIT A**

**Information About The Buyer Furnished To The Company By The Buyer  
Expressly For Use In Connection With The Registration Statement and Prospectus**

Aspire Capital Partners LLC (“Aspire Partners”) is the Managing Member of Aspire Capital Fund, LLC (“Aspire Fund”). SGM Holdings Corp (“SGM”) is the Managing Member of Aspire Partners. Mr. Steven G. Martin (“Mr. Martin”) is the president and sole shareholder of SGM, as well as a principal of Aspire Partners. Mr. Erik J. Brown (“Mr. Brown”) is the president and sole shareholder of Red Cedar Capital Corp (“Red Cedar”), which is a principal of Aspire Partners. Mr. Christos Komissopoulos (“Mr. Komissopoulos”) is president and sole shareholder of Chrisko Investors Inc. (“Chrisko”), which is a principal of Aspire Partners. Mr. William F. Blank, III (“Mr. Blank”) is president and sole shareholder of WML Ventures Corp. (“WML Ventures”), which is a principal of Aspire Partners. Each of Aspire Partners, SGM, Red Cedar, Chrisko, WML Ventures, Mr. Martin, Mr. Brown, Mr. Komissopoulos and Mr. Blank may be deemed to be a beneficial owner of common stock held by Aspire Fund. Each of Aspire Partners, SGM, Red Cedar, Chrisko, WML Ventures, Mr. Martin, Mr. Brown, Mr. Komissopoulos and Mr. Blank disclaims beneficial ownership of the common stock held by Aspire Fund.



Daniel I. Goldberg  
+1 212 479 6722  
dgoldberg@cooley.com

October 16, 2020

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

Ladies and Gentlemen:

You have requested our opinion with respect to certain matters in connection with the issuance and sale by X4 Pharmaceuticals, Inc., a Delaware corporation (the "**Company**") of up to \$50,000,000 shares (the "**Shares**") of the Company's common stock, par value \$0.001 per share (the "**Common Stock**"), pursuant to a Registration Statement on Form S-3 (No. 333-242372) (the "**Registration Statement**") filed with the Securities and Exchange Commission (the "**Commission**") under the Securities Act of 1933, as amended (the "**Act**"), the related prospectus included in the Registration Statement (the "**Base Prospectus**"), and the prospectus supplement filed with the Commission pursuant to Rule 424(b) of the Rules and Regulations of the Act (together with the Base Prospectus, the "**Prospectus**"). The Shares are to be sold by the Company pursuant to that certain Common Stock Purchase Agreement, dated as of October 14, 2020 (the "**Purchase Agreement**"), by and between the Company and Aspire Capital Fund, LLC.

In connection with this opinion, we have examined and relied upon (a) the Registration Statement and the Prospectus, (b) the Company's Restated Certificate of Incorporation, as amended, and Amended and Restated Bylaws, each as currently in effect, and (c) originals or copies certified to our satisfaction, of such records, documents, certificates, opinions, memoranda and other instruments as in our judgment are necessary or appropriate to enable us to render the opinion expressed below. We have assumed the genuineness of all signatures, the authenticity of all documents submitted to us as originals, the conformity to originals of all documents submitted to us as copies; the accuracy, completeness and authenticity of certificates of public officials and the due authorization, execution and delivery of all documents by all persons other than the Company where due execution and delivery are a prerequisite to the effectiveness thereof. As to certain factual matters, we have relied upon a certificate of an officer of the Company and have not independently verified such matters.

We have assumed (i) each sale of the Shares will be duly authorized by the Board of Directors of the Company, a duly authorized committee thereof or a person or body pursuant to an authorization granted in accordance with Section 152 of the General Corporation Law of the State of Delaware (the "**DGCL**") and (ii) that no more than 20,000,000 Shares will be sold. We express no opinion to the extent that future issuances of securities of the Company and/or anti-dilution adjustments to outstanding securities of the Company cause the number of shares of Common Stock outstanding or issuable upon conversion or exercise of outstanding securities of the Company to exceed the number of Shares then issuable under the Purchase Agreement.

Our opinion herein is expressed solely with respect to the DGCL. We express no opinion to the extent that any other laws are applicable to the subject matter hereof and express no opinion and provide no assurance as to compliance with any federal or state securities law, rule or regulation.



X4 Pharmaceuticals, Inc.  
Page Two

On the basis of the foregoing and in reliance thereon, and subject to the qualifications herein stated, we are of the opinion that the Shares, when sold and issued in accordance with the Registration Statement, the Prospectus and the Purchase Agreement, will be validly issued, fully paid and nonassessable.

We hereby consent to the reference to our firm under the captions "Legal Matters" in the Prospectus and to the filing of this opinion as an exhibit to a current report of the Company on Form 8-K to be filed with the Commission for incorporation by reference of this opinion into the Registration Statement.

Very truly yours,

**COOLEY LLP**

By: /s/ Daniel I. Goldberg  
Daniel I. Goldberg, Partner

**COMMON STOCK PURCHASE AGREEMENT**

**COMMON STOCK PURCHASE AGREEMENT** (the “**Agreement**”), dated as of October 14, 2020, by and between **X4 PHARMACEUTICALS, INC.**, a Delaware corporation (the “**Company**”), and **ASPIRE CAPITAL FUND, LLC**, an Illinois limited liability company (the “**Buyer**”). Capitalized terms used herein and not otherwise defined herein are defined in Section 10 hereof.

**WHEREAS:**

Subject to the terms and conditions set forth in this Agreement, the Company wishes to sell to the Buyer, and the Buyer wishes to buy from the Company, up to Fifty Million Dollars (\$50,000,000) of the Company’s common stock, par value \$0.001 per share (the “**Common Stock**”). The shares of Common Stock to be purchased hereunder are referred to herein as the “**Purchase Shares**.”

**NOW THEREFORE**, the Company and the Buyer hereby agree as follows:

**1. PURCHASE OF COMMON STOCK.**

Subject to the terms and conditions set forth in this Agreement, the Company has the right to sell to the Buyer, and the Buyer has the obligation to purchase from the Company, Purchase Shares as follows:

(a) Commencement of Purchases of Common Stock. Any time after Commencement (as defined below), the purchase and sale of Purchase Shares hereunder may occur from time to time upon written notices by the Company to the Buyer on the terms and conditions as set forth herein following the satisfaction of the conditions (the “**Commencement**”) as set forth in Sections 6 and 7 below, to occur within five (5) Business Days of the date of this Agreement (the date of satisfaction of such conditions, the “**Commencement Date**”).

(b) The Company’s Right to Require Regular Purchases. Subject to the terms and conditions of this Agreement, on any given Business Day after the Commencement Date, the Company shall have the right but not the obligation to direct the Buyer by its delivery to the Buyer of a Purchase Notice from time to time, and the Buyer thereupon shall have the obligation, to buy the number of Purchase Shares specified in such notice, up to 30,000 Purchase Shares, on such Business Day (as long as such notice is delivered on or before 5:00 p.m. Eastern time on such Business Day) (each such purchase, a “**Regular Purchase**”) at the Purchase Price on the Purchase Date; however, in no event shall the Purchase Amount of a Regular Purchase exceed One Million Dollars (\$1,000,000) per Business Day, unless the Buyer and the Company mutually agree. The Company and the Buyer may mutually agree to increase the number of Purchase Shares that may be sold per Regular Purchase to as much as an additional 2,000,000 Purchase Shares per Business Day. The Company may deliver additional Purchase Notices to the Buyer from time to time so long as the most recent purchase has been completed. The share amounts in this Section 1(b) shall be appropriately adjusted for any reorganization, recapitalization, non-cash dividend, stock split, reverse stock split or other similar transaction.

(c) VWAP Purchases. Subject to the terms and conditions of this Agreement, in addition to purchases of Purchase Shares as described in Section 1(b) above, with one Business Day’s prior written notice (as long as such notice is delivered on or before 5:00 p.m. Eastern time on the Business Day immediately preceding the VWAP Purchase Date), the Company shall also have the right but not the

obligation to direct the Buyer by the Company's delivery to the Buyer of a VWAP Purchase Notice from time to time, and the Buyer thereupon shall have the obligation, to buy the VWAP Purchase Share Percentage of the trading volume of the Common Stock on the VWAP Purchase Date up to the VWAP Purchase Share Volume Maximum on the VWAP Purchase Date (each such purchase, a "**VWAP Purchase**") at the VWAP Purchase Price. The Company may deliver a VWAP Purchase Notice to the Buyer on or before 5:00 p.m. Eastern time on a date on which the Company also submitted a Purchase Notice for a Regular Purchase of at least 30,000 Purchase Shares to the Buyer. The share amount in the prior sentence shall be appropriately adjusted for any reorganization, recapitalization, non-cash dividend, stock split, reverse stock split, or other similar transaction. A VWAP Purchase shall automatically be deemed completed at such time on the VWAP Purchase Date that the Sale Price falls below the VWAP Minimum Price Threshold; in such circumstance, the VWAP Purchase Amount shall be calculated using (i) the VWAP Purchase Share Percentage of the aggregate shares traded on the Principal Market for such portion of the VWAP Purchase Date prior to the time that the Sale Price fell below the VWAP Minimum Price Threshold and (ii) a VWAP Purchase Price calculated using the volume weighted average price of Common Stock sold during such portion of the VWAP Purchase Date prior to the time that the Sale Price fell below the VWAP Minimum Price Threshold. Each VWAP Purchase Notice must be accompanied by instructions to the Company's Transfer Agent to immediately issue to the Buyer an amount of Common Stock equal to the VWAP Purchase Share Estimate, a good faith estimate by the Company of the number of Purchase Shares that the Buyer shall have the obligation to buy pursuant to the VWAP Purchase Notice. In no event shall the Buyer, pursuant to any VWAP Purchase, purchase a number of Purchase Shares that exceeds the VWAP Purchase Share Estimate issued on the VWAP Purchase Date in connection with such VWAP Purchase Notice; however, the Buyer will immediately return to the Company any amount of Common Stock issued pursuant to the VWAP Purchase Share Estimate that exceeds the number of Purchase Shares the Buyer actually purchases in connection with such VWAP Purchase. Upon completion of each VWAP Purchase Date, the Buyer shall submit to the Company a confirmation of the VWAP Purchase in form and substance reasonably acceptable to the Company. The Company may deliver additional VWAP Purchase Notices to the Buyer from time to time so long as the most recent purchase has been completed.

(d) Payment for Purchase Shares. For each Regular Purchase, the Buyer shall pay to the Company an amount equal to the Purchase Amount as full payment for such Purchase Shares via wire transfer of immediately available funds on the same Business Day that the Buyer receives such Purchase Shares. For each VWAP Purchase, the Buyer shall pay to the Company an amount equal to the VWAP Purchase Amount as full payment for such Purchase Shares via wire transfer of immediately available funds on the second Business Day following the VWAP Purchase Date. All payments made under this Agreement shall be made in lawful money of the United States of America via wire transfer of immediately available funds to such account as the Company may from time to time designate by written notice in accordance with the provisions of this Agreement. Whenever any amount expressed to be due by the terms of this Agreement is due on any day that is not a Business Day, the same shall instead be due on the next succeeding day that is a Business Day.

(e) Purchase Price Floor. The Company and the Buyer shall not effect any sales under this Agreement on any Purchase Date where the Closing Sale Price is less than the Floor Price. "**Floor Price**" means \$0.25 per share of Common Stock, which shall not be adjusted for any reorganization, recapitalization, non-cash dividend, stock split, reverse stock split or other similar transaction.

(f) Records of Purchases. The Buyer and the Company shall each maintain records showing the remaining Available Amount at any given time and the dates and Purchase Amounts for each purchase, or shall use such other method reasonably satisfactory to the Buyer and the Company to reconcile the remaining Available Amount.

(g) Taxes. The Company shall pay any and all transfer, stamp or similar taxes that may be payable with respect to the issuance and delivery of any shares of Common Stock to the Buyer made under this Agreement.

(h) Compliance with Principal Market Rules. Notwithstanding anything in this Agreement to the contrary, and in addition to the limitations set forth in Section 1(e), the total number of shares of Common Stock that may be issued under this Agreement shall be limited to 3,255,700 shares of Common Stock (the “**Exchange Cap**”), which equals 19.99% of the Company’s outstanding shares of Common Stock as of the date hereof, unless stockholder approval is obtained to issue more than such 19.99%. The Exchange Cap shall be appropriately adjusted for any reorganization, recapitalization, non-cash dividend, stock split, reverse stock split or other similar transaction. The foregoing limitation shall not apply if stockholder approval has not been obtained and at any time the Exchange Cap is reached and at all times thereafter the average price paid for all shares of Common Stock issued under this Agreement is equal to or greater than \$6.76 (the “**Minimum Price**”), a price equal to the lower of (1) the Closing Sale Price immediately preceding the execution of this Agreement or (2) the arithmetic average of the five (5) Closing Sale Prices for the Common Stock immediately preceding the execution of this Agreement (in such circumstance, for purposes of the Principal Market, the transaction contemplated hereby would not be “below market” and the Exchange Cap would not apply). The Minimum Price shall be appropriately adjusted for any reorganization, recapitalization, non-cash dividend, stock split, reverse stock split or other similar transaction. Notwithstanding the foregoing, the Company shall not be required or permitted to issue, and the Buyer shall not be required to purchase, any shares of Common Stock under this Agreement if such issuance would breach the Company’s obligations under the rules or regulations of the Principal Market. The Company may, in its sole discretion, determine whether to obtain stockholder approval to issue more than 19.99% of its outstanding shares of Common Stock hereunder if such issuance would require stockholder approval under the rules or regulations of the Principal Market.

(i) Beneficial Ownership Limitation. The Company shall not issue, and the Buyer shall not purchase any shares of Common Stock under this Agreement, if such shares proposed to be issued and sold, when aggregated with all other shares of Common Stock then owned beneficially (as calculated pursuant to Section 13(d) of the Securities Exchange Act of 1934, as amended (the “**1934 Act**”) and Rule 13d-3 promulgated thereunder) by the Buyer and its affiliates would result in the beneficial ownership by the Buyer and its affiliates of more than 19.99% of the then issued and outstanding shares of Common Stock.

## 2. **BUYER’S REPRESENTATIONS AND WARRANTIES.**

The Buyer represents and warrants to the Company that as of the date hereof and as of the Commencement Date:

(a) Investment Purpose. The Buyer is entering into this Agreement and acquiring the Purchase Shares for its own account for investment only and not with a view towards, or for resale in connection with, the public sale or distribution thereof; provided however, by making the representations herein, the Buyer does not agree to hold any of the Purchase Shares for any minimum or other specific term.

(b) Accredited Investor Status. The Buyer is an “accredited investor” as that term is defined in Rule 501(a)(3) of Regulation D of the 1933 Act.

(c) [Intentionally Omitted.]

(d) Information. The Buyer has been furnished with all materials relating to the business, finances and operations of the Company and materials relating to the offer and sale of the Purchase Shares that have been reasonably requested by the Buyer, including, without limitation, the SEC Documents (as defined in Section 3(f) hereof). The Buyer understands that its investment in the Purchase Shares involves a high degree of risk. The Buyer (i) is able to bear the economic risk of an investment in the Purchase Shares including a total loss, (ii) has such knowledge and experience in financial and business matters that it is capable of evaluating the merits and risks of the proposed investment in the Purchase Shares and (iii) has had an opportunity to ask questions of and receive answers from the officers of the Company concerning the financial condition and business of the Company and other matters related to an investment in the Purchase Shares. Neither such inquiries nor any other due diligence investigations conducted by the Buyer or its representatives shall modify, amend or affect the Buyer’s right to rely on the Company’s representations and warranties contained in Section 3 below. The Buyer has sought such accounting, legal and tax advice as it has considered necessary to make an informed investment decision with respect to its acquisition of the Purchase Shares.

(e) No Governmental Review. The Buyer understands that no United States federal or state agency or any other government or governmental agency has passed on or made any recommendation or endorsement of the Purchase Shares or the fairness or suitability of the investment in the Purchase Shares nor have such authorities passed upon or endorsed the merits of the offering of the Purchase Shares.

(f) [Intentionally Omitted.]

(g) Organization. The Buyer is a limited liability company duly organized and validly existing in good standing under the laws of the jurisdiction in which it is organized, and has the requisite organizational power and authority to own its properties and to carry on its business as now being conducted.

(h) Validity; Enforcement. This Agreement has been duly and validly authorized, executed and delivered on behalf of the Buyer and is a valid and binding agreement of the Buyer enforceable against the Buyer in accordance with its terms, subject as to enforceability to (i) general principles of equity and to applicable bankruptcy, insolvency, reorganization, moratorium, liquidation and other similar laws relating to, or affecting generally, the enforcement of applicable creditors’ rights and remedies and (ii) public policy underlying any law, rule or regulation (including any federal or state securities law, rule or regulation) with regards to indemnification, contribution or exculpation. The execution and delivery of the Transaction Documents (as defined in Section 3(b) hereof) by the Buyer and the consummation by it of the transactions contemplated hereby and thereby do not conflict with the Buyer’s certificate of organization or operating agreement or similar documents, and do not require further consent or authorization by the Buyer, its managers or its members.

(i) Residency. The Buyer is a resident of the State of Illinois.



(j) **No Prior Short Selling.** The Buyer represents and warrants to the Company that at no time prior to the date of this Agreement has any of the Buyer, its agents, representatives or affiliates engaged in or effected, in any manner whatsoever, directly or indirectly, any (i) “short sale” (as such term is defined in Section 242.200 of Regulation SHO of the 1934 Act) of the Common Stock or (ii) hedging transaction, which establishes a net short position with respect to the Common Stock.

### 3. REPRESENTATIONS AND WARRANTIES OF THE COMPANY.

The Company represents and warrants to the Buyer that as of the date hereof and as of the Commencement Date:

(a) **Organization and Qualification.** The Company and its “Subsidiaries” (which for purposes of this Agreement means any entity in which the Company, directly or indirectly, owns more than 50% of the voting stock or capital stock or other similar equity interests) are corporations or limited liability companies duly organized and validly existing in good standing under the laws of the jurisdiction in which they are incorporated or organized, and have the requisite corporate or organizational power and authority to own their properties and to carry on their business as now being conducted. Each of the Company and its Subsidiaries is duly qualified as a foreign corporation or limited liability company to do business and is in good standing in every jurisdiction in which its ownership of property or the nature of the business conducted by it makes such qualification necessary, except to the extent that the failure to be so qualified or be in good standing could not reasonably be expected to have a Material Adverse Effect. As used in this Agreement, “Material Adverse Effect” means any material adverse effect on any of: (i) the business, properties, assets, operations, results of operations or financial condition of the Company and its Subsidiaries, if any, taken as a whole, or (ii) the authority or ability of the Company to perform its obligations under the Transaction Documents. The Company has no material Subsidiaries except as set forth on Schedule 3(a).

(b) **Authorization; Enforcement; Validity.** (i) The Company has the requisite corporate power and authority to enter into and perform its obligations under this Agreement, the Registration Rights Agreement and each of the other agreements entered into by the parties on the Commencement Date and attached hereto as exhibits to this Agreement (collectively, the “**Transaction Documents**”), and to issue the Purchase Shares in accordance with the terms hereof and thereof, (ii) the execution and delivery of the Transaction Documents by the Company and the consummation by it of the transactions contemplated hereby and thereby, including without limitation, the reservation for issuance and the issuance of the Purchase Shares issuable under this Agreement, have been duly authorized by the Company’s Board of Directors or duly authorized committee thereof, do not conflict with the Company’s Certificate of Incorporation or Bylaws (as defined below), and do not require further consent or authorization by the Company, its Board of Directors, except as set forth in this Agreement, or its stockholders (other than as contemplated by Section 1(h) hereof), (iii) this Agreement has been, and each other Transaction Document shall be on the Commencement Date, duly executed and delivered by the Company and (iv) this Agreement constitutes, and each other Transaction Document upon its execution on behalf of the Company, shall constitute, the valid and binding obligations of the Company enforceable against the Company in accordance with their terms, except as such enforceability may be limited by (y) general principles of equity or applicable bankruptcy, insolvency, reorganization, moratorium, liquidation or similar laws relating to, or affecting generally, the enforcement of creditors’ rights and remedies and (z) public policy underlying any law, rule or regulation (including any federal or state securities law, rule or regulation) with regards to indemnification, contribution or exculpation. The Board of Directors of the Company or duly authorized committee thereof has approved the resolutions (the “**Signing Resolutions**”)

substantially in the form as set forth as Exhibit B attached hereto to authorize this Agreement and the transactions contemplated hereby. The Signing Resolutions are valid, in full force and effect and have not been modified or supplemented in any material respect. The Company has delivered to the Buyer a true and correct copy of the Signing Resolutions as approved by the Board of Directors of the Company or an appropriate Board committee.

(c) Capitalization. As of the date hereof, the authorized capital stock of the Company consists of (i) 125,000,000 shares of Common Stock, par value \$0.001 per share, of which as of the date hereof, 16,286,645 shares are issued and outstanding, zero shares are held as treasury shares, 2,182,706 shares are reserved for future issuance pursuant to the Company's equity incentive plans, of which approximately 79,104 shares remain available for future option grants or stock awards, 160,493 shares are reserved for future issuance pursuant to the Company's employee stock purchase plan, of which 160,493 shares remain available for future issuance, and 13,506,040 shares are issuable and reserved for issuance pursuant to securities (other than stock options or equity based awards issued pursuant to the Company's stock incentive plans) exercisable or exchangeable for, or convertible into, shares of Common Stock, and (ii) 10,000,000 shares of preferred stock, of which as of the date hereof zero shares are issued and outstanding. All of such outstanding shares have been, or upon issuance will be, validly issued and are fully paid and non-assessable. Except as disclosed in Schedule 3(c), (i) no shares of the Company's capital stock are subject to preemptive rights or any other similar rights or any liens or encumbrances suffered or permitted by the Company, (ii) there are no outstanding debt securities of the Company or any of its Subsidiaries, (iii) there are no outstanding options, warrants, scrip, rights to subscribe to, calls or commitments of any character whatsoever relating to, or securities or rights convertible into, any shares of capital stock of the Company or any of its Subsidiaries, or contracts, commitments, understandings or arrangements by which the Company or any of its Subsidiaries is or may become bound to issue additional shares of capital stock of the Company or any of its Subsidiaries or options, warrants, scrip, rights to subscribe to, calls or commitments of any character whatsoever relating to, or securities or rights convertible into, any shares of capital stock of the Company or any of its Subsidiaries, (iv) there are no material agreements or arrangements under which the Company or any of its Subsidiaries is obligated to register the sale of any of their securities under the 1933 Act (except the Registration Rights Agreement), (v) there are no outstanding securities or instruments of the Company or any of its Subsidiaries which contain any redemption or similar provisions, and there are no contracts, commitments, understandings or arrangements by which the Company or any of its Subsidiaries is or may become bound to redeem a security of the Company or any of its Subsidiaries, (vi) there are no securities or instruments containing anti-dilution or similar provisions that will be triggered by the issuance of the Purchase Shares as described in this Agreement and (vii) the Company does not have any stock appreciation rights or "phantom stock" plans or agreements or any similar plan or agreement. The Company has furnished or made available to the Buyer true and correct copies of the Company's Restated Certificate of Incorporation, as amended and as in effect on the date hereof (the "**Certificate of Incorporation**"), and the Company's Amended and Restated Bylaws, as amended and as in effect on the date hereof (the "**Bylaws**").

(d) Issuance of Purchase Shares. At least 3,255,700 shares of Common Stock have been duly authorized and reserved for issuance upon future purchase as Purchase Shares under this Agreement. Upon issuance and payment therefore in accordance with the terms and conditions of this Agreement, the Purchase Shares shall be validly issued, fully paid and non-assessable and free from all taxes, liens and charges with respect to the issue thereof, with the holders being entitled to all rights accorded to a holder of Common Stock.

(e) No Conflicts. Except as disclosed in Schedule 3(e), the execution, delivery and performance of the Transaction Documents by the Company and the consummation by the Company of the transactions contemplated hereby and thereby (including, without limitation, the reservation for issuance and issuance of the Purchase Shares in accordance with the terms and conditions of this Agreement) will not (i) result in a violation of the Certificate of Incorporation, any Certificate of Designations, Preferences and Rights of any outstanding series of preferred stock of the Company or the Bylaws or (ii) conflict with, or constitute a default (or an event which with notice or lapse of time or both would become a default) under, or give to others any rights of termination, amendment, acceleration or cancellation of, any agreement, indenture or instrument to which the Company or any of its Subsidiaries is a party, or result, to the Company's knowledge, in a violation of any law, rule, regulation, order, judgment or decree (including federal and state securities laws and regulations and the rules and regulations of the Principal Market applicable to the Company or any of its Subsidiaries) or by which any property or asset of the Company or any of its Subsidiaries is bound or affected, except in the case of conflicts, defaults, terminations, amendments, accelerations, cancellations and violations under clause (ii), which could not reasonably be expected to result in a Material Adverse Effect. Except as disclosed in Schedule 3(e), neither the Company nor its Subsidiaries is in violation of any term of or in default under its Certificate of Incorporation, including any Certificate of Designation, Preferences and Rights of any outstanding series of preferred stock of the Company, or Bylaws or their organizational charter or bylaws, respectively. Except as disclosed in Schedule 3(e), neither the Company nor any of its Subsidiaries is in violation of any term of or is in default under any material contract, agreement, mortgage, indebtedness, indenture, instrument, judgment, decree or order or any statute, rule or regulation applicable to the Company or its Subsidiaries, except for possible violations, defaults, terminations or amendments that would not reasonably be expected to have a Material Adverse Effect. The business of the Company and its Subsidiaries is not being conducted, and shall not be conducted, in violation of any law, ordinance, or regulation of any governmental entity, except for possible violations, the sanctions for which either individually or in the aggregate could not reasonably be expected to have a Material Adverse Effect. Except as specifically contemplated by this Agreement, reporting obligations under the 1934 Act, or as required under the 1933 Act or applicable state securities laws or the filing of a Listing of Additional Shares Notification Form with the Principal Market, the Company is not required to obtain any consent, authorization or order of, or make any filing or registration with, any court or governmental agency or any regulatory or self-regulatory agency in order for it to execute, deliver or perform any of its obligations under or contemplated by the Transaction Documents in accordance with the terms hereof or thereof. Except as disclosed in Schedule 3(e) and for reporting obligations under the 1934 Act, all consents, authorizations, orders, filings and registrations which the Company is required to obtain pursuant to the preceding sentence shall be obtained or effected on or prior to the Commencement Date. Except as disclosed in Schedule 3(e), the Company is not subject to any notices or actions from or to the Principal Market other than routine matters incident to listing on the Principal Market and not involving a violation of the rules of the Principal Market. Except as disclosed in Schedule 3(e), to the Company's knowledge, the Principal Market has not commenced any delisting proceedings against the Company.

(f) SEC Documents; Financial Statements. Except as disclosed in Schedule 3(f), since June 30, 2019, the Company has filed all reports, schedules, forms, statements and other documents required to be filed by it with the SEC pursuant to the reporting requirements of the 1934 Act (all of the foregoing filed prior to the date hereof and all exhibits included therein and financial statements and schedules thereto and documents incorporated by reference therein being hereinafter referred to as the "**SEC Documents**"). As of their respective dates (except as they have been correctly amended), the SEC Documents complied in all material respects with the requirements of the 1934 Act and the rules and regulations of the SEC promulgated thereunder applicable to the SEC Documents, and none of the SEC

Documents, at the time they were filed with the SEC (except as they may have been properly amended), contained any untrue statement of a material fact or omitted to state a material fact required to be stated therein or necessary in order to make the statements therein, in light of the circumstances under which they were made, not misleading. As of their respective dates (except as they have been properly amended), the financial statements of the Company included in the SEC Documents complied as to form in all material respects with applicable accounting requirements and the published rules and regulations of the SEC with respect thereto. Such financial statements have been prepared in accordance with generally accepted accounting principles, consistently applied, during the periods involved (except (i) as may be otherwise indicated in such financial statements or the notes thereto or (ii) in the case of unaudited interim statements, to the extent they may exclude footnotes or may be condensed or summary statements) and fairly present in all material respects the financial position of the Company as of the dates thereof and the results of its operations and cash flows for the periods then ended (subject, in the case of unaudited statements, to normal year-end audit adjustments). Except as disclosed in Schedule 3(f) or routine correspondence, such as comment letters and notices of effectiveness in connection with previously filed registration statements or periodic reports publicly available on EDGAR, to the Company's knowledge, the Company or any of its Subsidiaries are not on the date hereof the subject of any inquiry, investigation or action by the SEC.

(g) Absence of Certain Changes. Except as disclosed in Schedule 3(g), since June 30, 2020, there has been no material adverse change in the business, properties, operations, financial condition or results of operations of the Company or its Subsidiaries taken as a whole. For purposes of this Agreement, neither a decrease in cash or cash equivalents or in the market price of the Common Stock nor losses incurred in the ordinary course of the Company's business shall be deemed or considered a material adverse change. The Company has not taken any steps, and does not currently expect to take any steps, to seek protection pursuant to any Bankruptcy Law nor does the Company or any of its Subsidiaries have any knowledge or reason to believe that its creditors intend to initiate involuntary bankruptcy or insolvency proceedings. The Company is financially solvent and is generally able to pay its debts as they become due.

(h) Absence of Litigation. Except as disclosed in Schedule 3(h), to the Company's knowledge, there is no action, suit, proceeding, inquiry or investigation before or by any court, public board, government agency, self-regulatory organization or body pending or, to the knowledge of the Company or any of its Subsidiaries, threatened against the Company, the Common Stock or any of the Company's Subsidiaries or any of the Company's or the Company's Subsidiaries' officers or directors in their capacities as such, which could reasonably be expected to have a Material Adverse Effect (each, an "**Action**"). A description of each such Action, if any, is set forth in Schedule 3(h).

(i) Acknowledgment Regarding Buyer's Status. The Company acknowledges and agrees that the Buyer is acting solely in the capacity of arm's length purchaser with respect to the Transaction Documents and the transactions contemplated hereby and thereby. The Company further acknowledges that the Buyer is not acting as a financial advisor or fiduciary of the Company (or in any similar capacity) with respect to the Transaction Documents and the transactions contemplated hereby and thereby and any advice given by the Buyer or any of its representatives or agents in connection with the Transaction Documents and the transactions contemplated hereby and thereby is merely incidental to the Buyer's purchase of the Purchase Shares. The Company further represents to the Buyer that the Company's decision to enter into the Transaction Documents has been based solely on the independent evaluation by the Company and its representatives and advisors.

(j) **Intellectual Property Rights.** To the Company's knowledge, the Company and its Subsidiaries own or possess adequate rights or licenses to use all material trademarks, trade names, service marks, service mark registrations, service names, patents, patent rights, copyrights, inventions, licenses, approvals, governmental authorizations, trade secrets and other intellectual property rights (collectively, "**Intellectual Property**") necessary to conduct their respective businesses as now conducted, except as set forth in Schedule 3(j) or to the extent that the failure to own, possess, license or otherwise hold adequate rights to use Intellectual Property would not, individually or in the aggregate, have a Material Adverse Effect. Except as disclosed in Schedule 3(j), to the Company's knowledge, none of the Company's active and registered Intellectual Property have expired or terminated, or, by the terms and conditions thereof, will expire or terminate within two years from the date of this Agreement, except as would not reasonably be expected to have a Material Adverse Effect. The Company and its Subsidiaries do not have any knowledge of any infringement by the Company or its Subsidiaries of any Intellectual Property of others and, except as set forth on Schedule 3(j), there is no claim, action or proceeding being made or brought against, or to the Company's knowledge, being threatened against, the Company or its Subsidiaries regarding Intellectual Property, which could reasonably be expected to have a Material Adverse Effect.

(k) **Environmental Laws.** To the Company's knowledge, the Company and its Subsidiaries (i) are in material compliance with any and all applicable foreign, federal, state and local laws and regulations relating to the protection of human health and safety or the environment and with respect to hazardous or toxic substances or wastes, pollutants or contaminants ("**Environmental Laws**"), (ii) have received all material permits, licenses or other approvals required of them under applicable Environmental Laws to conduct their respective businesses and (iii) are in material compliance with all terms and conditions of any such permit, license or approval, except where, in each of the three foregoing clauses, the failure to so comply or receive such approvals could not reasonably be expected to have, individually or in the aggregate, a Material Adverse Effect.

(l) **Title.** The Company and its Subsidiaries have good and marketable title to all personal property owned by them that is material to the business of the Company and its Subsidiaries, in each case free and clear of all liens, encumbrances and defects except such as are described in Schedule 3(l) or such as do not materially affect the value of such property and do not interfere with the use made and proposed to be made of such property by the Company and any of its Subsidiaries or could not reasonably be expected to have, individually or in the aggregate, a Material Adverse Effect. Any real property and facilities held under lease by the Company and any of its Subsidiaries, to the Company's knowledge, are held by them under valid, subsisting and enforceable leases with such exceptions as are not material and do not interfere with the use made and proposed to be made of such property and buildings by the Company and its Subsidiaries.

(m) **Insurance.** The Company and each of its Subsidiaries are insured by insurers of recognized financial responsibility against such losses and risks and in such amounts as management of the Company believes to be reasonable and customary in the businesses in which the Company and its Subsidiaries are engaged. To the Company's knowledge, since March 13, 2019, neither the Company nor any such Subsidiary has been refused any insurance coverage sought or applied for and neither the Company nor any such Subsidiary, to the Company's knowledge, will be unable to renew its 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 reasonably be expected to have a Material Adverse Effect.

(n) Regulatory Permits. The Company and its Subsidiaries possess all material certificates, authorizations and permits issued by the appropriate federal, state or foreign regulatory authorities necessary to conduct their respective businesses as currently conducted, except when the failure to so possess such certificates, authorizations or permits could not reasonably be expected to have, individually or in the aggregate, a Material Adverse Effect, and neither the Company nor any such Subsidiary has received any written notice of proceedings relating to the revocation or modification of any such material certificate, authorization or permit.

(o) Tax Status. The Company and each of its Subsidiaries has made or filed all federal and state income and all other material tax returns, reports and declarations required by any jurisdiction to which it is subject (unless and only to the extent that the Company and each of its Subsidiaries has set aside on its books reserves reasonably adequate for the payment of all unpaid and unreported taxes or filed valid extensions) and has paid all taxes and other governmental assessments and charges that are material in amount, shown or determined to be due on such returns, reports and declarations, except those being contested in good faith and has set aside on its books reserves reasonably adequate for the payment of all taxes for periods subsequent to the periods to which such returns, reports or declarations apply. To the Company's knowledge, there are no unpaid taxes in any material amount claimed to be due by the taxing authority of any jurisdiction.

(p) Transactions With Affiliates. Except as set forth on Schedule 3(p), and other than (i) the grant or exercise of stock options or any other equity securities offered pursuant to duly adopted stock or incentive compensation plans as disclosed on Schedule 3(c) and (ii) employment or indemnification agreements approved by the Board of Directors of the Company, none of the officers, directors or employees of the Company is on the date hereof a party to any transaction with the Company or any of its Subsidiaries (other than for services as employees, officers and directors and reimbursement for expenses incurred on behalf of the Company), including any contract, agreement or other arrangement providing for the furnishing of services to or by, providing for rental of real or personal property to or from, or otherwise requiring payments to or from any officer, director or such employee or, to the knowledge of the Company, any corporation, partnership, trust or other entity in which any officer, director, or any such employee has a material interest or is an officer, director, trustee or general partner.

(q) Application of Takeover Protections. The Company and its board of directors have taken or will take prior to the Commencement Date all necessary action, if any, in order to render inapplicable any control share acquisition, business combination, poison pill (including any distribution under a rights agreement) or other similar anti-takeover provision under the Certificate of Incorporation or the laws of the state of its incorporation, other than Section 203 of the Delaware General Corporation Law, which is or could become applicable to the Buyer as a result of the transactions contemplated by this Agreement, including, without limitation, the Company's issuance of the Purchase Shares and the Buyer's ownership of the Purchase Shares.

(r) Registration Statement. The Shelf Registration Statement (as defined in Section 4(a) hereof) has been declared effective by the SEC, and no stop order has been issued or is pending or, to the knowledge of the Company, threatened by the SEC with respect thereto. As of the date hereof, the Company has a dollar amount of securities registered and unsold under the Shelf Registration Statement, which is not less than the Available Amount.

#### 4. COVENANTS.

(a) Filing of Form 8-K and Prospectus Supplement. The Company agrees that it shall, within the time required under the 1934 Act, file a Current Report on Form 8-K disclosing this Agreement and the transaction contemplated hereby. The Company shall file within two (2) Business Days from the date hereof a prospectus supplement to the Company's existing shelf registration statement on Form S-3 (File No. 333-242372, the "**Shelf Registration Statement**") covering the sale of the Purchase Shares (the "**Prospectus Supplement**") in accordance with the terms of the Registration Rights Agreement between the Company and the Buyer, dated as of the date hereof (the "**Registration Rights Agreement**"). The Company shall use its reasonable best efforts to keep the Shelf Registration Statement or any New Registration Statement (as defined in the Registration Rights Agreement) effective pursuant to Rule 415 promulgated under the 1933 Act and available for sales of all Purchase Shares to the Buyer until such time as (i) it no longer qualifies to make sales under the Shelf Registration Statement (which shall be understood to include the inability of the Company to immediately register sales of Purchase Shares to the Buyer under the Shelf Registration Statement or any New Registration Statement pursuant to General Instruction I.B.6 of Form S-3), (ii) the date on which all the Purchase Shares have been sold under this Agreement and no Available Amount remains thereunder, or (iii) this Agreement has been terminated. The Shelf Registration Statement (including any amendments or supplements thereto and prospectuses or prospectus supplements, including the Prospectus Supplement, contained therein) or any New Registration Statement shall 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, in light of the circumstances in which they were made, not misleading.

(b) Blue Sky. The Company shall take such action, if any, as is reasonably necessary in order to obtain an exemption for or to qualify (i) the initial sale of the Purchase Shares to the Buyer under this Agreement and (ii) any subsequent sale of the Purchase Shares by the Buyer, in each case, under applicable securities or "Blue Sky" laws of the states of the United States in such states as is reasonably requested by the Buyer from time to time, and shall provide evidence of any such action so taken to the Buyer at its written request; *provided, however*, that the Company shall not be obligated to file any general consent to service of process or to qualify as a foreign corporation or as a dealer in securities in any jurisdiction in which it is not so qualified or to subject itself to taxation in respect of doing business in any jurisdiction in which it is not otherwise so subject.

(c) Listing. The Company shall promptly secure the listing of all of the Purchase Shares upon each national securities exchange and automated quotation system that requires an application by the Company for listing, if any, upon which shares of Common Stock are then listed (subject to official notice of issuance) and shall maintain such listing, so long as any other shares of Common Stock shall be so listed. The Company shall use its reasonable best efforts to maintain the Common Stock's listing on the Principal Market in accordance with the requirements of the Registration Rights Agreement. Neither the Company nor any of its Subsidiaries shall take any action that would be reasonably expected to result in the delisting or suspension of the Common Stock on the Principal Market, unless the Common Stock is immediately thereafter traded on the New York Stock Exchange, the NYSE American, the Nasdaq Global Select Market, the Nasdaq Global Market, or the Nasdaq Capital Market. The Company shall pay all fees and expenses in connection with satisfying its obligations under this Section.

(d) Limitation on Short Sales and Hedging Transactions. The Buyer agrees that beginning on the date of this Agreement and ending on the date of termination of this Agreement as provided in Section 11(k), the Buyer and its agents, representatives and affiliates shall not in any manner whatsoever

into or effect, directly or indirectly, any (i) "short sale" (as such term is defined in Section 242.200 of Regulation SHO of the 1934 Act) of the Common Stock or (ii) hedging transaction, which establishes a net short position with respect to the Common Stock.

(e) **Due Diligence.** The Buyer shall have the right, from time to time as the Buyer may reasonably request, to perform reasonable due diligence on the Company during normal business hours and subject to reasonable prior notice to the Company. The Company and its officers and employees shall provide information and reasonably cooperate with the Buyer in connection with any reasonable request by the Buyer related to the Buyer's due diligence of the Company, including, but not limited to, any such request made by the Buyer in connection with (i) the filing of the prospectus supplement described in Section 4(a) hereof and (ii) the Commencement; provided, however, that at no time is the Company required to disclose material nonpublic information to the Buyer or breach any obligation of confidentiality or non-disclosure to a third party or make any disclosure that could cause a waiver of attorney-client privilege. Except as may be required by law, court order or governmental authority, each party hereto agrees not to disclose any Confidential Information of the other party to any third party and shall not use the Confidential Information of such other party for any purpose other than in connection with, or in furtherance of, the transactions contemplated hereby; provided, that to the extent such disclosure is required by law, court order or governmental authority, the receiving party shall provide the disclosing party with reasonable prior written notice of such disclosure and make a reasonable effort to assist the disclosing party in obtaining a protective order preventing or limiting the disclosure and/or requiring that the Confidential Information so disclosed be used only for the purposes for which the law, court order or governmental authority requires. Each party hereto acknowledges that the Confidential Information shall remain the property of the disclosing party and agrees that it shall take all reasonable measures to protect the secrecy of any Confidential Information disclosed by the other party.

#### **5. TRANSFER AGENT INSTRUCTIONS.**

All of the Purchase Shares to be issued under this Agreement shall be issued without any restrictive legend unless the Buyer expressly consents otherwise. The Company shall issue irrevocable instructions to the Transfer Agent, and any subsequent transfer agent, to issue Common Stock in the name of the Buyer for the Purchase Shares (the "**Irrevocable Transfer Agent Instructions**"). The Company warrants to the Buyer that no instruction other than the Irrevocable Transfer Agent Instructions referred to in this Section 5, will be given by the Company to the Transfer Agent with respect to the Purchase Shares and that the Purchase Shares shall otherwise be freely transferable on the books and records of the Company as and to the extent provided in this Agreement and the Registration Rights Agreement.

#### **6. CONDITIONS TO THE COMPANY'S RIGHT TO COMMENCE SALES OF SHARES OF COMMON STOCK UNDER THIS AGREEMENT.**

The right of the Company hereunder to commence sales of the Purchase Shares is subject to the satisfaction of each of the following conditions on or before the Commencement Date (the date that the Company may begin sales of Purchase Shares):

(a) The Buyer shall have executed each of the Transaction Documents and delivered the same to the Company;

(b) The representations and warranties of the Buyer shall be true and correct as of the Commencement Date as though made at that time (except for representations and warranties that speak



as of a specific date, which shall be true and correct in all material respects as of such specific date) and the Buyer shall have performed, satisfied and complied in all material respects with the covenants and agreements required by this Agreement to be performed, satisfied or complied with by the Buyer at or prior to the Commencement Date; and

(c) The Prospectus Supplement shall have been delivered to the Buyer and no stop order with respect to the registration statement covering the sale of shares to the Buyer shall be pending or threatened by the SEC.

#### 7. CONDITIONS TO THE BUYER'S OBLIGATION TO MAKE PURCHASES OF SHARES OF COMMON STOCK.

The obligation of the Buyer to buy Purchase Shares under this Agreement is subject to the satisfaction of each of the following conditions on or before the Commencement Date (the date that the Company may begin sales of Purchase Shares) and once such conditions have been initially satisfied, there shall not be any ongoing obligation to satisfy such conditions after the Commencement has occurred:

(a) The Company shall have executed each of the Transaction Documents and delivered the same to the Buyer;

(b) The Common Stock shall be authorized for quotation on the Principal Market, trading in the Common Stock shall not have been within the last 365 days suspended by the SEC or the Principal Market, other than a general halt in trading in the Common Stock by the Principal Market under halt codes indicating pending or released material news, and the Purchase Shares shall be approved for listing upon the Principal Market;

(c) The Buyer shall have received the opinion of the Company's legal counsel dated as of the Commencement Date in customary form and substance;

(d) The representations and warranties of the Company shall be true and correct in all material respects (except to the extent that any of such representations and warranties is already qualified as to materiality in Section 3 above, in which case, such representations and warranties shall be true and correct without further qualification) as of the date of this Agreement and as of the Commencement Date as though made at that time (except for representations and warranties that speak as of a specific date, which shall be true and correct in all material respects as of such specific date) and the Company shall have performed, satisfied and complied in all material respects with the covenants, agreements and conditions required by the Transaction Documents to be performed, satisfied or complied with by the Company at or prior to the Commencement Date. The Buyer shall have received a certificate, executed by the CEO, President or CFO of the Company, dated as of the Commencement Date, to the foregoing effect in the form attached hereto as **Exhibit A**;

(e) The Board of Directors of the Company or a duly authorized committee thereof shall have adopted resolutions substantially in the form attached hereto as **Exhibit B** which shall be in full force and effect without any amendment or supplement thereto as of the Commencement Date;

(f) As of the Commencement Date, the Company shall have reserved out of its authorized and unissued Common Stock, solely for the purpose of effecting future purchases of Purchase Shares hereunder, 3,255,700 shares of Common Stock;

(g) The Irrevocable Transfer Agent Instructions, in form acceptable to the Buyer shall have been signed by the Company and the Buyer and shall have been delivered to the Transfer Agent;

(h) The Company shall have delivered to the Buyer a certificate evidencing the incorporation and good standing of the Company in the State of Delaware issued by the Secretary of State of the State of Delaware as of a date within ten (10) Business Days of the Commencement Date;

(i) The Company shall have delivered to the Buyer a secretary's certificate executed by the Secretary of the Company, dated as of the Commencement Date, in the form attached hereto as **Exhibit C**;

(j) The Shelf Registration Statement shall have been declared effective under the 1933 Act by the SEC and no stop order with respect thereto shall be pending or, to the knowledge of the Company, threatened by the SEC. The Company shall have prepared and delivered to the Buyer a final and complete form of prospectus supplement, dated and current as of the Commencement Date, to be used in connection with any issuances and sales by the Company of any Purchase Shares to the Buyer, and to be filed by the Company within two (2) Business Days after the Commencement Date pursuant to Rule 424(b). The Company shall have made all filings under all applicable federal and state securities laws necessary to consummate the issuance of the Purchase Shares pursuant to this Agreement in compliance with such laws;

(k) No Event of Default has occurred and is continuing, or any event which, after notice and/or lapse of time, would become an Event of Default has occurred;

(l) On or prior to the Commencement Date, the Company shall take all necessary action, if any, and such actions as reasonably requested by the Buyer, in order to render inapplicable any control share acquisition, business combination, stockholder rights plan or poison pill (including any distribution under a rights agreement) or other similar anti-takeover provision under the Certificate of Incorporation or the laws of the state of its incorporation, other than Section 203 of the Delaware General Corporation Law, that is or could become applicable to the Buyer as a result of the transactions contemplated by this Agreement, including, without limitation, the Company's issuance of the Purchase Shares and the Buyer's ownership of the Purchase Shares; and

(m) The Company shall have provided the Buyer with the information reasonably requested by the Buyer in connection with its due diligence requests made prior to, or in connection with, the Commencement, in accordance with the terms of Section 4(f) hereof.

## **8. INDEMNIFICATION.**

In consideration of the Buyer's execution and delivery of the Transaction Documents and acquiring the Purchase Shares hereunder and in addition to all of the Company's other obligations under the Transaction Documents, the Company shall defend, protect, indemnify and hold harmless the Buyer and all of its affiliates, members, officers, directors, and employees, and any of the foregoing person's agents or other representatives (including, without limitation, those retained in connection with the transactions contemplated by this Agreement) (collectively, the "**Indemnitees**") from and against any and all third party actions, causes of action, suits, claims, losses, costs, penalties, fees, liabilities and damages, and expenses in connection therewith (irrespective of whether any such Indemnitee is a party to the

action for which indemnification hereunder is sought), and including reasonable and documented attorneys' fees and disbursements (the "**Indemnified Liabilities**"), incurred by any Indemnitee as a result of, or arising out of, or relating to (a) any misrepresentation or breach of any representation or warranty made by the Company in the Transaction Documents or any other certificate, instrument or document contemplated hereby or thereby, (b) any breach of any covenant, agreement or obligation of the Company contained in the Transaction Documents or any other certificate, instrument or document contemplated hereby or thereby, or (c) any cause of action, suit or claim brought or made against such Indemnitee and arising out of or resulting from the execution, delivery, performance or enforcement of the Transaction Documents or any other certificate, instrument or document contemplated hereby or thereby, other than with respect to Indemnified Liabilities which directly and primarily result from (A) a breach of any of the Buyer's representations and warranties, covenants or agreements contained in this Agreement, or (B) the gross negligence, bad faith or willful misconduct of the Buyer or any other Indemnitee. To the extent that the foregoing undertaking by the Company may be unenforceable for any reason, the Company shall make the maximum contribution to the payment and satisfaction of each of the Indemnified Liabilities which is permissible under applicable law.

## 9. EVENTS OF DEFAULT.

An "**Event of Default**" shall be deemed to have occurred at any time as any of the following events occurs:

- (a) during any period in which the effectiveness of any registration statement is required to be maintained pursuant to the terms of the Registration Rights Agreement, the effectiveness of such registration statement lapses for any reason (including, without limitation, the issuance of a stop order) or is unavailable to the Company for the sale of all of the Registrable Securities (as defined in the Registration Rights Agreement) to the Buyer in accordance with the terms of the Registration Rights Agreement, and such lapse or unavailability continues for a period of ten (10) consecutive Business Days or for more than an aggregate of thirty (30) Business Days in any 365-day period, which is not in connection with a Permitted Delay (as defined in the Registration Rights Agreement), post-effective amendment to any such registration statement or the filing of a new registration statement; provided, however, that in connection with any post-effective amendment to such registration statement or filing of a new registration statement that is required to be declared effective by the SEC, such lapse or unavailability may continue for a period of no more than thirty (30) consecutive Business Days, which such period shall be extended for an additional thirty (30) Business Days if the Company receives a comment letter from the SEC in connection therewith;
- (b) the suspension from trading or failure of the Common Stock to be listed on a Principal Market for a period of three (3) consecutive Business Days;
- (c) the delisting of the Common Stock from the Principal Market, and the Common Stock is not immediately thereafter trading on the New York Stock Exchange, the NYSE American, the Nasdaq Global Select Market, the Nasdaq Global Market, or the Nasdaq Capital Market;
- (d) the failure for any reason by the Transfer Agent to issue Purchase Shares to the Buyer within five (5) Business Days after the applicable Purchase Date that the Buyer is entitled to receive;
- (e) the Company's breach of any representation or warranty (as of the dates made), covenant or other term or condition under any Transaction Document if such breach could reasonably be expected to have a Material Adverse Effect and except, in the case of a breach of a covenant which is reasonably curable, only if such breach continues uncured for a period of at least five (5) Business Days;

(f) if any Person commences a proceeding against the Company pursuant to or within the meaning of any Bankruptcy Law;

(g) if the Company 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, (D) makes a general assignment for the benefit of its creditors or (E) becomes insolvent;

(h) a court of competent jurisdiction enters an order or decree under any Bankruptcy Law that (A) is for relief against the Company in an involuntary case, (B) appoints a Custodian of the Company or for all or substantially all of its property, or (C) orders the liquidation of the Company or any Subsidiary; or

(i) if at any time after the Commencement Date, the Exchange Cap is reached unless and until stockholder approval has been obtained pursuant to Section 1(h) hereof. The Exchange Cap shall be deemed to be reached at such time if, upon submission of a Purchase Notice or VWAP Purchase Notice under this Agreement, the issuance of such shares of Common Stock would exceed the number of shares of Common Stock which the Company may issue under this Agreement without breaching the Company's obligations under the rules or regulations of the Principal Market.

In addition to any other rights and remedies under applicable law and this Agreement, including the Buyer termination rights under Section 11(k) hereof, so long as an Event of Default has occurred and is continuing, or if any event which, after notice and/or lapse of time, would become an Event of Default, has occurred and is continuing, or so long as the Closing Sale Price is below the Floor Price, the Company may not require and the Buyer shall not be obligated to purchase any shares of Common Stock under this Agreement. If pursuant to or within the meaning of any Bankruptcy Law, the Company commences a voluntary case or any Person commences a proceeding against the Company, a Custodian is appointed for the Company or for all or substantially all of its property, or the Company makes a general assignment for the benefit of its creditors, (any of which would be an Event of Default as described in Sections 9(f), 9(g) and 9(h) hereof) this Agreement shall automatically terminate without any liability or payment to the Company without further action or notice by any Person. No such termination of this Agreement under Section 11(k)(i) shall affect the Company's or the Buyer's obligations under this Agreement with respect to pending purchases and the Company and the Buyer shall complete their respective obligations with respect to any pending purchases under this Agreement.

#### **10. CERTAIN DEFINED TERMS.**

For purposes of this Agreement, the following terms shall have the following meanings:

(a) "**1933 Act**" means the Securities Act of 1933, as amended.

(b) "**Available Amount**" means initially Fifty Million Dollars (\$50,000,000) in the aggregate which amount shall be reduced by the Purchase Amount each time the Buyer purchases shares of Common Stock pursuant to Section 1 hereof.

- (c) **“Bankruptcy Law”** means Title 11, U.S. Code, or any similar federal or state law for the relief of debtors.
- (d) **“Business Day”** means any day on which the Principal Market is open for trading during normal trading hours (i.e., 9:30 a.m. to 4:00 p.m. Eastern Time), including any day on which the Principal Market is open for trading for a period of time less than the customary time.
- (e) **“Closing Sale Price”** means the last closing trade price for the Common Stock on the Principal Market as reported by the Principal Market.
- (f) **“Confidential Information”** means any information disclosed by either party to the other party, either directly or indirectly, in writing, orally or by inspection of tangible objects (including, without limitation, documents, prototypes, samples, protocols, development plans, commercialization plans, compounds, formulations, preclinical study and clinical trial results, plant and equipment), which is designated as “Confidential,” “Proprietary” or some similar designation. Information communicated orally shall be considered Confidential Information if such information is expressly identified as Confidential Information at the time of such initial disclosure and confirmed in writing as being Confidential Information within ten (10) Business Days after the initial disclosure. Confidential Information may also include information disclosed to a disclosing party by third parties. Confidential Information shall not, however, include any information which (i) was publicly known and made generally available in the public domain prior to the time of disclosure by the disclosing party; (ii) becomes publicly known and made generally available after disclosure by the disclosing party to the receiving party through no action or inaction of the receiving party or its affiliates; (iii) is already in the possession of the receiving party at the time of disclosure by the disclosing party as shown by the receiving party’s files and records immediately prior to the time of disclosure; (iv) is obtained by the receiving party from a third party without a breach of such third party’s obligations of confidentiality; or (v) is independently developed by the receiving party without use of or reference to the disclosing party’s Confidential Information, as shown by documents and other competent evidence in the receiving party’s possession.
- (g) **“Custodian”** means any receiver, trustee, assignee, liquidator or similar official under any Bankruptcy Law.
- (h) **“Maturity Date”** means the date that is thirty-six (36) months from the Commencement Date.
- (i) **“Person”** means an individual or entity including any limited liability company, a partnership, a joint venture, a corporation, a trust, an unincorporated organization and a government or any department or agency thereof.
- (j) **“Principal Market”** means the Nasdaq Capital Market; provided however, that in the event the Company’s Common Stock is ever listed or traded on the New York Stock Exchange, the NYSE American, the Nasdaq Global Select Market or the Nasdaq Global Market, then the “Principal Market” shall mean such other market or exchange on which the Company’s Common Stock is then listed or traded.
- (k) **“Purchase Amount”** means, with respect to any particular purchase made hereunder, the portion of the Available Amount to be purchased by the Buyer pursuant to Section 1 hereof as set forth in a valid Purchase Notice or VWAP Purchase Notice which the Company delivers to the Buyer.

(l) **“Purchase Date”** means, with respect to any Regular Purchase made hereunder, the Business Day of receipt by the Buyer of a valid Purchase Notice that the Buyer is to buy Purchase Shares pursuant to Section 1(b) hereof.

(m) **“Purchase Notice”** shall mean an irrevocable written notice from the Company to the Buyer directing the Buyer to buy Purchase Shares pursuant to Section 1(b) hereof as specified by the Company therein at the applicable Purchase Price on the Purchase Date.

(n) **“Purchase Price”** means the lesser of (i) the lowest Sale Price of the Common Stock on the Purchase Date or (ii) the arithmetic average of the three (3) lowest Closing Sale Prices for the Common Stock during the ten (10) consecutive Business Days ending on the Business Day immediately preceding such Purchase Date (to be appropriately adjusted for any reorganization, recapitalization, non-cash dividend, stock split, reverse stock split or other similar transaction).

(o) **“Sale Price”** means any trade price for the shares of Common Stock on the Principal Market during normal trading hours, as reported by the Principal Market.

(p) **“SEC”** means the U.S. Securities and Exchange Commission.

(q) **“Transfer Agent”** means the transfer agent of the Company as set forth in Section 11(f) hereof or such other person who is then serving as the transfer agent for the Company in respect of the Common Stock.

(r) **“VWAP Minimum Price Threshold”** means, with respect to any particular VWAP Purchase Notice, the Sale Price on the VWAP Purchase Date equal to the greater of (i) 80% of the Closing Sale Price on the Business Day immediately preceding the VWAP Purchase Date or (ii) such higher price as set forth by the Company in the VWAP Purchase Notice.

(s) **“VWAP Purchase Amount”** means, with respect to any particular VWAP Purchase Notice, the portion of the Available Amount to be purchased by the Buyer pursuant to Section 1(c) hereof pursuant to a valid VWAP Purchase Notice which requires the Buyer to buy the VWAP Purchase Share Percentage of the aggregate shares traded on the Principal Market during normal trading hours on the VWAP Purchase Date up to the VWAP Purchase Share Volume Maximum, subject to the VWAP Minimum Price Threshold.

(t) **“VWAP Purchase Date”** means, with respect to any VWAP Purchase made hereunder, the Business Day following the receipt by the Buyer of a valid VWAP Purchase Notice that the Buyer is to buy Purchase Shares pursuant to Section 1(c) hereof.

(u) **“VWAP Purchase Notice”** shall mean an irrevocable written notice from the Company to the Buyer directing the Buyer to buy Purchase Shares on the VWAP Purchase Date pursuant to Section 1(c) hereof as specified by the Company therein at the applicable VWAP Purchase Price with the applicable VWAP Purchase Share Percentage specified therein.

(v) **“VWAP Purchase Share Percentage”** means, with respect to any particular VWAP Purchase Notice pursuant to Section 1(c) hereof, the percentage set forth in the VWAP Purchase Notice which the Buyer will be required to buy as a specified percentage of the aggregate shares traded on the

Principal Market during normal trading hours up to the VWAP Purchase Share Volume Maximum on the VWAP Purchase Date subject to Section 1(c) hereof but in no event shall this percentage exceed thirty percent (30%) of such VWAP Purchase Date's share trading volume of the Common Stock on the Principal Market during normal trading hours.

(w) **"VWAP Purchase Price"** means the lesser of (i) the Closing Sale Price on the VWAP Purchase Date; or (ii) ninety-seven percent (97%) of volume weighted average price for the Common Stock traded on the Principal Market during normal trading hours on (A) the VWAP Purchase Date if the aggregate shares traded on the Principal Market on the VWAP Purchase Date have not exceeded the VWAP Purchase Share Volume Maximum and the Sale Price of Common Stock has not fallen below the VWAP Minimum Price Threshold (to be appropriately adjusted for any reorganization, recapitalization, non-cash dividend, stock split, reverse stock split or other similar transaction), or (B) the portion of the VWAP Purchase Date until such time as the sooner to occur of (1) the time at which the aggregate shares traded on the Principal Market has exceeded the VWAP Purchase Share Volume Maximum, or (2) the time at which the Sale Price of Common Stock falls below the VWAP Minimum Price Threshold (to be appropriately adjusted for any reorganization, recapitalization, non-cash dividend, stock split, reverse stock split or other similar transaction).

(x) **"VWAP Purchase Share Estimate"** means the number of shares of Common Stock that the Company has in its sole discretion irrevocably instructed its Transfer Agent to issue to the Buyer via the Depository Trust Company ("**DTC**") Fast Automated Securities Transfer Program in connection with a VWAP Purchase Notice pursuant to Section 1(c) hereof and issued to the Buyer's or its designee's balance account with DTC through its Deposit Withdrawal At Custodian (DWAC) system on the VWAP Purchase Date (to be appropriately adjusted for any reorganization, recapitalization, non-cash dividend, stock split, reverse stock split or other similar transaction).

(y) **"VWAP Purchase Share Volume Maximum"** means a number of shares of Common Stock traded on the Principal Market during normal trading hours on the VWAP Purchase Date equal to: (i) the VWAP Purchase Share Estimate, divided by (ii) the VWAP Purchase Share Percentage (to be appropriately adjusted for any reorganization, recapitalization, non-cash dividend, stock split, reverse stock split or other similar transaction).

## 11. MISCELLANEOUS.

(a) Governing Law; Jurisdiction; Jury Trial. The corporate laws of the State of Delaware shall govern all issues concerning the relative rights of the Company and its stockholders. All other questions concerning the construction, validity, enforcement and interpretation of this Agreement and the other Transaction Documents shall be governed by the internal laws of the State of Illinois, without giving effect to any choice of law or conflict of law provision or rule (whether of the State of Illinois or any other jurisdictions) that would cause the application of the laws of any jurisdictions other than the State of Illinois. Each party hereby irrevocably submits to the exclusive jurisdiction of the state and federal courts sitting in the City of Chicago, for the adjudication of any dispute hereunder or under the other Transaction Documents or in connection herewith or therewith, or with any transaction contemplated hereby or discussed herein, and hereby irrevocably waives, and agrees not to assert in any suit, action or proceeding, any claim that it is not personally subject to the jurisdiction of any such court, that such suit, action or proceeding is brought in an inconvenient forum or that the venue of such suit, action or proceeding is improper. Each party hereby irrevocably waives personal service of process and consents to process being served in any such suit, action or proceeding by mailing a copy thereof to such party at the address for

such notices to it under this Agreement and agrees that such service shall constitute good and sufficient service of process and notice thereof. Nothing contained herein shall be deemed to limit in any way any right to serve process in any manner permitted by law. **EACH PARTY HEREBY IRREVOCABLY WAIVES ANY RIGHT IT MAY HAVE, AND AGREES NOT TO REQUEST, A JURY TRIAL FOR THE ADJUDICATION OF ANY DISPUTE HEREUNDER OR IN CONNECTION HEREWITH OR ARISING OUT OF THIS AGREEMENT OR ANY TRANSACTION CONTEMPLATED HEREBY.**

(b) Counterparts. This Agreement may be executed in two or more identical counterparts, all of which shall be considered one and the same agreement and shall become effective when counterparts have been signed by each party and delivered to the other party; provided that a facsimile or pdf (or other electronic reproduction) signature shall be considered due execution and shall be binding upon the signatory thereto with the same force and effect as if the signature were an original, not a facsimile or PDF (or other electronic reproduction) signature.

(c) Headings. The headings of this Agreement are for convenience of reference and shall not form part of, or affect the interpretation of, this Agreement.

(d) Severability. If any provision of this Agreement shall be invalid or unenforceable in any jurisdiction, such invalidity or unenforceability shall not affect the validity or enforceability of the remainder of this Agreement in that jurisdiction or the validity or enforceability of any provision of this Agreement in any other jurisdiction.

(e) Entire Agreement. This Agreement and the Registration Rights Agreement supersede all other prior oral or written agreements between the Buyer, the Company, their affiliates and persons acting on their behalf with respect to the matters discussed herein, and this Agreement, the other Transaction Documents and the instruments referenced herein contain the entire understanding of the parties with respect to the matters covered herein and therein and, except as specifically set forth herein or therein, neither the Company nor the Buyer makes any representation, warranty, covenant or undertaking with respect to such matters. Each of the Company and the Buyer acknowledges and agrees that it has not relied on, in any manner whatsoever, any representations or statements, written or oral, other than as expressly set forth in this Agreement.

(f) Notices. Any notices, consents or other communications required or permitted to be given under the terms of this Agreement must be in writing and will be deemed to have been delivered: (i) upon receipt, when delivered personally; (ii) upon receipt, when sent by facsimile (provided confirmation of transmission is mechanically or electronically generated and kept on file by the sending party); (iii) upon receipt, when sent by electronic message (provided the recipient responds to the message and confirmation of both electronic messages are kept on file by the sending party); or (iv) one (1) Business Day after timely deposit with a nationally recognized overnight delivery service, in each case properly addressed to the party to receive the same. The addresses and facsimile numbers for such communications shall be:

If to the Company:

X4 Pharmaceuticals, Inc.  
61 North Beacon Street, 4th Floor  
Boston, MA 02134  
Telephone: 857-529-8300  
Attention: Derek Meisner  
Email: derek.meisner@x4pharma.com



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

Cooley LLP  
55 Hudson Yards  
New York, NY 10001  
Telephone: (212) 479-5000  
Facsimile: (212) 479-6275  
Attention: Daniel I. Goldberg  
Email: dgoldberg@cooley.com

If to the Buyer:

Aspire Capital Fund, LLC  
155 North Wacker Drive, Suite 1600  
Chicago, IL 60606  
Telephone: 312-658-0400  
Facsimile: 312-658-4005  
Attention: Steven G. Martin  
Email: smartin@aspirecapital.com

With a copy to (which shall not constitute delivery to the Buyer):

Morrison & Foerster LLP  
2000 Pennsylvania Avenue, NW, Suite 6000  
Washington, DC 20006  
Telephone: 202-778-1603  
Facsimile: 202-887-0763  
Attention: David M. Lynn, Esq.  
Email: dlynn@mofocom

If to the Transfer Agent:

Computershare Trust Company, N.A.  
250 Royall Street  
Canton, Massachusetts 02021  
Telephone:  
Facsimile:  
Attention:  
Email:

or at such other address and/or facsimile number and/or to the attention of such other person as the recipient party has specified by written notice given to each other party at least one (1) Business Day prior to the effectiveness of such change. Written confirmation of receipt (A) given by the recipient of such notice, consent or other communication, (B) mechanically or electronically generated by the sender's

facsimile machine containing the time, date, and recipient facsimile number, (C) electronically generated by the sender's electronic mail containing the time, date and recipient email address or (D) provided by a nationally recognized overnight delivery service, shall be rebuttable evidence of receipt in accordance with clause (i), (ii), (iii) or (iv) above, respectively.

(g) Successors and Assigns. This Agreement shall be binding upon and inure to the benefit of the parties and their respective successors and assigns. The Company shall not assign this Agreement or any rights or obligations hereunder without the prior written consent of the Buyer, including by merger or consolidation; provided, however, that any transaction, whether by merger, reorganization, restructuring, consolidation, financing or otherwise, whereby the Company remains the surviving entity immediately after such transaction shall not be deemed a succession or assignment. The Buyer may not assign its rights or obligations under this Agreement.

(h) No Third Party Beneficiaries. This Agreement is intended for the benefit of the parties hereto and their respective permitted successors and assigns, and is not for the benefit of, nor may any provision hereof be enforced by, any other person.

(i) Publicity. The Buyer shall have the right to approve before issuance any press release, SEC filing or any other public disclosure made by or on behalf of the Company whatsoever with respect to, in any manner, the Buyer, its purchases hereunder or any aspect of this Agreement or the transactions contemplated hereby; provided, however, that the Company shall be entitled, without the prior approval of the Buyer, to make any press release or other public disclosure (including any filings with the SEC) with respect to such transactions as is required by applicable law and regulations so long as the Company and its counsel consult with the Buyer in connection with any such press release or other public disclosure at least one (1) Business Day prior to its release; provided, however, that the Company's obligations pursuant to this Section 11(i) shall not apply if the material provisions of such press release, SEC filing, or other public disclosure previously has been publicly disclosed by the Company in accordance with this Section 11(i). The Buyer must be provided with a copy thereof at least one (1) Business Day prior to any release or use by the Company thereof.

(j) Further Assurances. Each party shall do and perform, or cause to be done and performed, all such further acts and things, and shall execute and deliver all such other agreements, certificates, instruments and documents, as the other party may reasonably request in order to carry out the intent and accomplish the purposes of this Agreement and the consummation of the transactions contemplated hereby.

(k) Termination. This Agreement may be terminated only as follows:

(i) By the Buyer any time an Event of Default exists without any liability or payment to the Company. However, if pursuant to or within the meaning of any Bankruptcy Law, the Company commences a voluntary case or any Person commences a proceeding against the Company, a Custodian is appointed for the Company or for all or substantially all of its property, or the Company makes a general assignment for the benefit of its creditors, (any of which would be an Event of Default as described in Sections 9(f), 9(g) and 9(h) hereof) this Agreement shall automatically terminate without any liability or payment to the Company without further action or notice by any Person. No such termination of this Agreement under this Section 11(k)(i) shall affect the Company's or the Buyer's obligations under this Agreement with respect to pending purchases and the Company and the Buyer shall complete their respective obligations with respect to any pending purchases under this Agreement.

(ii) In the event that the Commencement shall not have occurred the Company shall have the option to terminate this Agreement for any reason or for no reason without any liability whatsoever of either party to the other party under this Agreement.

(iii) In the event that the Commencement shall not have occurred within ten (10) Business Days of the date of this Agreement, due to the failure to satisfy any of the conditions set forth in Sections 6 and 7 above with respect to the Commencement, either party shall have the option to terminate this Agreement at the close of business on such date or thereafter without liability of either party to any other party; provided, however, that the right to terminate this Agreement under this Section 11(k)(iii) shall not be available to either party if such failure to satisfy any of the conditions set forth in Sections 6 and 7 is the result of a breach of this Agreement by such party or the failure of any representation or warranty of such party included in this Agreement to be true and correct in all material respects.

(iv) At any time after the Commencement Date, the Company shall have the option to terminate this Agreement for any reason or for no reason by delivering notice (a "**Company Termination Notice**") to the Buyer electing to terminate this Agreement without any liability whatsoever of either party to the other party under this Agreement. The Company Termination Notice shall not be effective until one (1) Business Day after it has been received by the Buyer.

(v) This Agreement shall automatically terminate on the date that the Company sells and the Buyer purchases the full Available Amount as provided herein, without any action or notice on the part of any party and without any liability whatsoever of any party to any other party under this Agreement.

(vi) If by the Maturity Date for any reason or for no reason the full Available Amount under this Agreement has not been purchased as provided for in Section 1 of this Agreement, this Agreement shall automatically terminate on the Maturity Date, without any action or notice on the part of any party and without any liability whatsoever of any party to any other party under this Agreement.

Except as set forth in Sections 11(k)(i) (in respect of an Event of Default under Sections 9(f), 9(g) and 9(h)), 11(k)(v) and 11(k)(vi), any termination of this Agreement pursuant to this Section 11(k) shall be effected by written notice from the Company to the Buyer, or the Buyer to the Company, as the case may be, setting forth the basis for the termination hereof. The representations and warranties of the Company and the Buyer contained in Sections 2, 3 and 5 hereof, the indemnification provisions set forth in Section 8 hereof and the agreements and covenants set forth in Sections 4(e) and 11, shall survive the Commencement and any termination of this Agreement. No termination of this Agreement shall affect the Company's or the Buyer's rights or obligations (i) under the Registration Rights Agreement which shall survive any such termination in accordance with its terms or (ii) under this Agreement with respect to pending purchases and the Company and the Buyer shall complete their respective obligations with respect to any pending purchases under this Agreement.

(l) No Financial Advisor, Placement Agent, Broker or Finder. The Company represents and warrants to the Buyer that it has not engaged any financial advisor, placement agent, broker or finder in connection with the transactions contemplated hereby. The Buyer represents and warrants to the Company that it has not engaged any financial advisor, placement agent, broker or finder in connection with the transactions contemplated hereby. Each party shall be responsible for the payment of any fees or commissions, if any, of any financial advisor, placement agent, broker or finder engaged by such party relating to or arising out of the transactions contemplated hereby. Each party shall pay, and hold the other party harmless against, any liability, loss or expense (including, without limitation, attorneys' fees and out of pocket expenses) arising in connection with any such claim.

(m) No Strict Construction. The language used in this Agreement will be deemed to be the language chosen by the parties to express their mutual intent, and no rules of strict construction will be applied against any party.

(n) Failure or Indulgence Not Waiver. No failure or delay in the exercise of any power, right or privilege hereunder shall operate as a waiver thereof, nor shall any single or partial exercise of any such power, right or privilege preclude other or further exercise thereof or of any other right, power or privilege.

\* \* \* \* \*

**IN WITNESS WHEREOF**, the Buyer and the Company have caused this Common Stock Purchase Agreement to be duly executed as of the date first written above.

**THE COMPANY:**

**X4 PHARMACEUTICALS, INC.**

By: /s/ Paula Ragan

Name: Paula Ragan, Ph.D.

Title: Chief Executive Officer

**BUYER:**

**ASPIRE CAPITAL FUND, LLC**

**BY: ASPIRE CAPITAL PARTNERS, LLC**

**BY: SGM HOLDINGS CORP.**

By: /s/ Steven G. Martin

Name: Steven G. Martin

Title: President

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## SCHEDULES

Schedule 3(a)	Subsidiaries
Schedule 3(c)	Capitalization
Schedule 3(e)	Conflicts
Schedule 3(f)	1934 Act Filings
Schedule 3(g)	Material Changes
Schedule 3(h)	Litigation
Schedule 3(j)	Intellectual Property
Schedule 3(l)	Title
Schedule 3(p)	Transactions with Affiliates

## EXHIBITS

Exhibit A	Form of Officer's Certificate
Exhibit B	Form of Resolutions of Board of Directors of the Company
Exhibit C	Form of Secretary's Certificate