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

FORM 8-K

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

Date of Report (Date of earliest event reported): August 9, 2019

X4 Pharmaceuticals, Inc.

(Exact name of registrant as specified in its charter)

Delaware
(State or other jurisdiction
of incorporation)

001-38295
(Commission
File Number)

27-3181608
(IRS Employer
Identification No.)

955 Massachusetts Avenue, 4th Floor
Cambridge, Massachusetts
(Address of principal executive offices)

02139
(Zip Code)

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

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
Common Stock	XFOR	The Nasdaq Capital Market

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.

Item 8.01. Other Events

As previously announced, on March 13, 2019, X4 Pharmaceuticals, Inc., formerly Arsanis, Inc. (the “Company”) completed its business combination with X4 Therapeutics, Inc., formerly X4 Pharmaceuticals, Inc. (“X4”), in accordance with the terms of that certain Agreement and Plan of Merger, dated as of November 26, 2018, as amended on December 20, 2018 and March 8, 2019, by and among the Company, X4 and Artemis AC Corp., a Delaware corporation and a wholly owned subsidiary of the Company.

On March 13, 2019, the Company filed a Form 8-K (the “March Form 8-K”) announcing the completion of this business combination, and on April 3, 2019 the Company filed Amendment No. 1 to the March Form 8-K to include the audited financial statements of X4 and the pro forma financial information of the Company and X4 required by Items 9.01(a) and 9.01(b) of Form 8-K, respectively.

In connection with the Company’s planned filing of a Registration Statement on Form S-3, the Company is now filing, as Exhibit 99.1 to this Current Report on Form 8-K, Management’s Discussion and Analysis of Financial Condition and Results of Operations for the year ended December 31, 2018.

Item 9.01 Financial Statements and Exhibits

(d) Exhibits

<u>Exhibit No.</u>	<u>Description</u>
99.1	<u>Management’s Discussion and Analysis of Financial Condition and Results of Operations</u>

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.

Date: August 9, 2019

X4 PHARMACEUTICALS, INC.

By: /s/Adam S. Mostafa

Name: Adam S. Mostafa

Title: Chief Financial Officer

X4 MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

You should read the following discussion and analysis of X4 Pharmaceuticals Inc. ("X4")'s financial condition and results of operations together with X4's consolidated financial statements and the related notes included in Exhibit 99.1 of X4 Pharmaceuticals, Inc.'s (formerly Arsanis, Inc.) Amendment No. 1 to the Current Report on Form 8-K filed with the Securities and Exchange Commission ("SEC") on April 3, 2019. Some of the information contained in this discussion and analysis including information with respect to X4's plans and strategy for X4's business and related financing, includes forward-looking statements that involve risks and uncertainties. As a result of many factors, including those factors set forth in the "Risk Factors" included in Exhibit 99.2 of X4's Current Report on Form 8-K filed with the SEC on April 11, 2019, X4's actual results could differ materially from the results described in or implied by the forward-looking statements contained in the following discussion and analysis.

Overview

X4 is a clinical-stage biopharmaceutical company focused on the discovery, development and commercialization of novel therapeutics for the treatment of rare diseases. X4's pipeline is comprised of first-in-class, oral, small molecule antagonists of chemokine receptor CXCR4, which have the potential to treat a broad range of rare diseases, including primary immunodeficiencies, or PIs, and cancer. X4's lead product candidate, X4P-001, has completed a Phase 2 trial in patients with Warts, Hypogammaglobulinemia, Infections, and Myelokathexis, or WHIM, syndrome. X4 initiated a global Phase 3 pivotal trial of X4P-001 in patients with WHIM syndrome in the first half of 2019 and plans to report top-line data from this Phase 3 trial in 2021. Beyond WHIM syndrome, X4 plans to initiate a Phase 1/2 trial of X4P-001 in another PI, severe congenital neutropenia, or SCN, and a Phase 1/2 trial of X4P-001 in Waldenström macroglobulinemia, or WM, in 2019, with data expected from each trial in 2020.

Since X4's inception in 2012, X4 has devoted substantially all of its efforts and financial resources to organizing and staffing its company, business planning, raising capital, acquiring or discovering product candidates and securing related intellectual property rights and conducting discovery, research and development activities for its product candidates. X4 does not have any products approved for sale and has not generated any revenue from product sales. X4 has funded its operations to date primarily with proceeds from sales of preferred stock, proceeds from the issuance of convertible debt and borrowings under loan and security agreements. Through December 31, 2018, X4 has received net proceeds of \$73.7 million from sales of its preferred stock (including proceeds from convertible debt, which converted into preferred stock) and gross proceeds of \$6.0 million from borrowings under the SVB Loan Agreement, gross proceeds of \$10.0 million from borrowings under the Hercules Loan Agreement and repaid all amounts due under the SVB Loan Agreement, totaling \$4.6 million.

X4 has incurred significant operating losses since inception. X4's ability to generate product revenue sufficient to achieve profitability will depend heavily on the successful development and eventual commercialization of one or more of X4's current or future product candidates. X4's net losses were \$17.9 million, \$22.0 million and \$33.3 million for the years ended December 31, 2016, 2017 and 2018, respectively. As of December 31, 2018, X4 had an accumulated deficit of \$79.2 million. X4 expects to continue to incur significant expenses and increasing operating losses for at least the next several years. X4 expects that its expenses and capital requirements will increase substantially in connection with its ongoing activities, particularly if and as X4:

- conducts additional clinical trials for its product candidates;
- continues to discover and develop additional product candidates;
- acquires or in-licenses other product candidates and technologies;
- maintains, expands and protects its intellectual property portfolio;
- hires additional clinical, scientific and commercial personnel;
- establishes a commercial manufacturing source and secures supply chain capacity sufficient to provide commercial quantities of any product candidates for which it may obtain regulatory approval;
- seeks regulatory approvals for any product candidates that successfully complete clinical trials;
- establishes a sales, marketing and distribution infrastructure to commercialize any products for which it may obtain regulatory approval; and
- adds operational, financial and management information systems and personnel, including personnel to support its product development and planned future commercialization efforts, as well as to support its transition to a public reporting company.

X4 will not generate revenue from product sales unless and until X4 successfully completes clinical development and obtains regulatory approval for its product candidates. If X4 obtains regulatory approval for any of its product candidates and does not enter into a commercialization partnership, X4 expects to incur significant expenses related to developing X4's internal commercialization capability to support product sales, marketing and distribution. Further, X4 expects to incur additional costs associated with operating as a public company as a result of the Merger described below.

As a result, X4 will need substantial additional funding to support its continuing operations and pursue its growth strategy. Until such time as X4 can generate significant revenue from product sales, if ever, X4 expects to finance its operations through the sale of equity, debt financings or other capital sources, which may include collaborations with other companies or other strategic transactions. X4 may not be able to raise additional funds or enter into such other agreements or arrangements when needed on favorable terms, or at all. If X4 fails to raise capital or enter into such agreements as and when needed, X4 may have to significantly delay, reduce or eliminate the development and commercialization of one or more of its product candidates or delay its pursuit of potential in-licenses or acquisitions.

Because of the numerous risks and uncertainties associated with product development, X4 is unable to predict the timing or amount of increased expenses or when or if it will be able to achieve or maintain profitability. Even if X4 is able to generate product sales, X4 may not become profitable. If X4 fails to become profitable or is unable to sustain profitability on a continuing basis, then X4 may be unable to continue its operations at planned levels and be forced to reduce or terminate its operations.

As of April 2, 2019, the issuance date of the annual consolidated financial statements for the year ended December 31, 2018, X4 expected that its cash and cash equivalents, including cash and cash equivalents received in connection with closing of the merger with Arsanis, would be sufficient to fund its operating expenses, capital expenditure requirements and debt service payments into the third quarter of 2019. See "*Liquidity and Capital Resources*." X4 will need to raise additional capital to finance its operations, which cannot be assured. X4 concluded on April 2, 2019, the issuance date of the annual consolidated financial statements for the year ended December 31, 2018, that this circumstance raised substantial doubt about its ability to continue as a going concern within one year of the issuance date of its annual consolidated financial statements for the year ended December 31, 2018.

Similarly, in its report on X4's financial statements for the year ended December 31, 2018, X4's independent registered public accounting firm included an explanatory paragraph stating that X4's recurring losses from operations and required additional funding to finance X4's operations raise substantial doubt about its ability to continue as a going concern.

Merger with Arsanis

Merger with Arsanis

On November 26, 2018, Arsanis, Inc., a publicly held Delaware corporation ("Arsanis"), Artemis AC Corp., a Delaware corporation and a wholly owned subsidiary of Arsanis ("Merger Sub"), and the Company entered into an Agreement and Plan of Merger, as amended on December 20, 2018 and March 8, 2019 (the "Merger Agreement"), pursuant to which the Merger Sub would merge with and into X4, with X4 surviving the merger as a wholly owned subsidiary of Arsanis. The transactions described in the foregoing sentence may be referred to in the Notes to Consolidated Financial Statements as "the merger" or "the merger with Arsanis" contained within the consolidated financial statements and the related notes included in Exhibit 99.1 of X4 Pharmaceuticals, Inc.'s (formerly Arsanis, Inc.) Amendment No. 1 to the Current Report on Form 8-K filed on April 3, 2019. The merger was completed on March 13, 2019 pursuant to the terms of the Merger Agreement.

Pursuant to the terms of the Merger Agreement, upon closing of the merger, all of X4's outstanding common stock and convertible preferred stock was exchanged for common stock of Arsanis and all outstanding options exercisable for common stock and warrants exercisable for convertible preferred stock of X4 were exchanged for options and warrants exercisable for common stock of Arsanis. In addition, immediately following the closing of the merger, the combined organization effected a 1-for-6 reverse stock split of its common stock and changed its name to X4 Pharmaceuticals, Inc. In connection with the merger, Arsanis changed its name to X4 Therapeutics, Inc. Following the closing of the merger, X4 Therapeutics, Inc. became a wholly owned subsidiary of X4 Pharmaceuticals, Inc. Except as noted otherwise, the consolidated financial statements and notes included in Exhibit 99.1 of X4 Pharmaceuticals, Inc.'s (formerly Arsanis, Inc.) Amendment No. 1 to the Current Report on Form 8-K filed on April 3, 2019 do not give effect to this reverse stock split.

The business combination was accounted for as a reverse merger in accordance with GAAP. Under this method of accounting, X4 was deemed to be the accounting acquirer for financial reporting purposes. This determination was primarily based on the facts that, immediately following the merger: (i) X4's stockholders own a substantial majority of the voting rights in the combined organization, (ii) X4 designated a majority of the members of the initial board of directors of the combined organization and (iii) X4's senior management hold all key positions in the senior management of the combined organization. Accordingly, for accounting purposes, the business combination was treated as the equivalent of X4 issuing stock to acquire the net assets of Arsanis. As a result, as of the closing date of the merger, the net assets of Arsanis were recorded at their acquisition-date fair values in the financial statements of X4 and the reported operating results prior to the business combination will be those of X4. In addition, transaction costs incurred by X4 in connection with the business combination will be expensed as incurred.

Components of Results of Operations

Revenue

To date, X4 has not generated any revenue from product sales and does not expect to generate any revenue from the sale of products in the foreseeable future. If X4's development efforts for its product candidates are successful and result in regulatory approval, X4 may generate revenue in the future from product sales. X4 cannot predict if, when, or to what extent it will generate revenue from the commercialization and sale of its product candidates. X4 may never succeed in obtaining regulatory approval for any of its product candidates.

Operating Expenses

Research and Development Expenses

Research and development expenses consist primarily of costs incurred in connection with the discovery and development of X4's product candidates. X4 expenses research and development costs as incurred. These expenses include:

- employee-related expenses, including salaries, related benefits and stock-based compensation expense, for employees engaged in research and development functions;
- expenses incurred in connection with the preclinical and clinical development of X4's product candidates, including under agreements with third parties, such as consultants and contract research organizations, or CROs;
- the cost of manufacturing drug products for use in X4's preclinical studies and clinical trials, including under agreements with third parties, such as consultants and contract manufacturing organizations, or CMOs;
- facilities, depreciation and other expenses, which include direct or allocated expenses for rent and maintenance of facilities and insurance;
- costs related to compliance with regulatory requirements; and
- payments made under third-party licensing agreements.

X4 recognizes external development costs based on an evaluation of the progress to completion of specific tasks using information provided to X4 by its service providers. This process involves reviewing open contracts and purchase orders, communicating with its personnel to identify services that have been performed on its behalf, and estimating the level of service performed and the associated cost incurred for the service when X4 has not yet been invoiced or otherwise notified of actual costs. Nonrefundable advance payments for goods or services to be received in the future for use in research and development activities are recorded as prepaid expenses. Such amounts are recognized as an expense when the goods have been delivered or the services have been performed, or when it is no longer expected that the goods will be delivered or the services rendered. Upfront payments, milestone payments and annual maintenance fees under license agreements are expensed in the period in which they are incurred.

X4's direct research and development expenses are tracked by product candidate and consist primarily of external costs, such as fees paid to outside consultants, CROs, CMOs and research laboratories in connection with its preclinical development, process development, manufacturing and clinical development activities. X4's direct research and development expenses by product candidate also include fees incurred under third-party license agreements. X4 does not allocate employee costs and costs associated with its discovery efforts, laboratory supplies and facilities, including depreciation or other indirect costs, to specific product candidates because these costs are deployed across multiple programs and, as such, are not separately classified. X4 uses internal resources primarily to conduct its research and discovery as well as for managing its preclinical development, process development, manufacturing and clinical development activities. These employees work across multiple programs and, therefore, X4 does not track its costs by product candidate.

The table below summarizes X4's research and development expenses incurred by product candidate:

	Year Ended December 31,		
	2018	2017	2016
	(in thousands)		
X4P-001	\$10,625	\$ 9,878	\$ 7,000
X4P-002	—	1,129	2,062
X4P-003	49	—	—
Unallocated research and development expenses	9,672	6,059	4,036
Total research and development expenses	<u>\$20,346</u>	<u>\$17,066</u>	<u>\$13,098</u>

Research and development activities are central to X4's business model. Product candidates in later stages of clinical development generally have higher development costs than those in earlier stages of clinical development, primarily due to the increased size and duration of later-stage clinical trials. As a result, X4 expects that its research and development expenses will increase over the next several years as it completes its ongoing Phase 2 trial in patients with WHIM syndrome; initiates a Phase 3 pivotal trial of X4P-001 in patients with WHIM syndrome in the first half of 2019; initiates a Phase 1/2 clinical trial of X4P-001 in WM in 2019; and initiates a Phase 1/2 clinical trial of X4P-001 in SCN in 2019. In addition, X4 expects research and development expenses to increase related to conducting preclinical development and pursuing initial clinical stages of its product candidates X4P-002 and X4P-003.

The successful development and commercialization of X4's product candidates are highly uncertain. At this time, X4 cannot reasonably estimate or know the nature, timing and costs of the efforts that will be necessary to complete the preclinical and clinical development of any of its product candidates. This is due to the numerous risks and uncertainties associated with product development and commercialization, including the following:

- the timing and progress of preclinical and clinical development activities;
- the number and scope of preclinical and clinical programs that X4 decides to pursue;
- X4's ability to maintain its current research and development programs and to establish new ones;
- establishing an appropriate safety profile with IND-enabling studies;
- successful patient enrollment in, and the initiation and completion of, clinical trials;
- the successful completion of clinical trials with safety, tolerability and efficacy profiles that are satisfactory to the FDA or any comparable foreign regulatory authority;
- the receipt of regulatory approvals from applicable regulatory authorities;
- the timing, receipt and terms of any marketing approvals from applicable regulatory authorities;
- X4's ability to establish new licensing or collaboration arrangements;
- establishing agreements with third-party manufacturers for clinical supply for X4's clinical trials and commercial manufacturing, if any of X4's product candidates is approved;
- development and timely delivery of clinical-grade and commercial-grade drug formulations that can be used in X4's clinical trials and for commercial launch;
- obtaining, maintaining, defending and enforcing patent claims and other intellectual property rights;
- launching commercial sales of X4's product candidates, if approved, whether alone or in collaboration with others; and
- maintaining a continued acceptable safety profile of the product candidates following approval.

A change in the outcome of any of these variables with respect to the development of X4's product candidates could significantly change the costs and timing associated with the development of that product candidate. X4 may never succeed in obtaining regulatory approval for any of its product candidates.

General and Administrative Expenses

General and administrative expenses consist primarily of salaries and related costs, including stock-based compensation, for personnel in executive, finance and administrative functions. General and administrative expenses also include direct and allocated facility-related costs as well as professional fees for legal, patent, consulting, investor and public relations, accounting, and audit services.

X4 anticipates that its general and administrative expenses will increase in the future as it increases its headcount to support its continued research activities and development of its product candidates. X4 also anticipates that it will incur increased accounting, audit, legal, regulatory, compliance and director and officer insurance costs as well as investor and public relations expenses associated with being a public company.

Other Income (Expense), Net

Interest Income

Interest income consists of interest earned on X4's cash equivalents, which consist of money market funds. X4's interest income has not been significant due to low interest rates earned on invested balances.

Interest Expense

Interest expense consists of interest on outstanding borrowings under X4's 2016 loan and security agreement with Silicon Valley Bank, or SVB, which X4 refers to as the SVB Loan Agreement, as well as amortization of debt issuance costs and accretion of a final payment payable upon the maturity or the repayment in full of all obligations under the SVB Loan Agreement. In October 2018, in connection with entering into the loan and security agreement with Hercules Capital, Inc., or Hercules, which X4 refers to as the Hercules Loan Agreement, all amounts due under the SVB Loan Agreement, including unpaid principal of \$4.3 million and a final payment \$0.3 million, were repaid with proceeds from the Hercules Loan Agreement and the SVB Loan Agreement was terminated. X4 expects that its interest expense will increase in connection with its Hercules Loan Agreement, under which it borrowed \$8.0 million in October 2018 and an additional \$2.0 million in December 2018.

Change in Fair Value of Preferred Stock Warrant Liability

In connection with X4's Series A and Series B preferred stock financings in 2015, 2017 and 2018, and entering into the SVB Loan Agreement in 2016, X4 issued warrants to purchase shares of its preferred stock. X4 classifies these warrants as a liability on its consolidated balance sheets and remeasures to fair value at each reporting date, and X4 recognizes changes in the fair value of the warrant liability as a component of other income (expense), net in its consolidated statements of operations and comprehensive loss. X4 will continue to recognize changes in the fair value of each warrant comprising the warrant liability until each respective warrant is exercised, expires or qualifies for equity classification.

All of X4's outstanding preferred stock warrants, other than the warrants issued to the lenders in connection with the SVB Loan Agreement, contain a feature whereby the warrants will be automatically exercised and net settled in shares upon an initial public offering, or IPO, of X4 Common Stock or a specified deemed liquidation event. Upon either of those events, the holders of the preferred stock warrants will be issued a number of shares equal in value to the difference between the fair value of the shares into which each warrant is exercisable and the exercise price of such warrant. The Merger does not qualify as an IPO or a deemed liquidation event under the terms of the warrants.

In addition, in connection with entering into the Hercules Loan Agreement, in October 2018, X4 issued warrants to purchase shares of X4 Preferred Stock. X4 will classify these warrants as a liability on its consolidated balance sheet and remeasure the liability to fair value at each reporting date. X4 will recognize changes in the fair value of the warrant liability as a component of other income (expense), net in the consolidated statement of operations and comprehensive loss. X4 will continue to recognize changes in the fair value of each warrant comprising the warrant liability until each respective warrant is exercised, expires or qualifies for equity classification.

Upon the closing of the Merger, pursuant to the Merger Agreement, all of X4's outstanding preferred stock warrants became exercisable for Arsanis Common Stock instead of X4 Preferred Stock; accordingly, the fair value of the warrant liability for these warrants at that time was reclassified to additional paid-in capital. As a result, following the closing of the Merger, X4 no longer recognizes changes in the fair value of the warrant liability as other income (expense), net in its consolidated statements of operations and comprehensive loss.

Change in Fair Value of Derivative Liability

X4's license agreement with Genzyme, a Sanofi company, contains a contingent payment obligation that requires that X4 make a payment to Genzyme upon a change of control event of X4. The contingent payment obligation meets the definition of a derivative instrument. X4 classifies this derivative as a liability on its consolidated balance sheets that X4 remeasures to fair value at each

reporting date, and X4 recognizes changes in the fair value of the derivative liability as a component of other income (expense), net in its consolidated statements of operations and comprehensive loss. X4 will continue to recognize changes in the fair value of the derivative liability until a change of control event occurs or until the license agreement is terminated. The Merger with Arsanis qualifies as a change of control event, as defined in the license agreement, but results in no payment being due to Genzyme under the license agreement.

Loss on Preferred Stock Repurchase Liability

In October 2017, X4 entered into a stock repurchase agreement with a holder of Series Seed preferred stock for the repurchase of shares of Series Seed preferred stock. X4 concluded that the arrangement was a freestanding financial instrument that was required to be recorded as a liability at fair value. Upon entering into the repurchase agreement, X4 recorded a preferred stock repurchase liability on its consolidated balance sheet of \$587 for the fair value of the financial instrument and recognized a corresponding expense as a component of other income (expense), net in its consolidated statement of operations and comprehensive loss. X4 subsequently remeasured the repurchase liability to fair value at each reporting date through the settlement date of the repurchase agreement in January 2018 and recognized changes in the fair value of the preferred stock repurchase liability as a component of other income (expense), net in its consolidated statements of operations and comprehensive loss.

Income Taxes

Since its inception, X4 has not recorded any income tax benefits for the net losses it has incurred in each year or for its earned research and development tax credits, as X4 believes, based upon the weight of available evidence, that it is more likely than not that all of its net operating loss carryforwards and tax credits will not be realized. As of December 31, 2018, X4 had U.S. federal and state net operating loss carryforwards of \$56.6 million and \$57.0 million, respectively, which may be available to offset future income tax liabilities and begin to expire in 2034. As of December 31, 2018, X4 also had U.S. federal and state research and development tax credit carryforwards of \$2.2 million and \$0.6 million, respectively, which may be available to offset future tax liabilities and each begin to expire in 2029. X4 has recorded a full valuation allowance against its net deferred tax assets at each balance sheet date.

Results of Operations

Comparison of the Years Ended December 31, 2018 and 2017

The following table summarizes X4's results of operations for the years ended December 31, 2018 and 2017:

	Years Ended December 31,		Change
	2018	2017	
	(in thousands)		
Operating expenses:			
Research and development	\$ 20,346	\$ 17,066	\$ 3,280
General and administrative	8,739	5,181	3,558
Total operating expenses	<u>29,085</u>	<u>22,247</u>	<u>6,838</u>
Loss from operations	<u>(29,085)</u>	<u>(22,247)</u>	<u>(6,838)</u>
Other income (expense):			
Interest income	236	64	172
Interest expense	(720)	(490)	(230)
Change in fair value of preferred stock warrant liability	(3,398)	1,360	(4,758)
Change in fair value of derivative liability	(89)	(94)	5
Loss on extinguishment of debt	(229)	—	(229)
Loss on preferred stock repurchase liability	—	(587)	587
Total other income (expense), net	<u>(4,200)</u>	<u>253</u>	<u>(4,453)</u>
Net loss and comprehensive loss	<u><u>\$ (33,285)</u></u>	<u><u>\$ (21,994)</u></u>	<u><u>\$ (11,291)</u></u>

Research and Development Expenses

	Years Ended December 31,		Change
	2018	2017	
	(in thousands)		
Direct research and development expenses by product candidate:			
X4P-001	\$10,625	\$ 9,878	\$ 747
X4P-002	—	1,129	(1,129)
X4P-003	49		49
Unallocated research and development expenses:			
Personnel-related (including stock-based compensation)	7,646	5,495	2,151
Other	2,026	564	1,462
Total research and development expenses	<u>\$20,346</u>	<u>\$17,066</u>	<u>\$ 3,280</u>

Research and development expenses were \$20.3 million and \$17.1 million for the years ended December 31, 2018, and December 31, 2017, respectively. The increase of \$3.3 million was primarily due to an increase of \$3.6 million in unallocated research and development costs, partially offset by a net decrease of \$0.3 million in external costs related to X4's product candidates.

Direct expenses of X4's X4P-001 product candidate increased by \$0.7 million for the year ended December 31, 2018, compared to the year ended December 31, 2017. The increase was primarily due to an increase of \$1.8 million in costs associated with the manufacturing of product in support of X4P-001 entering into planned clinical trials as well as an increase of \$0.7 million in medical affairs costs. These increases were partially offset by a decrease of \$1.8 million in clinical trial costs. X4 expects that its research and development expenses for X4P-001 will increase substantially over the next several years as it expects to complete its ongoing Phase 2 trial in patients with WHIM syndrome; initiate a Phase 3 pivotal trial of X4P-001 in patients with WHIM syndrome in the first half of 2019; initiate a Phase 1/2 clinical trial of X4P-001 in WM in 2019; and initiate a Phase 1/2 clinical trial of X4P-001 in SCN in 2019.

Direct expenses of X4's X4P-002 product candidate decreased by \$1.1 million for the year ended December 31, 2018, compared to the year ended December 31, 2017. The decrease was primarily due to costs incurred in connection with preclinical development activities in preparation for reaching a late lead optimization phase in the third quarter of 2017. X4 had no direct costs related to the X4P-002 product candidate during the year ended December 31, 2018 as X4 paused the development of X4P-002 in favor of focusing X4's resources on the development of its X4P-001 product candidate. X4 expects that its research and development expenses for X4P-002 will increase over the next several years as it plans to resume work on X4P-002's preclinical development and initial clinical stage activities.

Unallocated research and development expenses were \$9.7 million for the year ended December 31, 2018, compared to \$6.1 million for the year ended December 31, 2017. The increase of \$3.6 million was due to an increase of \$2.1 million in personnel-related costs and an increase of \$1.5 million in other costs. The increase in personnel-related costs was primarily due to the hiring of additional personnel in X4's research and development functions. Personnel-related costs for the years ended December 31, 2018 and 2017 included stock-based compensation of \$0.2 million and \$0.1 million, respectively. The increase in other costs was primarily due to an increase in consulting fees associated with medical statisticians, medical writing, quality and regulatory fees.

General and Administrative Expenses

General and administrative expenses were \$8.7 million and \$5.2 million for the years ended December 31, 2018, and 2017. The increase of \$3.6 million was primarily due to a \$3.1 million increase in professional fees, a \$0.3 million increase in recruiting costs and a \$0.2 million increase in stock-based compensation. Professional fees increased due to higher audit and market research expenses as well as legal costs incurred in connection with maintaining and registering worldwide patents and costs associated with X4's ongoing business operations. Personnel-related costs for the years ended December 31, 2018 and 2017 included stock-based compensation of \$0.6 million and \$0.4 million, respectively.

Other Income (Expense), Net

Other expense, net was \$4.2 million during the year ended December 31, 2018, compared to \$0.3 million in other income, net for the year ended December 31, 2017. The net decrease of \$4.5 million was primarily due to a \$4.8 million change in the fair value of the preferred stock warrant liability in the year ended December 31, 2018, partially offset by an increase of \$0.2 million in interest income.

Comparison of the Years Ended December 31, 2017 and 2016

The following table summarizes X4's results of operations for the year ended December 31, 2017 and 2016:

	Year Ended December 31,		Change
	2017	2016	
	(in thousands)		
Operating expenses:			
Research and development	\$ 17,066	\$ 13,098	\$ 3,968
General and administrative	5,181	4,789	392
Total operating expenses	<u>22,247</u>	<u>17,887</u>	<u>4,360</u>
Loss from operations	<u>(22,247)</u>	<u>(17,887)</u>	<u>(4,360)</u>
Other income (expense):			
Interest income	64	27	37
Interest expense	(490)	(53)	(437)
Change in fair value of preferred stock warrant liability	1,360	48	1,312
Change in fair value of derivative liability	(94)	—	(94)
Loss on preferred stock repurchase	(587)	—	(587)
Total other income (expense), net	<u>253</u>	<u>22</u>	<u>231</u>
Net loss and comprehensive loss	<u><u>\$(21,994)</u></u>	<u><u>\$(17,865)</u></u>	<u><u>\$(4,129)</u></u>

Research and Development Expenses

	Year Ended December 31,		Change
	2017	2016	
	(in thousands)		
Direct research and development expenses by product candidate:			
X4P-001	\$ 9,878	\$ 7,000	\$ 2,878
X4P-002	1,129	2,062	(933)
Unallocated research and development expenses:			
Personnel-related (including stock-based compensation)	5,495	3,741	1,754
Other	564	295	269
Total research and development expenses	<u><u>\$17,066</u></u>	<u><u>\$13,098</u></u>	<u><u>\$3,968</u></u>

Research and development expenses were \$17.1 million for the year ended December 31, 2017, compared to \$13.1 million for the year ended December 31, 2016. The increase of \$4.0 million was due to a \$1.9 million increase in external costs related to X4's product candidates and an increase of \$2.0 million in unallocated research and development expenses.

Direct expenses of X4's X4P-001 product candidate increased by \$2.9 million in the year ended December 31, 2017, compared to the year ended December 31, 2016. The increase was primarily due to a \$2.7 million increase in preclinical development and clinical trial activities that commenced in 2016 and continued through 2017 related to X4's Phase 1/2 clinical trials of X4P-001 for the treatment of renal cell carcinoma and melanoma and a \$1.5 million increase in preclinical development and clinical trial activities in 2017 related to X4's Phase 2 clinical trial for the treatment of WHIM syndrome, which commenced in late 2016 and enrolled its first patient in early 2017. The increases were partially offset by a \$1.3 million decrease in manufacturing costs, primarily due to a large API batch that was completed in the second half of 2016 as compared to smaller batches being completed during 2017. X4 expects that its research and development expenses for X4P-001 will increase over the next several years as it completes its Phase 2 trial in patients with WHIM syndrome; initiates a Phase 3 pivotal trial of X4P-001 in patients with WHIM syndrome in the first half of 2019; initiates a Phase 1/2 clinical trial of X4P-001 in WM in the first half of 2019; and initiates a Phase 1/2 clinical trial of X4P-001 in SCN in the first half of 2019.

Direct expenses of X4's X4P-002 product candidate decreased by \$0.9 million during the year ended December 31, 2017, compared to the year ended December 31, 2016. The decrease was primarily driven by a reduction in preclinical development activities once the molecule entered the lead optimization phase in the third quarter of 2017. X4 expects that its research and development expenses for X4P-002 will increase over the next several years as it plans to advance X4P-002's preclinical development and initial clinical stage activities.

Unallocated research and development expenses were \$6.1 million for the year ended December 31, 2017, compared to \$4.0 million for the year ended December 31, 2016. The increase of \$2.0 million was due to an increase of \$1.8 million in personnel-related costs and an increase of \$0.3 million in other costs. The increase in personnel-related costs was primarily due to an increase in salaries of \$1.2 million as a result of the hiring of additional personnel in X4's research and development functions and a \$0.6 million increase in costs for external consultants supporting X4's research and development programs for its product candidates. Personnel-related costs for each of the years ended December 31, 2016 and 2017 included stock-based compensation of \$0.1 million. The increase in other costs was primarily due to a \$0.5 million increase in facilities costs related to a lease for office space of X4's headquarters that X4 entered into in January 2017, partially offset by a \$0.2 million decrease in professional fees related to quality assurance and regulatory affairs associated with X4's research programs for its product candidates.

General and Administrative Expenses

General and administrative expenses were \$5.2 million for the year ended December 31, 2017, compared to \$4.8 million for the year ended December 31, 2016. The increase of \$0.4 million was primarily due to an increase of \$0.2 million in facilities costs, a \$0.1 million increase in personnel-related costs and a \$0.1 million increase in professional fees. The increase in facilities costs was related to a lease for office space of X4's headquarters that X4 entered into in January 2017. The increase of \$0.1 million in personnel-related costs was due to a \$0.3 million increase associated with the hiring of additional personnel in X4's general and administrative functions, partially offset by a \$0.2 million decrease associated with a decreased use of external consultants by X4. Personnel-related costs for each of the years ended December 31, 2016 and 2017 included stock-based compensation of \$0.4 million. The increase in professional fees was primarily due to a \$0.2 million increase in investor relations costs, partially offset by a decrease of \$0.1 million in legal expenses.

Other Income (Expense), Net

Other income, net was \$0.3 million during the year ended December 31, 2017, compared to less than \$0.1 million for the year ended December 31, 2016. The increase in other income, net of \$0.2 million was primarily due to a \$1.3 million increase in income generated from the change in the fair value of the preferred stock warrant liability. The gain was partially offset by a \$0.6 million loss related to the fair value of the preferred stock repurchase liability, a \$0.4 million increase in interest expense related to borrowings under X4's SVB Loan Agreement and a loss of \$0.1 million related to the change in fair value of the derivative liability recognized in connection with X4's license agreement with Genzyme.

Liquidity and Capital Resources

Since its inception, X4 has not generated any revenue from any sources, including from product sales, and have incurred significant operating losses and negative cash flows from its operations. X4 has funded its operations to date primarily with proceeds from sales of preferred stock, proceeds from the issuance of convertible debt and borrowings under loan and security agreements. Through December 31, 2018, X4 has received net proceeds of \$73.7 million from sales of its preferred stock (including proceeds from convertible debt, which converted into preferred stock), gross proceeds of \$6.0 million from borrowings under the SVB Loan Agreement and gross proceeds of \$10.0 million from borrowings under the Hercules Loan Agreement. X4 has repaid all amounts due under the SVB Loan Agreement, totaling \$4.6 million.

Cash Flows

The following table summarizes X4's sources and uses of cash for each of the periods presented:

	Year Ended December 31,		
	2018	2017	2016
	(in thousands)		
Net cash used in operating activities	\$(25,420)	\$(21,311)	\$(16,945)
Net cash used in investing activities	—	(378)	(39)
Net cash provided by (used in) financing activities	6,870	33,422	(78)
Net (decrease) increase in cash, cash equivalents and restricted cash	<u>\$(18,550)</u>	<u>\$ 11,733</u>	<u>\$(17,062)</u>

Operating Activities

During the twelve months ended December 31, 2018, operating activities used \$25.4 million of cash, resulting from X4's net loss of \$33.3 million, partially offset by non-cash charges of \$4.7 million and net cash provided by changes in X4's operating assets and liabilities of \$3.2 million. Net cash provided by changes in X4's operating assets and liabilities for the twelve months ended December 31, 2018 consisted of a \$0.3 million decrease in prepaid expenses and other current assets, a \$1.6 million increase in accrued expenses and a \$1.3 million increase in accounts payable, partially offset by a \$0.1 million decrease in deferred rent. The decrease in prepaid expenses and other current assets was primarily due to the expensing of prepaid amounts paid to CROs for preclinical development and clinical trial activities. The increase in accrued expenses was primarily due to higher professional fees and increases in research and development activities and costs, partially offset by a decrease in accrued employee compensation costs. The increase in accounts payable was primarily due to the timing of vendor invoicing and payments.

During the year ended December 31, 2017, operating activities used \$21.3 million of cash, primarily resulting from X4's net loss of \$22.0 million, partially offset by net cash provided by changes in X4's operating assets and liabilities of \$0.6 million. Net cash provided by changes in X4's operating assets and liabilities for the year ended December 31, 2017 consisted of a \$0.8 million increase in accrued expenses, a \$0.6 million increase in deferred rent and a \$0.4 million decrease in prepaid expenses and other current assets, all partially offset by a \$1.2 million decrease in accounts payable. The increase in accrued expenses was primarily due to increased preclinical development and clinical trial and manufacturing activities as well as increased professional fees and employee compensation costs. The increase in deferred rent was due to a lease for office space of X4's headquarters that X4 entered into in January 2017. The decrease in prepaid expenses and other current assets was primarily due to the expensing of prepaid amounts paid to CROs for preclinical development and clinical trial activities. The decrease in accounts payable was primarily due to the timing of vendor invoicing and payments.

During the year ended December 31, 2016, operating activities used \$16.9 million of cash, resulting from X4's net loss of \$17.9 million, partially offset by net non-cash charges of \$0.5 million and net cash provided by changes in X4's operating assets and liabilities of \$0.4 million. Net cash provided by changes in X4's operating assets and liabilities for the year ended December 31, 2016 consisted of a \$1.7 million increase in accounts payable and a \$0.4 million increase in accrued expenses, partially offset by a \$1.7 million increase in prepaid expenses and other current assets. The increase in accounts payable was primarily due to X4's increased level of operating activities. The increase in accrued expenses was primarily due to increased bonus payments related to additional personnel hiring and increased clinical costs associated with X4's research and development programs for its product candidates. The increase in prepaid expenses and other current assets was primarily due to increases in prepaid amounts paid to CROs for preclinical development and clinical trial activities associated with X4's research and development programs for its product candidates.

Investing Activities

During the year ended December 31, 2018, X4 had no cash flows from investing activities.

During the year ended December 31, 2017, net cash used in investing activities was \$0.4 million, consisting of purchases of property and equipment.

During the year ended December 31, 2016, net cash used in investing activities was insignificant.

Financing Activities

During the year ended December 31, 2018, net cash provided by financing activities was \$6.9 million, consisting primarily of net proceeds of \$4.5 million from X4's sale of Series B preferred stock and \$10.0 million of proceeds from borrowings under the Hercules Loan Agreement, partially offset by \$6.4 million of repayments of borrowings under the SVB Loan Agreement and \$1.1 million for the repurchase of Series Seed preferred stock pursuant to a stock repurchase agreement X4 entered into in October 2017.

During the year ended December 31, 2017, net cash provided by financing activities was \$33.4 million, consisting primarily of net proceeds of \$27.4 million from X4's sale of Series B preferred stock and borrowings of \$6.0 million under the SVB Loan Agreement.

During the year ended December 31, 2016, net cash used in financing activities was \$0.1 million, consisting primarily of payments of debt issuance costs.

Loan and Security Agreements

Loan and Security Agreement with Silicon Valley Bank

In October 2016, X4 entered into the SVB Loan Agreement, which provided for aggregate maximum borrowings of up to \$10.0 million, consisting of (i) a term loan of up to \$6.0 million, which X4 borrowed in June 2017, and (ii) subject to specified conditions, an additional term loan of up to \$4.0 million, or the Term B Loan, available for borrowing until December 31, 2017. As of December 31, 2017, X4 had not borrowed any amounts under the Term B Loan and the availability of the additional \$4.0 million expired. As of December 31, 2017 and December 31, 2018, X4 had \$6.0 million and \$0.0 million, respectively, of borrowings outstanding under the SVB Loan Agreement. In October 2018, in connection with entering into the Hercules Loan Agreement, all amounts due under the SVB Loan Agreement, including unpaid principal of \$4.3 million and a final payment of \$0.3 million, were repaid with proceeds from the Hercules Loan Agreement and the SVB Loan Agreement was terminated.

Borrowings under the SVB Loan Agreement bore interest at a variable rate equal to 5.5% plus the greater of (i) 3.5% or (ii) *The Wall Street Journal* prime rate; provided, however, that in an event of default, as defined, the interest rate applicable to borrowings under the SVB Loan Agreement would be increased by 5.0%. As of December 31, 2017, the interest rate applicable to borrowings under the SVB Loan Agreement was 10.0%. In addition, the SVB Loan Agreement provided for a final payment, payable upon maturity or the repayment in full of all obligations under the agreement, equal to 4.5% of the total amount borrowed, or \$0.3 million.

Borrowings under the SVB Loan Agreement were repayable in monthly interest-only payments through December 2017 and in equal monthly payments of principal and accrued interest from January 2018 until the maturity date of the SVB Loan Agreement in December 2020. At X4's option, X4 was entitled to prepay all, but not less than all, of the outstanding borrowings, subject to a prepayment premium of up to 3% of the principal amount outstanding as of the date of repayment.

Borrowings under the SVB Loan Agreement were collateralized by substantially all of X4's personal property, excluding intellectual property. Under the SVB Loan Agreement, X4 agreed to affirmative and negative covenants to which X4 would remain subject until maturity or repayment in full. The negative covenants included restrictions on X4's ability to incur additional indebtedness, pay dividends, encumber its intellectual property, or engage in certain fundamental business transactions, such as mergers or acquisitions of other businesses. Obligations under the SVB Loan Agreement were subject to acceleration upon occurrence of specified events of default, including payment default, insolvency and a material adverse change in X4's business, operations or financial or other condition.

In connection with entering into the SVB Loan Agreement, in October 2016, X4 issued to the lenders warrants for the purchase of 54,256 shares of Series A preferred stock at an exercise price of \$1.88 per share. The warrants were immediately exercisable and expire in October 2026.

In October 2018, in connection with entering into the Hercules Loan Agreement, all amounts due under the SVB Loan Agreement, including unpaid principal of \$4.3 million and a final payment of \$0.3 million, were repaid with proceeds from the Hercules Loan Agreement and the SVB Loan Agreement was terminated.

Loan and Security Agreement with Hercules Capital, Inc.

In October 2018, X4 entered into the Hercules Loan Agreement, which provided for aggregate maximum borrowings of up to \$13.0 million, consisting of (i) a term loan of up to \$8.0 million, which was available upon entering into the agreement, (ii) subject to specified financing conditions, an additional term loan of up to \$2.0 million, available for borrowing from January 1, 2019 to March 31, 2019, and (iii) subject to specified financing conditions and the receipt of the second tranche \$2.0 million term loan described above, an additional term loan of up to \$3.0 million, available for borrowing until March 31, 2019. In October 2018, X4 borrowed \$8.0 million under the Hercules Loan Agreement. Borrowings under the Hercules Loan Agreement bear interest at variable rates, with the first tranche bearing interest at a variable rate equal to the greater of (i) 9.5% or (ii) 9.5% plus *the Wall Street Journal* prime rate minus 5.25%, the second tranche bearing interest at a variable rate, subject to completion of specified financing conditions, equal to either (A) the greater of (i) 9.5% or (ii) 9.5% plus *the Wall Street Journal* prime rate minus 5.25% or (B) the greater of (i) 8.75% or (ii) 8.75% plus *the Wall Street Journal* prime rate minus 5.25%, and the third tranche bearing interest at a variable rate equal to the greater of (i) 8.75% or (ii) 8.75% plus *the Wall Street Journal* prime rate minus 5.25%. In an event of default, as defined, and until such event is no longer continuing, the interest rate applicable to borrowings under the Hercules Loan Agreement would be increased by 4.0%.

Borrowings under the Hercules Loan Agreement are repayable in monthly interest-only payments through August 2019, or a later date upon achievement of specified conditions, and in equal monthly payments of principal and accrued interest from September 2019 until the maturity date of the loan, which is either, (i) if the second tranche is not borrowed, November 2021 or, (ii) if the second tranche is borrowed, May 2022. At X4's option, X4 may prepay all, but not less than all, of the outstanding borrowings, subject to a prepayment premium of up to 2.0% of the principal amount outstanding as of the date of repayment. In addition, the Hercules Loan Agreement provides for a final payment, payable upon maturity or the repayment in full of all obligations under the agreement, of up to \$1.0 million.

Borrowings under the Hercules Loan Agreement are collateralized by substantially all of X4's personal property and other assets, including its intellectual property until a specified financing condition is met. Under the Hercules Loan Agreement, X4 has agreed to affirmative and negative covenants to which X4 will remain subject until maturity or repayment in full. The covenants include maintaining a minimum liquidity amount of the lesser of (i) 125% of outstanding borrowings under the Hercules Loan Agreement and (ii) 100% of X4's cash and cash equivalents in an account in which Hercules has a first priority security interest as well as restrictions on X4's ability to incur additional indebtedness, pay dividends, encumber its intellectual property, or engage in certain fundamental business transactions, such as mergers or acquisitions of other businesses. Obligations under the Hercules Loan Agreement are subject to acceleration upon occurrence of specified events of default, including payment default, insolvency and a material adverse change in X4's business, operations or financial or other condition.

In October 2018, in connection with entering into the Hercules Loan Agreement, X4 issued to the lender warrants for the purchase of 210,638 shares of Series B preferred stock at an exercise price of \$1.88 per share. The warrants were immediately exercisable and expire in October 2028.

In October 2018, in connection with entering into the Hercules Loan Agreement, all amounts due under the SVB Loan Agreement, including unpaid principal of \$4.3 million and a final payment of \$0.3 million, were repaid with proceeds from the Hercules Loan Agreement and the SVB Loan Agreement was terminated.

In December 2018, X4 entered into the First Amendment to the Hercules Loan Agreement, or the First Amendment, which amended the available borrowing dates of the second tranche from between January 1, 2019 and March 31, 2019 to between December 11, 2018 and December 14, 2018 and amended the term loan maturity date to November 1, 2021. In December 2018, X4 borrowed the additional \$2.0 million provided under the First Amendment. In connection with entering into the First Amendment, X4 agreed to issue to the lender warrants to purchase a specified number of shares of X4 Preferred Stock at an aggregate exercise price of \$99 at the earliest of (a) June 30, 2019, (b) the earlier to occur of (i) the date X4 prepays the outstanding borrowings or (ii) the date the outstanding borrowings become due and payable, or (c) on or before the fifth business day following the closing of or the announcement of the termination of the Merger.

Funding Requirements

X4 expects its expenses to increase substantially in connection with its ongoing activities, particularly as it advances the preclinical activities and clinical trials of its product candidates in development. In addition, upon the closing of the Merger, X4 expects to incur additional costs associated with operating as a public company. The timing and amount of X4's operating expenditures will depend largely on:

- the scope, number, initiation, progress, timing, costs, design, duration, any potential delays, and results of clinical trials and nonclinical studies for X4's current or future product candidates, particularly the Phase 3 trial of X4P-001 for the treatment of WHIM syndrome, X4's Phase 1/2 clinical trial of X4P-001 for the treatment of SCN, X4's Phase 1/2 clinical trial of X4P-001 for the treatment of WM, and X4's Phase 1/2 for the treatment of ccRCC;
- the clinical development plans X4 establishes for these product candidates;
- the number and characteristics of product candidates and programs that X4 develops or may in-license;
- the outcome, timing and cost of regulatory reviews, approvals or other actions to meet regulatory requirements established by the FDA and comparable foreign regulatory authorities, including the potential for the FDA or comparable foreign regulatory authorities to require that X4 perform more studies for its product candidates than those that X4 currently expects;
- X4's ability to obtain marketing approval for its product candidates;

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- the cost of filing, prosecuting, defending and enforcing X4's patent claims and other intellectual property rights covering its product candidates, including any such patent claims and intellectual property rights that X4 has licensed from Genzyme pursuant to the terms of its license agreement with Genzyme;
 - X4's ability to maintain, expand and defend the scope of its intellectual property portfolio, including the cost of defending intellectual property disputes, including patent infringement actions brought by third parties against X4 or its product candidates;
 - the cost and timing of completion of commercial-scale outsourced manufacturing activities with respect to X4's product candidates;
 - X4's ability to establish and maintain licensing, collaboration or similar arrangements on favorable terms and whether and to what extent X4 retains development or commercialization responsibilities under any new licensing, collaboration or similar arrangement;
 - the cost of establishing sales, marketing and distribution capabilities for any product candidates for which X4 may receive regulatory approval in regions where X4 chooses to commercialize its products on its own;
 - the success of any other business, product or technology that X4 acquires or in which X4 invests;
 - the costs of acquiring, licensing or investing in businesses, product candidates and technologies;
 - X4's need and ability to hire additional management and scientific and medical personnel;
 - the costs to operate as a public company in the United States, including the need to implement additional financial and reporting systems and other internal systems and infrastructure for X4's business;
 - market acceptance of X4's product candidates, to the extent any are approved for commercial sale; and
 - the effect of competing technological and market developments.

As of April 2, 2019, the issuance date of the annual consolidated financial statements for the year ended December 31, 2018, X4 expected that its cash and cash equivalents, including cash and cash equivalents received in connection with closing of the merger with Arsanis, would be sufficient to fund its operating expenses, capital expenditure requirements and debt service payments into the third quarter of 2019. X4 has based this estimate on assumptions that may prove to be wrong, and X4 could exhaust its available capital resources sooner than it expects.

Until such time, if ever, as X4 can generate substantial product revenue, X4 expects to finance its cash needs through a combination of equity offerings, debt financings, collaborations, strategic alliances, and marketing, distribution or licensing arrangements with third parties. To the extent that X4 raises additional capital through the sale of equity or convertible debt securities, the ownership interest of X4 may be materially diluted, and the terms of such securities could include liquidation or other preferences that adversely affect the rights of the X4 Stockholders and the rights of the stockholders of the combined organization following the closing of the Merger. Debt financing and preferred equity financing, if available, may involve agreements that include restrictive covenants that limit X4's ability to take specified actions, such as incurring additional debt, making capital expenditures or declaring dividends. If X4 raises funds through collaborations, strategic alliances or marketing, distribution or licensing arrangements with third parties, X4 may have to relinquish valuable rights to its technologies, future revenue streams, research programs or product candidates or grant licenses on terms that may not be favorable to X4. If X4 is unable to raise additional funds through equity or debt financings or other arrangements when needed, X4 may be required to delay, reduce or eliminate its product development or future commercialization efforts, or grant rights to develop and market product candidates that X4 would otherwise prefer to develop and market themselves.

Contractual Obligations and Commitments

The following table summarizes X4's contractual obligations as of December 31, 2018 and the effects that such obligations are expected to have on its liquidity and cash flows in future periods:

	Payments Due by Period				
	Total	Less than 1 Year	1 to 3 Years	4 to 5 Years	More than 5 Years
		(in thousands)			
Debt obligations (1)	\$12,598	\$ 2,700	\$ 9,898	\$—	\$ —
Operating lease commitments (2)	2,960	810	2,150	—	—
Manufacturing commitments (3)	238	238	—	—	—
Research agreements (4)	222	166	56	—	—
Capital lease commitments (5)	20	15	5	—	—
Total	<u>\$16,038</u>	<u>\$ 3,929</u>	<u>\$12,109</u>	<u>\$—</u>	<u>\$ —</u>

- (1) Amounts in the table reflect the contractually required principal and interest payments payable under the Hercules Loan Agreement.
- (2) Amounts in the table reflect payments due for X4's lease of office space in Cambridge, Massachusetts, under an operating lease agreement that expires in July 2022.
- (3) Amounts in the table reflect the non-cancelable purchase commitments under an agreement with one of X4's external CMOs, which X4 has engaged to manufacture preclinical and clinical trial materials.
- (4) Amounts in the table reflect the non-cancelable payment commitments under a sponsored research agreement with a university that X4 has engaged to conduct discovery research and preclinical development activities.
- (5) Amounts in the table reflect principal and interest payments due for X4's capital lease of computer equipment, which expires in April 2020.

In addition to the contracts with payment commitments that X4 has reflected in the table above, X4 has entered into other contracts in the normal course of business with certain CROs, CMOs and other third parties for preclinical research studies and testing, clinical trials and manufacturing services. These contracts do not contain any minimum purchase commitments and are cancelable by X4 upon prior notice and, as a result, are not included in the table of contractual obligations and commitments above. Payments due upon cancellation consist only of payments for services provided and expenses incurred, including non-cancelable obligations of X4's service providers, up to the date of cancellation.

In addition, under various licensing and related agreements to which X4 is a party, X4 may be required to make milestone payments and to pay royalties and other amounts to third parties. X4 has not included any such contingent payment obligations in the table above as the amount, timing and likelihood of such payments are not known. Such contingent payment obligations are described below.

Under X4's license agreement with Genzyme, X4 is obligated to make milestone payments in the aggregate of up to \$25.0 million, contingent upon the achievement by X4 of certain late-stage regulatory and sales milestones with respect to licensed products. X4 is also obligated under the license agreement to pay Genzyme tiered royalties based on annual net sales of licensed products that X4 commercializes under the license agreement. X4 may be required to make a one-time milestone payment to Genzyme upon the consummation by X4 of a change of control transaction, in an amount equal to 5.5% of the consideration paid to X4's equity holders, other than Genzyme, in connection with such change of control transaction, after deducting X4's outstanding debt obligations and the aggregate cash investments made by X4's equity holders into X4 prior to the closing of the change of control transaction. The Merger qualifies as a change of control event, as defined in the license agreement, but results in no payment being due to Genzyme under the license agreement. See Note 12 to X4's consolidated financial statements included as Exhibit 99.1 of X4 Pharmaceuticals, Inc.'s (formerly Arsanis, Inc.) Amendment No. 1 to the Current Report on Form 8-K filed on April 3, 2019.

Under X4's license agreement with Georgetown University, or Georgetown, X4 is obligated to make aggregate milestone payments to Georgetown of up to \$0.8 million related to commercial sales of a product. See Note 12 to X4's consolidated financial statements included as Exhibit 99.1 of X4 Pharmaceuticals, Inc.'s (formerly Arsanis, Inc.) Amendment No. 1 to the Current Report on Form 8-K filed on April 3, 2019.

Critical Accounting Policies and Significant Judgments and Estimates

X4's consolidated financial statements are prepared in accordance with generally accepted accounting principles in the United States. The preparation of X4's consolidated financial statements and related disclosures requires X4 to make estimates and judgments that affect the reported amounts of assets, liabilities, costs and expenses, and the disclosure of contingent assets and liabilities in its financial statements. X4 bases its estimates on historical experience, known trends and events and various other factors that X4 believes are reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. X4 evaluates its estimates and assumptions on an ongoing basis. X4's actual results may differ from these estimates under different assumptions or conditions.

While X4's significant accounting policies are described in more detail in Note 2 to its consolidated financial statements included in Exhibit 99.1 of X4 Pharmaceuticals, Inc.'s (formerly Arsanis, Inc.) Amendment No. 1 to the Current Report on Form 8-K filed on April 3, 2019, X4 believes that the following accounting policies are those most critical to the judgments and estimates used in the preparation of its consolidated financial statements.

Accrued Research and Development Expenses

As part of the process of preparing its consolidated financial statements, X4 is required to estimate its accrued research and development expenses. This process involves reviewing open contracts and purchase orders, communicating with its applicable personnel to identify services that have been performed on X4's behalf and estimating the level of service performed and the associated cost incurred for the service when X4 has not yet been invoiced or otherwise notified of actual costs. The majority of X4's service providers invoice X4 in arrears for services performed, on a pre-determined schedule or when contractual milestones are met; however, some require advance payments. X4 makes estimates of its accrued expenses as of each balance sheet date in the consolidated financial statements based on facts and circumstances known to them at that time. X4 periodically confirms the accuracy of these estimates with the service providers and makes adjustments, if necessary. Examples of estimated accrued research and development expenses include fees paid to:

- vendors in connection with preclinical development activities;
- CROs and investigative sites in connection with preclinical studies and clinical trials; and
- CMOs in connection with the production of preclinical and clinical trial materials.

X4 bases the expense recorded related to external research and development on its estimates of the services received and efforts expended pursuant to quotes and contracts with multiple CMOs and CROs that supply, conduct and manage preclinical studies and clinical trials on its behalf. The financial terms of these agreements are subject to negotiation, vary from contract to contract and may result in uneven payment flows. There may be instances in which payments made to X4's vendors will exceed the level of services provided and result in a prepayment of the expense. Payments under some of these contracts depend on factors such as the successful enrollment of patients and the completion of clinical trial milestones. In accruing service fees, X4 estimates the time period over which services will be performed and the level of effort to be expended in each period. If the actual timing of the performance of services or the level of effort varies from the estimate, X4 adjusts the accrual or the amount of prepaid expenses accordingly. Although X4 does not expect its estimates to be materially different from amounts actually incurred, X4's understanding of the status and timing of services performed relative to the actual status and timing of services performed may vary and may result in reporting amounts that are too high or too low in any particular period. To date, there have not been any material adjustments to X4's prior estimates of accrued research and development expenses.

Stock-Based Compensation

X4 measures all stock-based awards granted to employees and directors based on the fair value on the date of the grant and recognize compensation expense for those awards, net of estimated forfeitures, over the requisite service period, which is generally the vesting period of the respective award. X4 issues stock-based awards with only service-based vesting conditions and records the expense for these awards using the straight-line method. X4 has not issued any stock-based awards with performance-based vesting conditions.

For stock-based awards granted to non-employee consultants, compensation expense is recognized over the period during which services are rendered by such non-employee consultants until completed. At the end of each financial reporting period prior to completion of the service, the fair value of these awards is remeasured using the then-current fair value of X4 Common Stock and updated assumption inputs in the Black-Scholes option-pricing model.

The fair value of each stock option grant is estimated on the date of grant using the Black-Scholes option-pricing model, which uses as inputs the fair value of X4 Common Stock and assumptions X4 makes for the volatility of X4 Common Stock, the expected term of its stock options, the risk-free interest rate for a period that approximates the expected term of its stock options and its expected dividend yield.

Determination of the Fair Value of Common Stock

As there had been no public market for the X4 Common Stock prior to the Arsanis Merger, during the years ended December 31, 2018, 2017 and 2016 the estimated fair value of the X4 Common Stock has been determined by the X4 Board of Directors as of the date of each option grant, with input from management, considering its most recently available third-party valuations of the X4 Common Stock and the X4 Board of Directors' assessment of additional objective and subjective factors that it believed were relevant

and which may have changed from the date of the most recent third-party valuation through the date of the grant. These third-party valuations were performed in accordance with the guidance outlined in the American Institute of Certified Public Accountants' Accounting and Valuation Guide, *Valuation of Privately-Held-Company Equity Securities Issued as Compensation*. The valuations of X4 Common Stock were prepared using a hybrid method, which used market approaches to estimate the enterprise value of X4. The hybrid method is a probability-weighted expected return method, or PWERM, where the equity value in one or more of the scenarios is calculated using an option pricing method, or OPM. The PWERM is a scenario-based methodology that estimates the fair value of common stock based upon an analysis of future values for the company, assuming various outcomes. The common stock value is based on the probability-weighted present value of expected future investment returns considering each of the possible outcomes available as well as the rights of each class of stock. The future value of the common stock under each outcome is discounted back to the valuation date at an appropriate risk-adjusted discount rate and probability weighted to arrive at an indication of value for the common stock. A discount for lack of marketability of the common stock is then applied to arrive at an indication of value for the common stock. The OPM treats common stock and preferred stock as call options on the total equity value of a company, with exercise prices based on the value thresholds at which the allocation among the various holders of a company's securities changes. Under this method, the common stock has value only if the funds available for distribution to stockholders exceeded the value of the preferred stock liquidation preferences at the time of the liquidity event, such as a strategic sale or a merger. These third-party valuations were performed at various dates, which resulted in valuations of the X4 Common Stock of \$0.67 per share as of December 31, 2017, \$0.99 per share as of June 30, 2018, \$0.99 per share as of September 30, 2018 and \$1.56 per share as of December 31, 2018. In addition to considering the results of these third-party valuations, the X4 Board of Directors considered various objective and subjective factors to determine the fair value of the X4 Common Stock as of each grant date, including:

- the prices at which X4 sold X4 Preferred Stock and the superior rights and preferences of the X4 Preferred Stock relative to the X4 Common Stock at the time of each grant;
- the progress of X4's research and development programs, including the status of preclinical studies and planned clinical trials for its product candidates;
- X4's stage of development and commercialization and its business strategy;
- external market conditions affecting the biopharmaceutical industry, and trends within the biopharmaceutical industry;
- X4's financial position, including cash on hand, and its historical and forecasted performance and operating results;
- the lack of an active public market for the X4 Common Stock and X4 Preferred Stock;
- the likelihood of achieving a liquidity event, such as an IPO, merger, consolidation or a sale of X4 in light of prevailing market conditions; and
- the analysis of IPOs and the market performance of similar companies in the biopharmaceutical industry.

The assumptions underlying these valuations represented the management of X4's best estimates, which involved inherent uncertainties and the application of management's judgment. As a result, if X4 had used significantly different assumptions or estimates, the fair value of the X4 Common Stock and X4's stock-based compensation expense could be materially different.

Once a public trading market for the combined organization's common stock has been established in connection with the closing of the Merger, it will no longer be necessary for the X4 Board of Directors to estimate the fair value of the X4 Common Stock in connection with X4's accounting for granted stock options and other such awards X4 may grant, as the fair value of the combined organization's common stock will be determined based on the quoted market price of such common stock.

Options Granted

The following table sets forth by grant date the number of shares subject to options granted during the year ended December 31, 2018, the per share exercise price of the options, the fair value of X4 Common Stock per share on each grant date, and the per share estimated fair value of the options:

Grant Date	Number of Shares Subject to Options Granted	Per Share Exercise Price of Options	Fair Value of Common Stock per Share on Grant Date	Per Share Estimated Fair Value of Options
January 31, 2018	1,122,496	\$ 0.67	\$ 0.67	\$ 0.48
April 11, 2018	346,000	\$ 0.67	\$ 0.93 ⁽¹⁾	\$ 0.72
August 22, 2018	2,142,414	\$ 0.99	\$ 0.99	\$ 0.73
October 4, 2018	1,194,050	\$ 0.99	\$ 0.99	\$ 0.73

- (1) At the time of the option grants on April 11, 2018, the X4 Board of Directors determined that the fair value of the X4 Common Stock of \$0.67 per share calculated in the valuation as of December 31, 2017 reasonably reflected the per share fair value of the X4 Common Stock as of the grant date. However, as described below, the fair value of X4 Common Stock at the date of this grant was adjusted in connection with a retrospective fair value assessment for accounting purposes.

In preparing for the issuance of X4's financial statements, in August 2018, X4 performed a retrospective fair value assessment and concluded that the fair value of X4 Common Stock underlying stock options that it granted on April 11, 2018 was \$0.93 per share for accounting purposes. X4 applied the fair value of X4 Common Stock from its retrospective fair value assessment to determine the fair value of these awards and calculate stock-based compensation expense for accounting purposes. This reassessed value was based, in part, upon a third-party valuation of X4 Common Stock prepared as of the April 11, 2018 grant date on a retrospective basis. The third-party valuation was prepared using a hybrid method, which used market approaches to determine X4's enterprise value.

Valuation of Preferred Stock Warrant Liability

In connection with X4's preferred stock financings in 2015, 2017 and 2018, entering into the Hercules Loan Agreement in 2018, and entering into the SVB Loan Agreement in 2016, X4 issued warrants to purchase shares of X4 Preferred Stock. X4 classifies these warrants as a liability on its consolidated balance sheets because these warrants are freestanding financial instruments that may require X4 to transfer assets upon exercise. The warrant liability was initially recorded at fair value upon the date of issuance of each warrant and is subsequently remeasured to fair value at each reporting date. Changes in the fair value of the warrant liability are recognized as a component of other income (expense), net in the consolidated statement of operations and comprehensive loss of X4. X4 will continue to recognize changes in the fair value of each warrant comprising the warrant liability until each respective warrant is exercised, expires or qualifies for equity classification.

X4 used various valuation methods, including the Monte Carlo method, the option-pricing method and the hybrid method, all of which incorporate assumptions and estimates, to value the preferred stock warrants. X4 assesses these assumptions and estimates on a quarterly basis as additional information impacting the assumptions is obtained. Estimates and assumptions impacting the fair value measurement include the fair value per share of the underlying shares of X4's Series A and Series B preferred stock, risk-free interest rate, expected dividend yield, expected volatility of the price of the underlying preferred stock, and the remaining contractual term of the warrants (except for the warrants that would be automatically exercised upon an initial public offering, in which case the remaining estimated term to automatic exercise was used). The most significant assumption in the Monte Carlo method, the option-pricing method and the hybrid method impacting the fair value of the preferred stock warrants is the fair value of X4 Preferred Stock as of each remeasurement date. X4 determines the fair value per share of the underlying X4 Preferred Stock by taking into consideration the most recent sales of X4 Preferred Stock, results obtained from third-party valuations and additional factors that are deemed relevant. As of December 31, 2016, 2017 and 2018, the fair value of the Series A preferred stock was \$1.90 per share, \$1.19 per share and \$1.70 per share, respectively. As of December 31, 2017 and 2018, the fair value of the Series B preferred stock was \$1.84 per share and \$1.86 per share, respectively. X4 has historically been a private company and lacks company-specific historical and implied volatility information of X4 Capital Stock. Therefore, X4 estimates its expected stock volatility based on the historical volatility of publicly traded peer companies for a term equal to the estimated remaining term of the warrants. The risk-free interest rate is determined by reference to the U.S. Treasury yield curve for time periods approximately equal to the estimated remaining term of the warrants. X4 estimated a 0% expected dividend yield based on the fact that X4 has never paid or declared dividends and does not intend to do so in the foreseeable future.

All of X4's outstanding preferred stock warrants, other than the warrants issued to the lenders in connection with the SVB Loan Agreement, contain a feature whereby the warrants will be automatically exercised and net settled in shares upon an IPO or a specified deemed liquidation event. Upon either of those events, the holders of the preferred stock warrants will be issued a number of shares of X4 equal in value to the difference between the fair value of the shares into which each warrant is exercisable and the exercise price of such warrant. The Merger does not qualify as an IPO or a deemed liquidation event under the warrants.

Upon the closing of the Merger, pursuant to the Merger Agreement, all of X4's outstanding preferred stock warrants will become exercisable for Arsanis Common Stock instead of preferred stock; accordingly, the fair value of the warrant liability for these warrants at that time will be reclassified to additional paid-in capital. As a result, following the closing of the Merger, X4 will no longer recognize changes in the fair value of the warrant liability as other income (expense), net in its consolidated statement of operations and comprehensive loss.

Valuation of Derivative Liability

X4's license agreement with Genzyme contains a contingent payment obligation that requires that X4 make a cash payment to Genzyme upon a change of control event of X4. The contingent payment obligation meets the definition of a derivative instrument as the contingent payment obligation is not clearly and closely related to its host instrument and is a cash-settled liability. Accordingly, X4 classifies this derivative as a liability on its consolidated balance sheets. The derivative liability was initially recorded at fair value on the date of entering into the license agreement and is subsequently remeasured to fair value at each reporting date. Changes in the fair value of the derivative liability are recognized as a component of other income (expense), net in its consolidated statement of operations and comprehensive loss. X4 will continue to recognize changes in the fair value of the derivative liability until a change of control event occurs or until the license agreement is terminated.

The fair value of the derivative liability was estimated by X4 at each reporting date based, in part, on the results of third-party valuations, which were prepared using the option-pricing method or the hybrid method, each of which considered as inputs the type, timing and probability of the occurrence of a change of control event, the potential amount of the payment under potential exit scenarios, the fair value per share of the underlying common stock and the risk-adjusted discount rate.

The Merger qualifies as a change of control event, as defined in the license agreement, but results in no payment being due to Genzyme under the license agreement.

Valuation of Preferred Stock Repurchase Liability

In October 2017, X4 entered into a stock repurchase agreement with a holder of Series Seed preferred stock for the repurchase of shares of Series Seed preferred stock. X4 classifies this repurchase agreement as a liability on its consolidated balance sheets as the repurchase agreement was a freestanding financial instrument that required X4 to transfer assets upon settlement. The preferred stock repurchase liability was initially recorded at fair value on the date of entering into the repurchase agreement and was subsequently remeasured to fair value at each reporting date and upon the settlement date until the settlement of the repurchase agreement, which occurred in January 2018. Changes in the fair value of the preferred stock repurchase liability were recognized as a component of other income (expense), net in its consolidated statements of operations and comprehensive loss. The fair value of the preferred stock repurchase liability was estimated by multiplying (i) the 598,975 shares of Series Seed preferred stock that X4 agreed to repurchase by (ii) the difference between the agreed repurchase price of \$1.88 per share and the fair value per share of the Series Seed preferred stock, which result approximated the fair value of the preferred stock repurchase liability given the short duration of the contract. X4 determined the fair value per share of the Series Seed preferred stock by taking into consideration the most recent sales of its preferred stock, results obtained from third-party valuations and additional factors that were deemed relevant. In January 2018, the Series Seed preferred stock repurchase agreement was settled through X4's repurchase of the shares.

Emerging Growth Company Status

The JOBS Act permits an EGC such as X4 to take advantage of an extended transition period to comply with new or revised accounting standards applicable to public companies until those standards would otherwise apply to private companies. X4 has irrevocably elected to "opt out" of this provision and, as a result, X4 will comply with new or revised accounting standards when they are required to be adopted by public companies that are not emerging growth companies.

Off-Balance Sheet Arrangements

X4 did not have during the periods presented, and X4 does not currently have, any off-balance sheet arrangements, as defined in the rules and regulations of the SEC.

Recently Issued Accounting Pronouncements

A description of recently issued accounting pronouncements that may potentially impact X4's financial position and results of operations is disclosed in Note 2 to X4's consolidated financial statements included as Exhibit 99.1 of X4 Pharmaceuticals, Inc.'s (formerly Arsanis, Inc.) Amendment No. 1 to the Current Report on Form 8-K filed on April 3, 2019.

QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT THE MARKET RISK OF X4

As a smaller reporting company, as defined by Rule 12b-2 of the Exchange Act and in Item 10(f)(1) of Regulation S-K, we are electing scaled disclosure reporting obligations and therefore are not required to provide the information requested by this Item.