UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, DC 20549

FORM 10-Q

(Mark One)

☒ **QUARTERLY REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the quarterly period ended June 30, 2019

OR

☐ **TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the transition period from to

Commission File Number: 001-38942

ARCTURUS THERAPEUTICS HOLDINGS INC.

(Exact Name of Registrant as Specified in its Charter)

Delaware **(State or other jurisdiction of incorporation or organization)**	**32-0595345** **(I.R.S. Employer Identification No.)**
10628 Science Center Drive, Suite 250 **San Diego, California** **(Address of principal executive offices)**	**92121** **(Zip Code)**

Registrant's telephone number, including area code: (858) 900-2660

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, par value $0.001 per share	ARCT	The NASDAQ Stock Market LLC

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes ☒ No ☐

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes ☒ No ☐

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

Large accelerated filer	☐	Accelerated filer	☐
Non-accelerated filer	☒	Smaller reporting company	☒
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. ☐

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act). Yes ☐ No ☒

As of August 9, 2019, the registrant had 14,274,378 shares of voting common stock outstanding.

ARCTURUS THERAPEUTICS HOLDINGS INC. AND ITS SUBSIDIARIES

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PART I—FINANCIAL INFORMATION

Item 1. Financial Statements.

ARCTURUS THERAPEUTICS HOLDINGS INC. AND ITS SUBSIDIARIES
CONDENSED CONSOLIDATED BALANCE SHEETS
(In U.S. dollars in thousands, except par value information)

	June 30, 2019 (unaudited)	December 31, 2018
Assets		
Current assets:		
Cash and cash equivalents	$ 55,840	$ 36,709
Accounts receivable	5,817	4,481
Prepaid expenses and other current assets	1,681	638
Total current assets	63,338	41,828
Property and equipment, net	1,986	1,975
Operating lease right-of-use asset, net	5,509	—
Equity-method investment	—	288
Non-current restricted cash	107	107
Total assets	$ 70,940	$ 44,198
Liabilities and shareholders' equity		
Current liabilities:		
Accounts payable	$ 3,187	$ 2,398
Accrued liabilities	3,497	3,907
Deferred revenue	9,730	6,272
Total current liabilities	16,414	12,577
Deferred revenue, net of current portion	17,652	7,534
Long-term debt	9,980	9,911
Operating lease liability, net of current portion	5,276	—
Deferred rent	—	534
Total liabilities	$ 49,322	$ 30,556
Stockholders' equity		
Common stock: $0.001 par value; 30,000 shares authorized; 13,120 issued and outstanding at June 30, 2019; NIS 0.07 par value; 30,000 shares authorized, 10,762 issued, 10,719 outstanding and 43 held in treasury at December 31, 2018	13	214
Additional paid-in capital	74,851	58,302
Accumulated deficit	(53,246)	(44,874)
Total stockholders' equity	21,618	13,642
Total liabilities and stockholders' equity	$ 70,940	$ 44,198

The accompanying notes are an integral part of these condensed consolidated financial statements.

ARCTURUS THERAPEUTICS HOLDINGS INC. AND ITS SUBSIDIARIES
CONDENSED CONSOLIDATED STATEMENTS OF OPERATIONS AND COMPREHENSIVE LOSS
(unaudited)
U.S. dollars in thousands (except per share data)

	Three Months Ended June 30,		Six Months Ended June 30,	
	2019	2018	2019	2018
Collaboration revenue	$ 10,153	$ 2,386	$ 14,503	$ 4,753
Operating expenses:				
Research and development, net	7,269	4,225	14,593	8,166
General and administrative	3,456	8,233	6,990	13,331
Total operating expenses	10,725	12,458	21,583	21,497
Loss from operations	(572)	(10,072)	(7,080)	(16,744)
Loss from equity-method investment	—	(47)	(288)	(47)
Finance (expense) income, net	(113)	169	(201)	270
Net loss	$ (685)	$ (9,950)	$ (7,569)	$ (16,521)
Net loss per share, basic and diluted	$ (0.07)	$ (0.99)	$ (0.74)	$ (1.65)
Weighted-average shares outstanding, basic and diluted	10,412	10,057	10,255	10,043
Comprehensive loss:				
Net loss	$ (685)	$ (9,950)	$ (7,569)	$ (16,521)
Unrealized gain on short-term investments	—	7	—	5
Comprehensive loss	$ (685)	$ (9,943)	$ (7,569)	$ (16,516)

The accompanying notes are an integral part of these condensed consolidated financial statements.

ARCTURUS THERAPEUTICS HOLDINGS INC. AND ITS SUBSIDIARIES
CONDENSED CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY
(unaudited)
U.S. dollars in thousands

Three Months Ended June 30, 2019

	Common Stock Shares	Common Stock Amount	Additional Paid-In Capital	Accumulated Other Comprehensive (Loss) Gain	Accumulated Deficit	Total Stockholders' Equity
BALANCE - March 31, 2019	**10,762**	**$ 214**	**$ 58,701**	**$ —**	**$ (52,561)**	**$ 6,354**
Net loss	—	—	—	—	(685)	(685)
Treasury stock	(43)	—	—	—	—	—
Issuance of common stock upon exercise of stock options	1	—	1	—	—	1
Share-based compensation	—	—	403	—	—	403
Redomiciliation share exchange	—	(203)	203	—	—	—
Issuance of restricted common stock and option, net of issuance costs	2,400	2	15,543	—	—	15,545
BALANCE – June 30, 2019	**13,120**	**$ 13**	**$ 74,851**	**$ —**	**$ (53,246)**	**$ 21,618**

Three Months Ended June 30, 2018

	Common Stock Shares	Common Stock Amount	Additional Paid-In Capital	Accumulated Other Comprehensive (Loss) Gain	Accumulated Deficit	Total Stockholders' Equity
BALANCE - March 31, 2018	**10,738**	**$ 213**	**$ 57,003**	**$ (5)**	**$ (29,660)**	**$ 27,551**
Net loss	—	—	—	—	(9,950)	(9,950)
Unrealized gain on short-term investments	—	—	—	7	—	7
Share-based compensation	—	—	140	—	—	140
Issuance of common stock upon exercise of stock options	10	1	46	—	—	47
BALANCE – June 30, 2018	**10,748**	**$ 214**	**$ 57,189**	**$ 2**	**$ (39,610)**	**$ 17,795**

Six Months Ended June 30, 2019

	Common Stock Shares	Common Stock Amount	Additional Paid-In Capital	Accumulated Other Comprehensive (Loss) Gain	Accumulated Deficit	Total Stockholders' Equity
BALANCE - December 31, 2018	**10,762**	**$ 214**	**$ 58,302**	**$ —**	**$ (44,874)**	**$ 13,642**
Net loss	—	—	—	—	(7,569)	(7,569)
Treasury stock	(43)	—	—	—	—	—
Issuance of common stock upon exercise of stock options	1	—	1	—	—	1
Share-based compensation	—	—	802	—	—	802
Redomiciliation share exchange	—	(203)	203	—	—	—
Issuance of restricted common stock and option, net of issuance costs	2,400	2	15,543	—	—	15,545
Effect of adoption of ASU 2014-09	—	—	—	—	(803)	(803)
BALANCE – June 30, 2019	**13,120**	**$ 13**	**$ 74,851**	**$ —**	**$ (53,246)**	**$ 21,618**

Six Months Ended June 30, 2018

	Common Stock Shares	Common Stock Amount	Additional Paid-In Capital	Accumulated Other Comprehensive (Loss) Gain	Accumulated Deficit	Total Stockholders' Equity
BALANCE – December 31, 2017	**10,699**	**$ 212**	**$ 56,674**	**$ (3)**	**$ (23,089)**	**$ 33,794**
Net loss	—	—	—	—	(16,521)	(16,521)
Unrealized gain on short-term investments	—	—	—	5	—	5
Share-based compensation	—	—	166	—	—	166
Issuance of common stock upon exercise of stock options	49	2	349	—	—	351
BALANCE – June 30, 2018	**10,748**	**$ 214**	**$ 57,189**	**$ 2**	**$ (39,610)**	**$ 17,795**

The accompanying notes are an integral part of these condensed consolidated financial statements.

ARCTURUS THERAPEUTICS HOLDINGS INC. AND ITS SUBSIDIARIES
CONDENSED CONSOLIDATED STATEMENTS OF CASH FLOWS
(unaudited)
U.S. dollars in thousands

	Six Months Ended June 30,	
	2019	**2018**
OPERATING ACTIVITIES:		
Net loss	$ (7,569)	$ (16,521)
Adjustments to reconcile net loss to net cash provided by (used in) operating activities:		
Depreciation and amortization	349	256
Amortization of right-of-use operating lease asset	359	—
Share-based compensation expense	802	166
Non-cash interest expense	69	—
Loss from equity-method investment	288	—
Changes in operating assets and liabilities		
Accounts receivable	(1,336)	(891)
Prepaid expense and other assets	(1,043)	644
Accounts payable	773	838
Accrued liabilities	(1,536)	1,764
Deferred revenue	12,773	5,542
Net cash provided by (used in) operating activities	3,929	(8,202)
INVESTING ACTIVITIES:		
Proceeds from maturities of short-term investments	—	22,253
Purchases of short-term investments	—	(9,211)
Acquisition of property and equipment	(344)	(1,000)
Net cash (used in) provided by investing activities	(344)	12,042
FINANCING ACTIVITIES:		
Proceeds from the issuance of restricted common stock and option, net of issuance costs	15,545	—
Proceeds from exercise of stock options	1	351
Net cash provided by financing activities	15,546	351
NET INCREASE IN CASH, CASH EQUIVALENTS AND RESTRICTED CASH	19,131	4,191
Cash, cash equivalents and restricted cash at beginning of the period	36,816	25,238
Cash, cash equivalents and restricted cash at end of the period	$ 55,947	$ 29,429

	Six Months Ended June 30,	
	2019	**2018**
Supplemental disclosure of cash flow information		
Cash paid for interest	$ 340	$ —
Non-cash investing activities		
Right-of-use asset obtained in exchange for lease liabilities	$ 5,868	$ —
Sale of intangible assets for equity investment	$ —	$ 590
Release of repurchase liability for restricted shares	$ —	$ 37
Purchase of property and equipment in accounts payable	$ 16	$ 150

The accompanying notes are an integral part of these condensed consolidated financial statements.

Note 1. Description of Business, Basis of Presentation and Summary of Significant Accounting Policies

Description of Business

Arcturus Therapeutics Holdings Inc. and its subsidiaries (referred to as the "Company") is a RNA medicines company focused on significant opportunities in rare, liver, and respiratory diseases. Management believes that the Company's key proprietary technology has the potential to address the major hurdles in RNA development, namely the effective and safe delivery of RNA therapeutics to disease-relevant target tissues.

The financial statements for periods prior to June 17, 2019, the effective date of the Redomiciliation, relate to Arcturus Therapeutics Ltd. and relate to Arcturus Therapeutics Holdings Inc. for the period from and after June 17, 2019. Unless stated otherwise or the context otherwise requires, references to the "Company," "Arcturus," "we," "our" and "us" mean Arcturus Therapeutics Holdings Inc. and its consolidated subsidiaries from and after the effective time of the Redomiciliation and, prior to that time, to its predecessor, Arcturus Therapeutics Ltd.

Basis of Presentation

The accompanying condensed consolidated financial statements include the accounts of Arcturus Therapeutics Holdings Inc. and its subsidiaries and are unaudited. All intercompany accounts and transactions have been eliminated in consolidation. These condensed consolidated financial statements have been prepared in accordance with U.S. generally accepted accounting principles ("GAAP") for interim financial information. Accordingly, they do not include all of the information and footnotes required by GAAP for complete financial statements. In management's opinion, the accompanying condensed consolidated financial statements reflect all adjustments, consisting of normal recurring adjustments, considered necessary for a fair presentation of the results for the interim periods presented.

Interim financial results are not necessarily indicative of results anticipated for the full year. These condensed consolidated financial statements should be read in conjunction with the audited financial statements and footnotes included in the Company's Annual Report on Form 10-K for the year ended December 31, 2018.

These condensed consolidated financial statements are prepared in accordance with GAAP, which requires management to make estimates and assumptions regarding the valuation of certain debt and equity instruments, the equity-method investment, share-based compensation, accruals for liabilities, deferred revenue, expense accruals, and other matters that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting periods. Although these estimates are based on management's knowledge of current events and actions the Company may undertake in the future, actual results may ultimately differ from these estimates and assumptions.

Liquidity

The Company's activities since inception have consisted principally of performing research and development activities, general and administration activities, and raising capital. The Company's activities are subject to significant risks and uncertainties, including failing to secure additional funding before the Company achieves sustainable revenues and profit from operations.

The Company is a pre-clinical bioscience company that is dependent on obtaining external equity and debt financings to fund its operations. Historically, the Company's primary sources of financing have been through the sale of its securities, through issuance of debt and through collaboration agreements. The Company raised $10.0 million in gross proceeds from a long-term debt agreement entered into on October 12, 2018 with Western Alliance Bank (Note 5). In addition, on June 18, 2019, the Company entered into a Third Amendment to the Research Collaboration and License Agreement (the "Third Amendment") with Ultragenyx Pharmaceutical Inc. ("Ultragenyx"), from which the Company received $30.0 million (Note 2). Research and development activities have required significant capital investment since the Company's inception.

The Company expects its operations to continue to require cash investment to pursue the Company's research and development activities, including preclinical studies, formulation development, clinical trials and related drug manufacturing. The Company has experienced net losses since its inception and as of June 30, 2019 has an accumulated deficit of $53.2 million. The Company expects to continue to incur additional losses for the foreseeable future, and the Company will need to raise additional debt or equity financing or enter into additional collaborations to fund its development. The ability of the Company to transition to profitability is dependent on identifying and developing successful mRNA drug candidates. In the near future, if the Company is not able to achieve planned milestones, incurs costs in excess of its forecasts, or does not meet the covenant requirements associated with its debt (Note 5), it will

need to reduce discretionary spending, or discontinue the development of some or all of its products, which will delay part of its development programs, all of which will have a material adverse effect on the Company's ability to achieve its intended business objectives. There can be no assurances that additional financing will be secured or, if secured, will be on favorable terms to the Company. The Company's management is of the opinion that its current financial resources will be sufficient to continue the development of the Company's products for at least twelve months from the date that the condensed consolidated financial statements for the quarter ended June 30, 2019 are issued.

Recent Developments

Arcturus Therapeutics Ltd. ("Arcturus Israel") completed the process to redomicile from an Israeli limited company to a Delaware corporation (the "Redomiciliation"). On February 11, 2019, Arcturus Israel filed an application with the Tel-Aviv District Court (the "Israeli Court") to approve the convening of a general shareholders meeting of Arcturus Israel for the approval of the Redomiciliation pursuant to Sections 350 and 351 of the Israeli Companies Law (the "Companies Law"). Following the Israeli Court approval dated March 13, 2019, the Company filed with the Securities and Exchange Commission a registration statement on Form S-4 (the "Form S-4"), which included a joint proxy statement/prospectus for the convening of the general shareholder meeting, held on May 17, 2019, as described in the Form S-4. The general shareholders meeting resulted in the approval of the Redomiciliation, and Arcturus Israel then approached the Israeli Court and requested its approval of the Redomiciliation.

In connection with the Redomiciliation, Arcturus Israel entered into a share exchange agreement (the "Exchange Agreement") with a special-purpose company, Arcturus Therapeutics Holdings Inc., the reporting company and parent to Arcturus Therapeutics, Inc. ("Arcturus Sub").

In furtherance of the Redomiciliation, and pursuant to the terms of the Exchange Agreement, the holders of ordinary shares of Arcturus Israel as of a future record date and the holders of options to purchase ordinary shares of Arcturus Israel as of the same record date transferred their ordinary shares of Arcturus Israel and options to purchase ordinary shares of Arcturus Israel, respectively, to the Company and, in exchange thereof, received one share of common stock of the Company for each ordinary share of Arcturus Israel and an option to purchase one share of common stock of the Company in exchange for each ordinary share of Arcturus Israel underlying the existing option to be so exchanged, respectively.

As a result of the Exchange Agreement, the par value of Arcturus Israel's ordinary shares prior to the Redomiciliation is presented in New Israeli Shekel ("NIS") and the par value of the Company's common stock subsequent to the Redomiciliation is presented in United States Dollars ("USD").

As of June 17, 2019, the common stock of the Company is listed on the NASDAQ Stock Market LLC ("NASDAQ"). Upon consummation of the transactions contemplated by the Share Exchange Agreement, Arcturus Israel's ordinary shares were delisted from trading on NASDAQ, and Arcturus Israel became a private company (as defined in the Companies Law) wholly-owned by the Company.

Pursuant to the Exchange Agreement, on June 12, 2019 all of the shares of Arcturus Sub were distributed to the Company and Arcturus Sub become a wholly-owned and direct subsidiary of the Company. This distribution was completed in connection with a liquidation of Arcturus Israel which was formally initiated after the redomiciliation described above.

See *"Note 10. Subsequent Events"* for further information related to the CureVac Amendment, CFF Amendment and Registered Direct Offerings, each as defined therein.

Segment Information

Operating segments are identified as components of an enterprise about which separate discrete financial information is available for evaluation by the chief operating decision-maker in making decisions regarding resource allocation and assessing performance. The Company and its chief operating decision-maker view the Company's operations and manage its business in one operating segment, which is the research and development of medical applications for the Company's nucleic acid-focused technology.

Revenue Recognition

Effective January 1, 2019, the Company adopted *ASU 2014-09, Revenue from Contracts with Customers (Topic 606)*, or Topic 606, using the modified retrospective transition method. Topic 606 provides a unified model to determine how revenue is recognized and the Company applied the standard to collaborative research and technology agreements that were in progress as of the effective date, January 1, 2019. The Company determines revenue recognition for arrangements within the scope of Topic 606 by performing the following five steps: (i) identify the contract; (ii) identify the performance obligations in the contract; (iii) determine the transaction price; (iv) allocate the transaction price to the performance obligations in the contract; and (v) recognize revenue when, or as, the company satisfies a performance obligation.

The terms of the Company's collaborative research and development agreements include license fees, upfront payments, milestone payments when and if certain research or technology transfer milestones are achieved, development milestones and reimbursement for research and development activities, option exercise fees, other contingent payments for the achievement of defined collaboration objectives and certain preclinical, clinical, regulatory and sales-based events, as well as royalties on sales of commercialized products. Arrangements that include upfront payments are recorded as deferred revenue upon receipt or when due and may require deferral of revenue recognition to a future period until the Company performs obligations under these arrangements. The Company records research funding as accounts receivable when the right to consideration is unconditional. The event-based milestone payments represent variable consideration, and the Company uses the most likely amount method to estimate this variable consideration because the Company will either receive the milestone payment or will not, which makes the potential milestone payment a binary event. The most likely amount method requires the Company to determine the likelihood of earning the milestone payment. Given the high degree of uncertainty around achievement of these milestones, the Company determines the milestone amounts to be fully constrained and does not recognize revenue until the uncertainty associated with these payments is resolved. The Company will recognize revenue from sales-based royalty payments when or as the sales occur. The Company will re-evaluate the transaction price in each reporting period as uncertain events are resolved and other changes in circumstances occur.

A performance obligation is a promise in a contract to transfer a distinct good or service to the collaborative partner and is the unit of account in Topic 606. A contract's transaction price is allocated to each distinct performance obligation based on relative standalone selling price and recognized as revenue when, or as, the performance obligation is satisfied. Under Topic 606, the Company elected to use the practical expedients permitted related to adoption, which does not require the Company to disclose certain information regarding certain remaining performance obligations as of the end of the reporting period. Topic 606 is applicable for revenue recognized in accordance with the practical expedient for measuring progress toward satisfaction of a performance obligation, and variable consideration classified as a sales-based or usage-based royalty promised in exchange for a license.

See Note 2, "Collaboration Revenue" for specific details surrounding the Company's collaboration arrangements.

Leases

In February 2016, the FASB issued ASU 2016-02, Leases (Topic 842), which requires lessees to recognize most leases on the balance sheet as lease liabilities with corresponding right-of-use assets and to disclose key information about leasing arrangements. The Company adopted Topic 842 on its effective date in the first quarter of 2019 using a modified retrospective approach. The Company elected the available package of practical expedients upon adoption, which allowed it to carry forward historical assessments of whether existing agreements contained a lease and the classification of existing operating leases. The Company continues to report its financial position as of December 31, 2018 under the former lease accounting standard (Topic 840) in the condensed consolidated balance sheet.

The adoption impact was due to the recognition of an operating lease liability with a corresponding right-of-use asset based on the present value of remaining minimum lease payments. A reduction of the right-of-use asset was recorded to reflect the balance of the deferred rent obligation and there was no impact to retained earnings.

Research and Development, Net

Research and development costs are expensed as incurred. These expenses result from the Company's independent research and development efforts as well as efforts associated with collaboration arrangements. Research and development costs include salaries and personnel-related costs, consulting fees, fees paid for contract research and manufacturing services, the costs of laboratory supplies, equipment and facilities, preclinical studies and other external costs are shown net of any royalty bearing grants.

Statement of Cash Flows

The following table provides a reconciliation of cash and cash equivalents and restricted cash reported within the condensed consolidated balance sheet to the total of the same such amounts shown in the condensed consolidated statement of cash flows:

(in thousands)	June 30, 2019	June 30, 2018
Cash and cash equivalents	$ 55,840	$ 29,322
Non-current restricted cash	107	107
Total cash, cash equivalents and restricted cash shown in the statement of cash flows	$ 55,947	$ 29,429

Net Loss per Share

Basic net loss per share is calculated by dividing the net loss by the weighted-average number of shares of common stock outstanding for the period, without consideration for common stock equivalents. Diluted net loss per share is calculated by dividing the net loss by the weighted-average number of shares of common stock and dilutive common stock equivalents outstanding for the period determined using the treasury-stock method. Dilutive shares of common stock are comprised of stock options.

No dividends were declared or paid during the reported periods.

Recently Adopted Accounting Pronouncements

Revenue from Contracts with Customers

In May 2014, the Financial Accounting Standards Board (FASB) issued Topic 606, which supersedes nearly all existing revenue recognition guidance under GAAP. The FASB subsequently issued amendments to Topic 606 that have the same effective date and transition date.

The Company adopted this new guidance, effective January 1, 2019, using the modified retrospective transition method, in which the standard is applied as of the date of initial adoption. The Company recorded the cumulative effect of initially applying the standard as an adjustment to the opening balance of accumulated deficit. The adoption of the new revenue recognition guidance resulted in an increase of $0.8 million to deferred revenue and an increase of $0.8 million to accumulated deficit as of January 1, 2019. The change in revenue was due to a change in how the Company accounts for changes in the measure of progress and changes to the transaction price and for the recognition of revenue. Under Topic 605, the Company accounted for changes to the measure of progress and changes to the transaction price prospectively. Topic 606 requires companies to account for a change to the measure of progress or a change to the transaction price as a cumulative catch-up in the period of change. There were no other impacts upon the adoption of Topic 606. The Company will apply the standard to all new contracts initiated on or after the effective date.

Leases

In February 2016, the FASB issued Accounting Standards Update ("ASU") 2016-02, *Leases (Topic 842)* in order to increase transparency and comparability among organizations by recognizing lease assets and lease liabilities on the balance sheet for those leases classified as operating leases under previous GAAP. ASU 2016-02 requires a lessee to recognize a liability for lease payments (the lease liability) and a right-of-use asset (representing its right to use the underlying asset for the lease term) on the balance sheet. ASU 2016-02 is effective for fiscal years beginning after December 15, 2018 (including interim periods within those periods) using a modified retrospective approach.

In July 2018, the FASB issued ASU 2018-11, *Leases (Topic 842): Targeted Improvements*, which provides entities an optional transition method to apply the new guidance as of the adoption date, rather than as of the earliest period presented. In transition, entities may also elect a package of practical expedients that must be applied in its entirety to all leases commencing before the effective date, unless the lease was modified, to not reassess (a) the existence of a lease, (b) lease classification or (c) determination of initial direct costs, which effectively allows entities to carryforward accounting conclusions under previous U.S. GAAP.

The Company adopted ASU 2016-02, using the optional transition method and electing the package of practical expedients described above on January 1, 2019. Due to the adoption, the Company recognized a new lease liability on the Company's consolidated balance sheet for its operating lease of office and lab space of $6.4 million on January 1, 2019, with a corresponding right-of-use asset of $5.9 million based on the present value of the remaining minimum rental payments. See Note 8 for further discussion.

Note 2. Collaboration Revenue

The Company has entered into license agreements and collaborative research and development arrangements with pharmaceutical and biotechnology companies. Under these arrangements, the Company is entitled to receive license fees, upfront payments, milestone payments when and if certain research or technology transfer milestones are achieved, development milestones, reimbursement for research and development activities, option exercise fees, other contingent payments for the achievement of defined collaboration objectives and certain preclinical, clinical, regulatory and sales-based events, as well as royalties on sales of commercialized products. The Company's costs of performing these services are included within research and development expense. The Company’s milestone payments are typically defined by achievement of certain preclinical, clinical, and commercial success criteria. Preclinical milestones may include in vivo proof of concept in disease animal model(s), lead candidate identification, and completion of IND-enabling studies. Clinical milestones may include successful enrollment of the first or second patient in or completion of Phase I, II, and III clinical trials, and commercial revenue is often tiered based on net or aggregate sale amounts. The Company cannot guarantee the achievement of these milestones due to risks associated with preclinical and clinical activities required for development of nucleic acid medicine-based therapeutics.

The following table presents changes during the six months ended June 30, 2019 in the balances of contract assets, including receivables from collaborative partners, and contract liabilities, including deferred revenue, as compared to what was disclosed in the Company's Annual Report.

(in thousands)	Contract Assets
BALANCE - December 31, 2018	$ 4,480
Additions for advanced billings	11,038
Deductions for cash collections	(9,701)
BALANCE – June 30, 2019	$ 5,817

(in thousands)	Contract Liabilities
BALANCE - December 31, 2018	$ 13,806
Additions for advanced billings	27,650
Additions for promised goods/services to be provided in current and future periods in connection with Topic 606 adoption	803
Deductions for promised goods/services provided in current period	(14,877)
BALANCE – June 30, 2019	$ 27,382

The following paragraphs provide information regarding the nature and purpose of the Company's most significant collaboration arrangements.

Collaboration Partner – Janssen

In October 2017 the Company entered into a research collaboration and license agreement with Janssen (the "2017 Agreement"). The 2017 Agreement allocated discovery, development, funding obligations, and ownership of related intellectual property among the Company and Janssen. The Company received an upfront payment of $7.7 million and may receive preclinical, development and sales milestone payments of $56.5 million, as well as royalty payments on any future licensed product sales. Janssen began reimbursing the Company for research costs during the first quarter of 2019 upon the completion of the first of three research periods. Janssen may also pay option exercise fees within the $1.0 million to $5.0 million range per target. Janssen will pay royalties on annual net sales of licensed products in the low to mid-single digits range, subject to reduction on a country-by-country and licensed-product-by-licensed-product basis and subject to certain events, such as expiration of program patents. In addition, the 2017 Agreement includes an exclusivity period.

Accounting Analysis under ASC 606

In evaluating the 2017 Agreement in accordance with ASC Topic 606, the Company concluded that the contract counterparty, Janssen, is a customer. The Company identified the following promised goods/services as of the inception of the Agreement: (i) research services, (ii) license to use Arcturus technology and (iii) participation in the Joint Research Committee. The Company concluded that the promised goods/services are incapable of being distinct and consequently do not have any value on a standalone basis. Accordingly, they are determined to represent a single performance obligation. The Company concluded that Janssen's options to select additional collaboration targets and to license rights to selected targets are not priced at a discount and therefore do not represent performance obligations for which the transaction price would be allocated.

At inception of the contract, the transaction price included the $7.7 million upfront consideration received and budgeted reimbursable out-of-pocket costs of $18.2 million. None of the development and commercialization milestones were included in the transaction price, as all milestone amounts were fully constrained. As part of its evaluation of the constraint, the Company considered numerous factors, including that receipt of the milestones is outside the control of the Company and contingent upon success in future clinical trials and the collaborator's efforts. Any consideration related to sales-based royalties will be recognized when the related sales occur, provided that the reported sales are reliably measurable, and the Company has no remaining promised goods/services, as such sales were determined to relate predominantly to the license granted to Janssen and therefore have also been excluded from the transaction price. As of June 30, 2019, the remaining transaction price of $23.6 million is expected to be recognized using an input method over the remaining research period of 21 months. The Company will re-evaluate the transaction price in each reporting period as uncertain events are resolved and other changes in circumstances occur. For the three months ended June 30, 2019, no adjustments were made to the transaction price.

As the Company determined that only a single performance obligation exists, no allocation of the transaction price is necessary. The transaction price is recorded as deferred revenue in the Company's balance sheet and is recognized as revenue under the proportional performance method of revenue recognition in accordance with the Company's established budget of costs to be incurred. Total deferred revenue as of June 30, 2019 and December 31, 2018 for Janssen was $6.2 million and $6.5 million, respectively. The Company recognized revenue of $0.6 million and $1.1 million for the three and six months ended June 30, 2019, respectively, and $0.2 million and $0.3 million for the three and six months ended June 30, 2018, respectively. No transition adjustment was necessary upon adoption of Topic 606.

Collaboration Partner – Ultragenyx

In October 2015 the Company entered into a research collaboration and license agreement with Ultragenyx (the "Ultragenyx Agreement"), whereby Arcturus granted to Ultragenyx a co-exclusive license under Arcturus technology and shall be in effect only during the reserve target exclusivity term as discussed in the following paragraphs. During the initial phase of the collaboration, the Company will design and optimize therapeutics for certain rare disease targets. Ultragenyx has the option under the Ultragenyx Agreement to add additional rare disease targets during the collaborative development period. Additionally, during the collaborative development period, the Company will participate with Ultragenyx in a joint steering committee. The Ultragenyx Agreement also includes an initial exclusivity period with an option to extend this period.

For each program, Ultragenyx will reimburse the Company for all internal and external development costs incurred, pursuant to the Ultragenyx Agreement, and if Ultragenyx achieves certain, clinical, regulatory and sales milestones, then the Company is eligible to receive royalty payments.

As part of the Ultragenyx Agreement, Ultragenyx paid an upfront fee of $10.0 million and agreed to certain research and development funding obligations. The Company is also entitled to certain additional payments upon exercise of the Ultragenyx expansion option or exclusivity extension (if any), and for costs incurred by the Company in conducting the activities assigned under each collaboration development plan. In addition, on a development target-by-development target basis during the two-year period from the effective date of contract, Ultragenyx will pay the Company a one-time milestone payment after the first optimized lead designation for the first product with respect of such development target. For each development target for which Ultragenyx exercises its option, Ultragenyx will pay the Company a one-time option exercise fee that increases based upon the number of development targets selected by Ultragenyx from $2.0 million to $5.0 million. Upon execution of Amendment 3, defined and discussed below, the option exercise fees per development target range from $0.5 million to $1.5 million.

The agreement includes potential milestone payments for selected targets from Ultragenyx to the Company. The current potential development, regulatory and commercial milestone payments for the existing development targets as of June 30, 2019 are $139.0 million. Ultragenyx will pay royalties as a single-digit percentage of net sales on a product-by-product and country-by-country basis during the applicable royalty term. As of June 30, 2019, the Company has not yet reached the clinical phase of the contract. In 2018, the Company signed an amendment with Ultragenyx, that will reduce option exercise fees, milestone payments and/or royalty rates by 50% dependent on whether a development target or product is not covered by a patent directed to a chemistry methodology to increase mRNA half-life. For Amendment 3, defined and discussed below, the 50% reduction does not apply to the option exercise fees.

During 2017, the Company entered into an amendment with Ultragenyx to add one year to the exclusivity period for the reserved targets, in consideration for a one-time payment of $2.0 million. The extension of the exclusivity period did not change the length of the research and development period. Further, the amendment allows Ultragenyx the opportunity to review and comment on its filings and prosecution efforts of pending Company patents that relate to Ultragenyx chemistry. During the fourth quarter of 2018, Ultragenyx extended the exclusivity on a specified number of reserved targets for an additional year with an annual reserve target list maintenance fee of $1.5 million.

On June 18, 2019, Arcturus and Ultragenyx amended the collaboration agreement for a third time ("Amendment 3"). As part of Amendment 3, the total number of targets was increased from 10 to 12, and reserve targets will be exclusively reserved for Ultragenyx with no fees for four years after execution of the amendment. An equity component was also added as part of Amendment 3 wherein Ultragenyx purchased 2.4 million shares of common stock at a premium price giving Ultragenyx 18.3% ownership in the Company. Along with the equity purchase, Ultragenyx received the option to purchase 0.6 million additional shares of common stock at $16 per share within two years of executing the amendment (Note 6).

The consideration received from Ultragenyx is equal to $30.0 million, comprised of a $24.0 million common stock purchase and a $6.0 million upfront payment. Specifically for Amendment 3, management determined the transaction price to be $14.4 million, comprised of $6.0 million from the upfront payment and $8.4 million from the premium paid by Ultragenyx for the purchase of Arcturus common stock. See further discussion below regarding determining the transaction price. Management determined the fair value of the premium received by using the opening stock price subsequent to execution of Amendment 3 and applying a lack of marketability discount as the shares received by Ultragenyx are restricted for two years.

Accounting Analysis under ASC 606

In evaluating the Ultragenyx agreement in accordance with ASC Topic 606, the Company concluded that the contract counterparty, Ultragenyx, is a customer. The Company identified the following promised goods/services as of the inception of the Agreement and execution of Amendment 3: (i) research services, (ii) license to use Arcturus technology, (iii) exclusivity and (iv) participation in the Joint Steering Committee. The Company concluded that the promised goods/services are incapable of being distinct and consequently do not have any value on a standalone basis. Accordingly, they are determined to represent a single performance obligation. The Company concluded that Ultragenyx's options to extend exclusivity and options to select additional collaboration targets and to license rights to selected targets are not priced at a discount and therefore do not represent performance obligations for which the transaction price would be allocated.

At inception of the contract, the transaction price included only the upfront consideration received. The Company concluded that the reimbursement of labor and expenses qualifies for the practical expedient under Topic 606, which allows the Company to recognize revenue in the amount for which it has a right to invoice if the Company's right to consideration is an amount that corresponds directly to the value to the customer of the performance completed to date. Therefore under the practical expedient the Company is not required to determine the transaction price, allocate the transaction price and determine the timing of revenue recognition for the reimbursement of labor and expenses. None of the development and commercialization milestones were included in the transaction price, as all milestone amounts were fully constrained. As part of its evaluation of the constraint, the Company considered numerous factors, including that the consideration is outside the control of the Company and contingent upon success in future clinical trials, approval from the Food and Drug Administration ("FDA") and the collaborator's efforts. Any consideration related to sales-based royalties will be recognized when the related sales occur as they are constrained, provided that the reported sales are reliably measurable and the Company has no remaining promised goods/services, as such sales were determined to relate predominantly to the license granted to Ultragenyx and therefore have also been excluded from the transaction price. Upon execution of the 2017 amendment, the $2.0 million payment was added to the transaction price. The exclusivity extension fee received by the Company during the fourth quarter of 2018 was recorded as deferred revenue and has been recognized as revenue on a straight-line basis over the one-year period that the promised goods/services are provided. Upon execution of Amendment 3, the exclusivity extension fee was added to the transaction price.

Upon execution of Amendment 3, the Company concluded that there is a single performance obligation, and no allocation of the transaction price is necessary. Amendment 3 was deemed a contract modification and accounted for as part of the original Ultragenyx Agreement. Management increased the transaction price by $14.4 million and the Company recorded a cumulative catch-up adjustment of $1.1 million on the modification date. The new transaction price will be recognized to revenue on a straight-line basis using an input method over the 4-year reserve target exclusivity period. The reserve target exclusivity period represents the timing over which promised goods/services will be provided. The Company will re-evaluate the transaction price in each reporting period as uncertain events are resolved and other changes in circumstances occur. Total deferred revenue as of June 30, 2019 and December 31, 2018 for Ultragenyx was $14.5 million and $2.7 million, respectively. The Company recognized revenue of $2.5 million and $3.9 million for the three and six months ended June 30, 2019, respectively, and $1.2 million and $2.7 million for the three and six months ended June 30, 2018, respectively.

Upon adoption of Topic 606, the Company reversed $0.8 million of previously recorded revenue related to Ultragenyx through an increase to deferred revenue and a decrease to beginning retained earnings. The adjustment was due to a change in the way the Company accounts for updates to the period over which revenue is recognized as well as accounting for adjustments to the transaction price. Under Topic 605, the Company accounted for these changes prospectively and under Topic 606 the Company accounts for the changes as a change in estimate recorded as a cumulative catch-up in the period in which the change occurred.

Collaboration Partner – CureVac

In January 2018, the Company entered into a Development and Option Agreement with CureVac, (the "Development and Option Agreement"). Under the terms of the Development and Option Agreement, the parties have agreed to conduct joint preclinical development programs once CureVac makes a payment to pull down a target on the basis of which CureVac is granted options for taking a license on pre-agreed license terms to develop and commercialize certain products incorporating the Company's patents and know-how related to delivery technology (the LUNAR® platform) (the "Arcturus Delivery Technology"), and CureVac patents and know-how related to mRNA technology. Subject to certain restrictions, the parties will have an undivided one-half interest in the patents and know-how developed jointly by the parties during the course of the Development and Option Agreement. Pursuant to the terms of the Development and Option Agreement, CureVac will have a number of target options to co-develop from a reserved target list to enter into licenses under the Arcturus Delivery Technology with respect to the development, manufacture and commercialization of licensed products (which can include products identified for development by the Company unless the Company is permitted by the terms of the Development and Option Agreement to place such products on a restricted list). A separate notice and fee will be required for each license agreement. If the target to which the license agreement relates is chosen by the parties for co-development under the Co-Development Agreement (which is defined below and discussed in the following paragraph) the license agreement will terminate as such programs will be covered under the Co-Development Agreement discussed below, and therefore

CureVac will be given a credit for any exercise fees, milestone payments already paid and all other payments made in relation to the license agreement towards future such payments incurred with respect to future licenses under the Arcturus Delivery Technology.

Prior to expiration of the initial term of 8 years, the Agreement also includes an option to extend the term on an annual basis for up to 3 years and subject to payment by CureVac to Arcturus of a non-refundable annual extension fee. The agreement included potential milestone payments for selected targets from CureVac to the Company. The current potential milestone payment for the remaining target as of June 30, 2019 is $14.0 million for rare disease targets and $23.0 million for non-rare disease targets. CureVac will pay royalties as a percentage of net sales on a product-by-product and country-by-country basis during the applicable royalty term in the low single-digit range. As of June 30, 2019, the Company has not yet reached the clinical phase of the contract. Pursuant to a May 2018 amendment to the Development and Option Agreement (as amended and restated on September 28, 2018), the Company increased the number of targets available to CureVac under the Development and Option Agreement and agreed upon the license forms to be executed upon selection of the targets by CureVac.

Concurrently with the Development and Option Agreement, the Company entered into a Co-Development and Co-Commercialization Agreement (the "Co-Development Agreement") which the Company considered a combined contract with the Development and Option Agreement for purposes of revenue recognition. However, on February 11, 2019, the Company announced the termination of the obligations of CureVac for the preclinical development of ARCT-810, effective 180 days from February 5, 2019 and the re-assumption by the Company of the worldwide rights thereto. Subsequent to June 30, 2019, CureVac and the Company terminated the Co-Development Agreement for a settlement payment of $4.0 million (Note 10).

Arcturus will reassume 100% global rights for its flagship asset, clinical development candidate ARCT-810, a messenger RNA (mRNA) drug to treat ornithine transcarbamylase ("OTC") deficiency. ARCT-810 was previously subject to equal cost sharing between Arcturus and CureVac under the Co-Development Agreement. CureVac elected not to continue its obligations for the preclinical development of ARCT-810 under and pursuant to the terms of the agreement. Under the terms of the Co-Development Agreement, the parties collaborated to develop and commercialize mRNA-based products for treating OTC deficiency, incorporating CureVac's mRNA technology, the Arcturus' mRNA technology and the Arcturus Delivery Technology. The overall collaboration with CureVac was managed by a joint steering committee. Pursuant to the Co-Development Agreement, the Company and CureVac shared equally the internal costs and third-party costs incurred to conduct preclinical development, subject to exceptions specified in the Co-Development Agreement for specified manufacturing costs and costs in the parties' respective development plans, among others.

Accounting Analysis under ASC 606

In evaluating the CureVac Development and Option Agreement and Co-Development Agreement in accordance with ASC Topic 606, the Company concluded that the contract counterparty, CureVac, is a customer. The Company identified the following promised goods/services as of the inception of the Agreement: (i) research services, (ii) license to use Arcturus technology, (iii) exclusivity and (iv) participation in the Joint Steering Committee. The Company concluded that the promised goods/services are incapable of being distinct and consequently do not have any value on a standalone basis. Accordingly, they are determined to represent a single performance obligation. The Company concluded that CureVac's options to extend the research term and options to select additional collaboration targets and to license rights to selected targets are not priced at a discount and therefore do not represent performance obligations for which the transaction price would be allocated.

At inception of the contract, the transaction price included only the $5.0 million upfront consideration received. The Company concluded that the reimbursement of labor and expenses within the Development and Option Agreement qualifies for the practical expedient under Topic 606 which allows the Company to recognize revenue in the amount for which it has a right to invoice if the Company's right to consideration is an amount that corresponds directly to the value to the customer of the performance completed to date. Therefore, under the practical expedient, the Company is not required to determine the transaction price, allocate the transaction price and determine the timing of revenue recognition for the reimbursement of labor and expenses. None of the development and commercialization milestones were included in the transaction price, as all milestone amounts were fully constrained. As part of its evaluation of the constraint, the Company considered numerous factors, including that receipt of the milestones is outside the control of the Company and contingent upon success in future clinical trials and the collaborator's efforts. Any consideration related to sales-based royalties will be recognized when the related sales occur as they are constrained, provided that the reported sales are reliably measurable and the Company has no remaining promised goods/services, as such sales were determined to relate predominantly to the license granted to CureVac and therefore have also been excluded from the transaction price. The Company will re-evaluate the transaction price in each reporting period as uncertain events are resolved and other changes in circumstances occur. For the three months ended June 30, 2019, no adjustments were made to the transaction price.

As the Company determined that only a single performance obligation exists, no allocation of the transaction price is necessary. The upfront payment of $5.0 million was recorded as deferred revenue in the Company's balance sheet upon receipt and is currently being recognized as revenue on a straight-line basis using an input method over the eight-year contractual term as of June 30, 2019. Total deferred revenue as of June 30, 2019 and December 31, 2018 for CureVac was $4.0 million and $4.4 million, respectively. The

Company recognized revenue of $3.4 million and $5.3 million for the three and six months ended June 30, 2019, respectively, and $0.3 million and $0.5 million for the three and six months ended June 30, 2018, respectively. No adjustment was necessary upon adoption of Topic 606.

Other Collaboration Revenue

The Company recognized total other collaboration revenue of $3.6 million and $4.1 million for the three and six months ended June 30, 2019, respectively, and $0.7 million and $1.2 million for the three and six months ended June 30, 2018, respectively. Of the total other collaboration revenue for the three and six months ended June 30, 2019, $3.3 million and $3.5 million, respectively, was primarily related to the Research and Exclusive License Agreement with Synthetic Genomics, Inc. ("SGI") into which the Company entered during October 2017. Under the agreement, the Company granted SGI an exclusive license for the Arcturus LMD Technology to research, develop and sell products for diseases excluding all respiratory disease viruses other than influenza. Revenue related to this agreement is made up of labor reimbursements and sublicense revenue. The Company recognized a sublicense revenue amount of $3.3 million for the three months ended June 30, 2019 whereby SGI sublicensed to multiple parties.

Note 3. Fair Value Measurements

The Company establishes the fair value of its assets and liabilities using the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. The Company establishes a fair value hierarchy based on the inputs used to measure fair value.

The three levels of the fair value hierarchy are as follows:

Level 1: Quoted prices in active markets for identical assets or liabilities.

Level 2: Inputs, other than the quoted prices in active markets, that are observable either directly or indirectly.

Level 3: Unobservable inputs in which little or no market data exists and are therefore determined using estimates and assumptions developed by the Company, which reflect those that a market participant would use.

The carrying value of cash, restricted cash, accounts receivable, accounts payable, and accrued liabilities approximate their respective fair values due to their relative short maturities. The carrying amounts of long-term debt for the amount drawn on the Company's debt facility approximates fair value as the interest rate is variable and reflects current market rates.

As of June 30, 2019 and December 31, 2018, all assets measured at fair value on a recurring basis consisted of cash equivalents, money market funds, which were classified within Level 1 of the fair value hierarchy. The fair value of these financial instruments was measured based on quoted prices.

Note 4. Balance Sheet Details

Prepaid expenses and other current assets consisted of the following as of June 30, 2019 and December 31, 2018:

(in thousands)	June 30, 2019	December 31, 2018
Prepaid expenses	$ 1,659	$ 546
Other current assets	22	92
Total	$ 1,681	$ 638

Property and equipment, net consisted of the following:

(in thousands)	June 30, 2019	December 31, 2018
Research equipment	$ 3,001	$ 2,711
Computers and software	235	200
Office equipment and furniture	561	527
Leasehold improvements	35	34
Total	3,832	3,472
Less accumulated depreciation and amortization	(1,846)	(1,497)
Property and equipment, net	$ 1,986	$ 1,975

Depreciation and amortization expense was $0.2 million and $0.1 million for the three months ended June 30, 2019 and 2018, respectively, and $0.3 million and $0.3 million for six months ended June 30, 2019 and 2018, respectively.

Accrued liabilities consisted of the following as of June 30, 2019 and December 31, 2018:

(in thousands)	June 30, 2019	December 31, 2018
Accrued compensation	$ 1,468	$ 974
Refundable fees received	—	2,259
Current portion of operating lease liability	775	—
Other accrued liabilities	1,254	674
Total	$ 3,497	$ 3,907

Note 5. Debt

Long-term debt with Western Alliance Bank

On October 12, 2018, the Company entered into a Loan and Security Agreement with Western Alliance Bank whereby the Company received gross proceeds of $10.0 million under a long-term debt agreement (the "Loan"). The Loan has a maturity date of October 1, 2022 and carries interest at the U.S. prime rate plus 1.25%. The loan has an interest-only period of 19 months, which could be extended by an additional 6 months if certain conditions are met, followed by an amortization period of 30 months, or 24 months if the interest-only period is extended.

The Company paid a loan origination fee of $128,000 which was recorded as a debt discount and is being accreted over the term of the Loan. In addition, the Company is required to pay a fee of $350,000 upon certain change of control events.

Upon maturity or prepayment, the Company will be required to pay a 3% fee, or a 2% fee if the U.S. Food and Drug Administration accepts certain Investigational New Drug ("IND") applications prior to maturity. Because acceptance of an IND is outside of the Company's control, management estimated that the Company will be liable for a fee of 3% of the principal balance, or $300,000 upon repayment or maturity, and such fee is accreted to the debt balance using the effective interest method over the term of the Loan.

The Loan is collateralized by all of the assets of the Company, excluding intellectual property, which is subject to a negative pledge. The Loan contains customary conditions of borrowing, events of default and covenants, including covenants that restrict the Company's ability to dispose of assets, merge with or acquire other entities, incur indebtedness and make distributions to holders of the Company's capital stock. In addition, the Company is required to maintain at least 50% of its deposit and investment accounts, or $20 million, whichever is lower, with Western Alliance Bank.

The Loan also includes covenants which include the Company's (1) nomination of a clinical candidate by December 31, 2018, which the Company is in compliance with, and (2) submission of a clinical candidate for Investigational New Drug application ("IND"), made to the U.S. Food and Drug Administration by December 31, 2019 and have it approved by January 31, 2020, provided that, if the Company has received net cash proceeds from sale, on or after October 12, 2018, of the Company's equity securities in an amount of not less than $15,000,000, then the IND submission date shall be extended to May 31, 2020 and the approval date shall be extended to June 30, 2020. As a result of the equity purchase by Ultragenyx of 2.4 million shares of common stock (previously discussed at Note 2), the IND submission date and approval date have been extended to May 31, 2020 and June 30, 2020, respectively.

Should an event of default occur, including the occurrence of a material adverse effect, the Company could be liable for immediate repayment of all obligations under the Loan. As of June 30, 2019, the Company is in compliance with all covenants and conditions of the Loan.

Note 6. Stockholders' Equity

Equity Purchase Agreement

On June 18, 2019, the Company entered into an Equity Purchase Agreement (the "Ultragenyx Agreement") with Ultragenyx Pharmaceutical Inc. ("Ultragenyx"). Pursuant to the terms of the Ultragenyx Agreement, the Company sold an aggregate of 2,400,000 shares (the "Shares") of common stock, par value $0.001 per share ("Common Stock") at a price of $10.00 per share to Ultragenyx on June 19, 2019. Pursuant to the Ultragenyx Agreement, the Company also granted Ultragenyx a two-year option (the "Option") to purchase up to 600,000 additional shares of Common Stock at a price of $16.00 per share.

The Option to purchase additional shares of Common Stock may not be exercised if Ultragenyx's ownership of the Company's common stock would exceed 19.99% of the Company's total shares outstanding following such exercise. The option was recorded as a component of stockholders' equity within additional paid-in capital.

Pursuant to the terms of the Ultragenyx Agreement, until the later of (i) the first anniversary of the closing date or (ii) the date on which Ultragenyx beneficially owns less than 8.0% of the total voting power of the Company, at each annual stockholders meeting or any stockholders meeting at which members of the board of directors (the "Board") are to be elected, the Company must nominate one director designated by Ultragenyx (the "Ultragenyx Designee"). Additionally, the Ultragenyx Designee has the contractual right to be appointed to all Board committees (subject to applicable NASDAQ rules). Ultragenyx also has the right to have a designee attend Board meetings as a non-voting observer.

Pursuant to the Ultragenyx Agreement, Ultragenyx agreed to customary standstill provisions and restrictions on transfer of the Shares. The standstill provisions and transfer restrictions last until June 19, 2021, and expire earlier upon the occurrence of certain events set forth in the Ultragenyx Agreement. The Ultragenyx Agreement contains customary representations, warranties and indemnification obligations of the parties.

In connection with the Ultragenyx Agreement, the Company and Ultragenyx entered into a Registration Rights Agreement (the "Registration Rights Agreement"). The Registration Rights Agreement requires the Company to file a registration statement providing for the resale of the Shares within 180 days of June 18, 2019, and provides Ultragenyx with certain "piggy-back" registration rights with respect to registration statements that the Company may file.

Restricted Common Shares

In March 2013, the founders of the Company purchased 2,783,686 shares of common stock for $0.0068 per share. Of the shares purchased, 1,538,353 were subject to a repurchase option whereby the Company has an option for two months after date of termination of service to repurchase any or all of the unvested shares at the original purchase price per share. The repurchase option shall be deemed to be automatically exercised by the Company as of the end of the two-month period unless the Company notifies the purchaser that it does not intend to exercise its option. The shares will be vested (1) 25% after obtaining suitable siRNA license; (2) 25% after *in vivo* proof-of-concept achieved; (3) 25% after a regulatory agency new drug application (such as an Investigational New Drug application) is filed and accepted by the applicable regulatory agency; and (4) 25% after human biological proof-of-concept is achieved. The Company met the first two milestones during 2013 and 2014 leaving an unvested balance of 769,176 shares. In 2017, the stock purchase agreements were amended to clarify vesting conditions and also to accelerate the vesting of 146,510 shares resulting in a modification expense of $1,495,000. As of June 30, 2019 and 2018, there were 622,667 shares of common stock unvested and subject to the repurchase option.

Net Loss per Share

Dilutive securities that were not included in the calculation of diluted net loss per share for the three and six months ended June 30, 2019 as they were anti-dilutive totaled 93,407 and 80,585, respectively, and 81,056 and 87,028 for the three and six months ended June 30, 2018, respectively.

For the three and six months ended June 30, 2019 and 2018, the calculation of the weighted-average number of shares outstanding excludes unvested restricted shares of common stock of 622,667.

Note 7. Share-Based Compensation

Arcturus Therapeutics Inc. had one stock compensation plan prior to the merger, the 2013 Equity Incentive Plan (the "2013 Plan") which provides for the granting of options, warrants, restricted stock awards, restricted stock units, and other equity-based compensation to the Company's directors, employees and consultants. In connection with the merger and as required in the 2013 Plan, all outstanding options in the 2013 Plan converted into options to purchase Alcobra Ltd.'s ordinary shares, as renamed Arcturus Therapeutics Ltd., and the applicable share amounts and exercise prices were adjusted to reflect the exchange ratio. The 2013 Plan has been extinguished and no additional grants shall be made from the 2013 Plan. Options granted under the 2013 Plan generally expire ten years from the date of grant. There are 39,912 shares available for future issuance under the 2013 Plan at June 30, 2019. As discussed in the next paragraph, the 2013 Plan was assumed by the 2010 Plan and no additional shares will be issued under the 2013 Plan.

Prior to the merger, Alcobra Ltd. granted options to officers, directors, advisors, management and other key employees through the 2010 Incentive Option Plan (the "2010 Plan"). Substantially all options that were outstanding under the 2010 Plan became fully vested upon the closing of the merger. The value of these options was included as a component of the purchase price recorded in conjunction with the merger. The number of shares subject to and the exercise prices applicable to these outstanding options were adjusted in connection with the 1- for- 7 reverse share split in conjunction with the merger. Options granted under the 2010 Plan generally expire ten years from the date of grant. Upon merger, the 2013 Plan was assumed by the 2010 Plan. The Company generally issues new shares upon option exercise. There were 131,091 shares available for future issuance under the 2010 Plan as of June 30, 2019; however, the Company will not issue additional shares under the 2010 Plan.

In August 2018, the Company adopted the 2018 Omnibus Equity Incentive Plan ("2018 Plan"). Under the 2018 Plan, the Company is authorized to issue up to a maximum of 1,100,000 shares of common stock pursuant to the exercise of incentive stock options or other awards provided for therein. As of June 2019, the Company issued a certain number of options to purchase common stock to a group of employees as well as options to purchase a total of 243,750 shares of common stock to certain executives. The Company also issued options to purchase a total of 130,000 shares of common stock to the non-executive members of the Company's board of directors. As of June 30, 2019, there were 220,250 shares available for future issuance under the 2018 Plan. In June 2019, the Company adopted the 2019 Omnibus Equity Incentive Plan ("2019 Plan"), which is expected to be ratified by the Company at its next annual meeting. Under the 2019 Plan, the Company is authorized to issue up to a maximum of 2,600,000 shares of common stock pursuant to the exercise of incentive stock options or other awards provided for therein. In connection with the Redomiciliation, all outstanding options to purchase shares in Arcturus Israel under the above described plans were exchanged for an option to purchase the same number of shares of the Company's common stock under the 2019 Plan. The Company does not intend to issue new options under the 2019 Plan until the 2019 is ratified by stockholders. Accordingly, as of June 30, 2019, there were 1,199,891 shares are available for future issuance under the 2019 Plan. Prior to the Redomiciliation, Arcturus Israel approved grants of options to purchase 160,000 shares to the Chief Executive Officer and Chief Financial Officer under the 2018 Plan. These grants were previously approved subject to approval of the shareholders of Arcturus Israel. The grants will be effective upon stockholder ratification of the 2019 Plan.

Stock Options

The following table presents the weighted-average assumptions used in the Black-Scholes valuation model by the Company in calculating the fair value of stock options granted:

	For the Three Months Ended June 30,		For the Six Months Ended June 30,	
	2019	2018	2019	2018
Expected life (in years)	6.1	7.3	6.1	7.3
Expected volatility	75.6 %	76.4 %	74.7 %	76.4 %
Expected dividend yield	— %	— %	— %	— %
Risk-free interest rate	2.30 %	1.87 %	2.42 %	1.87 %
Grant date weighted average fair value	$ 4.76	$ 7.94	$ 3.89	$ 7.94

The following table summarizes the Company's stock option activity for the six months ended June 30, 2019:

	Number of Shares		Weighted Average Exercise Price	Weighted-Average Remaining Contractual Term (Years)	Aggregate Intrinsic Value (in thousands)
Outstanding - December 31, 2018	1,184,433		$ 7.41		
Granted	126,000	*	$ 5.82		
Exercised	(823)		$ 1.03		
Forfeited/cancelled	(69,501)		$ 8.07		
Outstanding - June 30, 2019	1,240,109		$ 7.21	8.56	$ 2,770
Exercisable - June 30, 2019	373,533		$ 6.38	7.26	$ 1,150
Exercisable and expected to vest - June 30, 2019	1,240,109		$ 7.21	8.56	$ 2,770

* Total options granted during the first six-month period of 2019 excludes 160,000 options when granted were subject to stockholder approval pertaining to the Chief Executive Officer and Chief Financial Officer.

At June 30, 2019, the total unrecognized compensation cost of $4.2 million will be recognized over the weighted-average remaining service period of approximately 2.9 years. The fair value of the options vested during the six months ended June 30, 2019 was $0.6 million.

Share-based compensation expenses included in the Company's condensed statements of operations and comprehensive loss for the three and six months ended June 30, 2019 and 2018 were:

	For the Three Months Ended June 30,		For the Six Months Ended June 30,	
(in thousands)	2019	2018	2019	2018
Research and development	$ 157	$ 7	$ 308	$ 15
General and administrative	246	133	494	151
Total	$ 403	$ 140	$ 802	$ 166

Share-based compensation expense for the three and six months ended June 30, 2019 excludes expense related to options granted to the Chief Executive Officer and Chief Financial Officer as the option grants are subject to shareholder approval.

Note 8. Leases

In October 2017, the Company entered into a non-cancellable operating lease agreement for office space adjacent to its previously occupied headquarters. The commencement of the lease began in March 2018 and the lease extends for approximately 84 months from the commencement date with a remaining lease term of six years. Monthly rental payments are due under the lease and there are escalating rent payments during the term of the lease. The Company is also responsible for its proportional share of operating expenses of the building and common areas. In conjunction with the new lease, the Company will receive free rent for four months and received a tenant improvement allowance of $74,000. The lease may be extended for one five-year period at the then current market rate with annual escalations; however, the Company deemed the extension option not reasonably certain to be exercised and therefore excluded the option from the lease terms. The Company entered into an irrevocable standby letter of credit with the landlord for a security deposit of $96,000 upon executing the lease which is included (along with additional funds required to secure the letter of credit) in the balance of non-current restricted cash.

Operating lease right-of-use asset and liability on the condensed consolidated balance sheets represent the present value of remaining lease payments over the remaining lease terms. The Company does not allocate lease payments to non-lease components; therefore, payments for common-area-maintenance and administrative services are not included in the operating lease right-of-use asset and liability. The Company uses its incremental borrowing rate to calculate the present value of the lease payments, as the implicit rate in the lease is not readily determinable.

As of June 30, 2019, the payments of the operating lease liability were as follows:

(in thousands)	Remaining Lease Payments
2019	$ 622
2020	1,272
2021	1,310
2022	1,349
2023	1,390
Thereafter	1,745
Total remaining lease payments	7,688
Less: imputed interest	(1,637)
Total operating lease liabilities	$ 6,051
Weighted-average remaining lease term	6 years
Weighted-average discount rate	8.4%

Operating lease costs consist of the fixed lease payments included in operating lease liability and are recorded on a straight-line basis over the lease terms. Operating lease costs were $0.3 million and $0.6 million for the three and six months ended June 30, 2019.

Note 9. Related Party Transactions

Ultragenyx

On June 17, 2019, Arcturus and Ultragenyx executed Amendment 3. In addition, as a result of the Ultragenyx Agreement, Ultragenyx owns 18.3% of the outstanding common stock of the Company as of June 30, 2019. For the three and six months ended June 30, 2019, the Company has recognized revenue of $2.5 million and $3.9 million, respectively, and for the three and six months ended June 30, 2018, the Company recognized revenue of $1.2 million and $2.7 million. As of June 30, 2019 and 2018, the Company holds accounts receivable balances of a negligible amount and $0.4 million, respectively. (Note 2)

Providence

In March 2016, the Company entered into a Research Collaboration and License Agreement with a related party, Providence, whose CEO and President is also a shareholder of the Company, to identify and optimize microRNA modulators or mimetics for the treatment of neoplastic diseases. In April 2017, the Providence Agreement was amended to include mRNA for the treatment of neoplastic disease. In July 2018, the Providence Agreement was amended and restated to cover brain neoplasms, breast neoplasms and ovarian neoplasms. Each party is responsible for their own research costs under the agreement, and Providence is responsible for all development costs through the completion of Phase 2 clinical trials. The Company is entitled to share in future product revenue of each product provided the Company shares in the product's post Phase 2 costs. Separately, Providence has agreed to pay for FTEs at a specified rate. For the three and six months ended June 30, 2019, the Company has recognized revenue of a negligible amount and $0.3 million, respectively, and for the three and six months ended June 30, 2018, the Company has recognized revenue of a negligible amount and $0.1 million, respectively.

Equity-Method Investment

In June 2018, the Company completed the sale of its intangible asset related to the ADAIR technology. Pursuant to the asset purchase agreement for ADAIR, the Company received a 30% ownership interest in the common stock of a privately held company in consideration for the sale of the ADAIR technology. As this ownership interest is greater than 20% and one executive of the Company holds a seat on the investee's board of directors, the Company has the ability to exercise significant influence over the operating and financial policies of this investee; therefore, the Company accounts for this investment as an equity-method investment. The Company has no requirement to invest further in this private company. The Company has recorded $0.6 million of its share of losses of the investee leaving no equity investment balance as of June 30, 2019.

Note 10. Subsequent Events

CureVac

On July 26, 2019 Arcturus Therapeutics, Inc. ("Arcturus"), a subsidiary of the Company, entered into an amendment (the "CureVac Amendment") to its Development and Option Agreement, as amended (the "Development and Option Agreement"), with CureVac AG ("CureVac"), pursuant to which Arcturus and CureVac agreed to (a) modify the time period during which CureVac may select potential targets to be licensed from the Company pursuant to the terms of the Development and Option Agreement, (b) reduce the overall number of maximum targets to be reserved and licensed from fifteen (15) to ten (10) targets, (c) simplify the process for selecting and reserving targets, (d) define conditions under which targets can be pre-restricted by Arcturus in connection with its own research and development activities and (e) restore CureVac's original obligations with respect to the funding of scientists at Arcturus.

In connection with the entry into the CureVac Amendment, on July 26, 2019, Arcturus and CureVac also entered into a Termination Agreement (the "Termination Agreement") terminating the Co-Development and Co-Commercialization Agreement (the "Co-Development Agreement") between the Company and CureVac dated as of January 1, 2018. The Termination Agreement is effective as of July 26, 2019.

Pursuant to the Termination Agreement, CureVac agreed to make a one-time payment to Arcturus in the amount of $4,000,000 in consideration for such termination, including payments in connection with CureVac's termination of co-development of ARCT-810 as a therapy for ornithine transcarbamylase (OTC) deficiency. The payment was collected during July 2019. The Termination Agreement includes a customary mutual release and a mutual non-disparagement clause and provides for the survival of the confidentiality provisions in the Co-Development Agreement.

The foregoing description of the CureVac Amendment and the Termination Agreement does not purport to be complete and is qualified in its entirety by reference to the CureVac Amendment, a copy of which is filed hereto as Exhibit 10.20, and the Termination Amendment, a copy of which is filed hereto as Exhibit 10.21.

Cystic Fibrosis Foundation

On August 1, 2019, Arcturus Therapeutics, Inc. ("Arcturus Sub"), a subsidiary of the Company, entered into an amendment (the "CFF Amendment") to its Development Program Letter Agreement of May 16, 2017, as amended by Amendment No. 1 dated July 13, 2018 (the "Underlying Agreement") with the Cystic Fibrosis Foundation ("CFF"), pursuant to which Arcturus Sub and CFF agreed to: (a) increase the Amount of Award (as defined in the Underlying Agreement) from CFF to advance LUNAR-CF to $15.0 million from approximately $3.2 million, require Arcturus Sub to provide $5.0 million in matching funds for remaining budgeted costs, and modify the disbursement schedule from CFF to Arcturus related thereto such that (i) $4.0 million will be disbursed upon execution of the CFF Amendment, (ii) $2.0 million will be disbursed within 30 days of the first day of each of January, April, July and October 2020 upon Arcturus invoicing CFF to meet project goals, and (iii) the last payment of $3.0 million less the prior award previously paid out, equaling approximately $2.1 million, will be disbursed upon Arcturus Sub invoicing CFF to meet good manufacturing practices and opening an IND application; (b) replace the existing royalties due to CFF under the Underlying Agreement with specified royalties expressed as a percentage of net sales, subject to specified royalty caps expressed as a multiple of the Actual Award (as defined in the CFF Amendment) and expiration of the royalties upon specified time limitations or patent or exclusivity expiration, among other limitations and exclusions; (c) define conditions under which Arcturus Sub shall pay to CFF disposition payments in the event of a Disposition Transaction (as defined in the CFF Amendment), including a license, sale or other transfer of a Covered Product or Arcturus Development Program Technology (excluding Net Sales) or a Change of Control Transaction; (d) provide a termination right to CFF; and (e) make corresponding changes to exhibits, definitions and other provisions of the Underlying Agreement consistent with the Amendment, including the replacement of references to Cystic Fibrosis Foundation Therapeutics, Inc. with CFF to reflect the prior assignment of the Underlying Agreement to CFF.

The foregoing description of the CFF Amendment does not purport to be complete and is qualified in its entirety by reference to the CFF Amendment, a copy of which is filed hereto as Exhibit 10.16.

Registered Direct Offerings

On July 26, 2019, the Company entered into an engagement letter (the "Letter Agreement") with H.C. Wainwright & Co., LLC (the "Placement Agent") relating to the Company's registered direct offering of common stock (the "Offering") to certain institutional investors (the "Investors"). Roth Capital Partners, LLC and Ladenburg Thalmann & Co. Inc. acted as financial advisors for the transaction. Pursuant to the Letter Agreement, the Company agreed to pay the Placement Agent a cash fee of 6.0% of the gross proceeds from the Offering raised from Investors and up to $75,000 for expenses.

In addition, on August 1, 2019 and August 2, 2019, the Company and the Investors entered into securities purchase agreements relating to the issuance and sale of shares of common stock. The purchase price per share for each share offered to the Investors is $11.50. The aggregate gross proceeds of the Offering were $13.2 million, for the sale in the aggregate of 1,145,653 shares of common stock.

The net proceeds to the Company from the Offering, after deducting Placement Agent fees and the Company's estimated offering expenses, are expected to be approximately $12.2 million. The Offering closed on August 5, 2019.

The offer and sale of the common stock was registered under the Securities Act of 1933, as amended (the "Securities Act"), on the Company's Registration Statement on Form S-3 (Registration No. 333-232281), previously filed with the Securities and Exchange Commission and declared effective on July 29, 2019.

Item 2. Management's Discussion and Analysis of Financial Condition and Results of Operations.

The following is a discussion of the financial condition and results of operations of Arcturus Therapeutics Holdings Inc. for the three and six-month periods ended June 30, 2019. Unless otherwise specified herein, references to the "Company," "Arcturus," "we," "our" and "us" mean Arcturus Therapeutics Holdings Inc and its consolidated subsidiaries from and after the effective time of the Redomiciliation and, prior to that time, to our predecessor, Arcturus Therapeutics Ltd. You should read the following discussion and analysis together with the interim condensed consolidated financial statements and related notes included elsewhere herein. For additional information relating to our management's discussion and analysis of financial conditions and results of operations, please see our Annual Report on Form 10-K for the year ended December 31, 2018 (the "2018 Annual Report"), which was filed with the U.S. Securities and Exchange Commission (the "Commission") on March 18, 2019 and amended on April 10, 2019. Unless otherwise defined herein, capitalized words and expressions used herein shall have the same meanings ascribed to them in the 2018 Annual Report.

This report includes forward-looking statements which, although based on assumptions that we consider reasonable, are subject to risks and uncertainties which could cause actual events or conditions to differ materially from those currently anticipated and expressed or implied by such forward-looking statements.

You should read this report and the documents that we reference in this report and have filed as exhibits to this report completely and with the understanding that our actual future results may be materially different from what we expect. You should also review the factors and risks we describe in the reports we will file or submit from time to time with the Commission after the date of this report. We qualify all of our forward-looking statements by these cautionary statements.

Overview

Arcturus is the successor to Arcturus Israel. Following the Redomiciliation on June 17, 2019, Arcturus became the ultimate parent company of Arcturus Israel.

Arcturus is an emerging RNA medicines company focused on the development and commercialization of therapeutics directed towards rare, infectious, fibrotic, and respiratory diseases with significant unmet medical need. The genetic medicines industry is constantly struggling to identify non-viral delivery solutions for large RNA molecules to different cell types. Arcturus' LUNAR® Delivery technology is lipid mediated – and non-viral. LUNAR is versatile, compatible with various types of RNA -- and has been shown to deliver large RNA to different cell types including Liver hepatocytes, Liver stellate cells, Muscle cells (myocytes), and Lung cells (including bronchial epithelial cells).

Our activities since inception have consisted principally of performing research and development activities, general and administrative activities and raising capital to fund those efforts. Our activities are subject to significant risks and uncertainties, including failing to secure additional funding before we achieve sustainable revenues and profit from operations. As of June 30, 2019, we had an accumulated deficit of $53.2 million.

Liquidity and Capital Resources

Our products that are being developed have not generated significant revenue. As a result, we have suffered recurring losses and significant cash resources will be required to execute our business plans. These losses are expected to continue for an extended period of time.

Historically, our major sources of cash have comprised proceeds from collaboration partners, various public and private offerings of our common stock, option and warrant exercises, and interest income. From inception through June 2019, we raised approximately $170.3 million in gross proceeds from various public and private offerings of our common stock, debt issuances, collaboration agreements, and the merger with Alcobra. In July of 2019, we raised $30 million through execution of an amended collaboration agreement and an equity purchase agreement with Ultragenyx.

As of June 30, 2019, we had approximately $55.9 million in cash, restricted cash and cash equivalents. Our plans to mitigate an expected shortfall of capital, to support future operations, include raising additional funds. The actual amount of cash that we will need to operate is subject to many factors. After June 30, 2019, the Company raised additional capital in excess of $17.0 million, including proceeds from the Offerings in excess of $13.0 million and a one-time payment to Arcturus in the amount of $4.0 million. See *"Note 10. Subsequent Events"* for further information.

Based on our planned operations, we expect that our current cash and cash equivalents balances, inclusive of the August 2019 financing, will be sufficient to fund our operations for at least 12 months after the date the condensed consolidated financial statements are filed without raising additional capital through equity or debt financing. The accompanying financial statements have been prepared on a going concern basis, which contemplates the realization of assets and the satisfaction of liabilities in the normal course of business. The financial statements do not include any adjustments relating to the recoverability and classification of asset amounts or the classification of liabilities that might be necessary should we be unable to continue as a going concern within one year after the date the financial statements are issued.

We also recognize that we will need to raise additional capital in order to continue to execute our business plan in the future. There is no assurance that additional financing will be available when needed, that we will be able to obtain financing on terms acceptable to us, or that we will become profitable and generate positive operating cash flow. If we are unable to raise sufficient additional funds, we will have to scale back operations.

Overview

Since our inception, we have funded our operations principally with proceeds from the sale of capital stock, convertible notes and revenues earned through collaborative agreements. At June 30, 2019, we had $55.8 million in unrestricted cash and cash equivalents.

To support our long-term plans, we intend to seek additional capital through equity or debt financings, collaborative or other funding arrangements with partners or through other sources of financing. Should we seek additional financing from outside sources, we may not be able to raise such financing on terms acceptable to us or at all. If we are unable to raise additional capital when required or on acceptable terms, we may be required to scale back or discontinue the advancement of product candidates, reduce headcount, liquidate our assets, file for bankruptcy, reorganize, merge with another entity, or cease operations.

If we are unable to maintain sufficient financial resources, our business, financial condition and results of operations will be materially and adversely affected. There can be no assurance that we will be able to obtain the needed financing on acceptable terms or at all. Additionally, equity or debt financings may have a dilutive effect on the holdings of our existing shareholders.

The following table shows a summary of our cash flows for the six months ended June 30, 2019 and 2018 (in thousands):

	Six Months Ended June 30,	
(Dollars in thousands)	**2019**	**2018**
Cash provided by (used in):		
Operating activities	$ 3,929	$ (8,202)
Investing activities	(344)	12,042
Financing activities	15,546	351
Net increase in cash and restricted cash	$ 19,131	$ 4,191

Operating Activities

Our primary use of cash is to fund operating expenses, which consist mainly of research and development expenditures and general and administrative expenditures. We have incurred significant losses which have been partially offset by cash collected through our collaboration agreements and acquired through our 2017 merger. Cash collections under the collaboration agreements can vary from year to year depending on the terms of agreement and work performed. These changes on cash flows primarily relate to the timing of cash receipts for upfront payments, reimbursable expenses and achievement of milestones under these collaborative agreements.

Net cash provided by operating activities was $3.9 million on a net loss of $7.6 million for the six months ended June 30, 2019, compared to net cash used of $8.2 million on a net loss of $16.5 million for the six months ended June 30, 2018. Adjustments for non-cash charges, including share-based compensation, depreciation and amortization, interest expense and loss from equity-method investment were $1.5 million and $0.4 million for the six months ended June 30, 2019 and 2018, respectively. Changes in working capital resulted in adjustments to operating net cash inflows of $9.6 million and $7.9 million for the six months ended June 30, 2019 and 2018, respectively, and were primarily driven by increases in deferred revenue and accounts payable partly offset by increases in accounts receivable and prepaid expenses for the six months ended June 30, 2019.

Investing Activities

Net cash used in investing activities of $0.3 million for the six months ended June 30, 2019 reflected cash used to purchase property and equipment. Net cash provided by investing activities of $12.0 million for the six months ended June 30, 2018 reflected proceeds of the maturities of our short-term investments of $22.3 million, offset by purchases of short-term investments of $9.2 million, and cash used to purchase property and equipment of $1.0 million.

Financing Activities

Net cash provided by financing activities for the six months ended June 30, 2019 reflected proceeds from the issuance of common stock and the exercise of stock options of $15.5 million. Net cash provided by financing activities for the six months ended June 30, 2018 consisted of net proceeds from the exercise of share options of $0.4 million.

Funding Requirements

We anticipate that we will continue to generate annual net losses for the foreseeable future, and we expect the losses to increase as we continue the development of, and seek regulatory approvals for, our product candidates, and begin commercialization of our products. As a result, we will require additional capital to fund our operations in order to support our long-term plans. The Company intends to seek additional capital through equity and/or debt financings, collaborative or other funding arrangements with partners or through other sources of financing. Should we seek additional financing from outside sources, we may not be able to raise such financing on terms acceptable to us or at all. If we are unable to raise additional capital when required or on acceptable terms, we may be required to scale back or discontinue the advancement of product candidates, reduce headcount, liquidate our assets, file for bankruptcy, reorganize, merge with another entity, or cease operations.

Our future funding requirements are difficult to forecast and will depend on many factors, including the following:

- the achievement of milestones under our strategic alliance agreements;
- the terms and timing of any other strategic alliance, licensing and other arrangements that we may establish;
- the initiation, progress, timing and completion of preclinical studies and clinical trials for our product candidates;
- the number and characteristics of product candidates that we pursue;
- the outcome, timing and cost of regulatory approvals;
- delays that may be caused by changing regulatory requirements;
- the cost and timing of hiring new employees to support our continued growth;
- the costs involved in filing and prosecuting patent applications and enforcing and defending patent claims;
- the costs and timing of procuring clinical and commercial supplies of our product candidates;
- the costs and timing of establishing sales, marketing and distribution capabilities;
- the costs associated with legal proceedings; and
- the extent to which we acquire or invest in businesses, products or technologies.

Results of Operations

The following discussion and analysis of our financial condition and results of operations should be read in conjunction with our condensed consolidated financial statements and related notes appearing elsewhere in this Report and our audited financial statements and related notes for the year ended December 31, 2018. Our historical results of operations and the year-to-year comparisons of our results of operations that follow are not necessarily indicative of future results.

Collaboration Revenue

We enter into arrangements with pharmaceutical and biotechnology partners that may contain upfront payments, license fees for research and development arrangements, research and development funding, milestone payments, option exercise fees and royalties on future sales. The following table summarizes our total revenues for the periods indicated (in thousands):

	Three Months Ended June 30,		2018 to 2019	
(Dollars in thousands)	2019	2018	$ change	% change
Collaboration revenue	$ 10,153	$ 2,386	$ 7,767	*

* *Greater than 100%*

Collaboration revenue increased by $7.8 million during the three months ended June 30, 2019 as compared to the three months ended June 30, 2018 . The increase in collaboration revenue primarily relates to increased revenue of $7.5 million recognized upon the execution of Amendment 3 with Ultragenyx, increased revenue associated with CureVac for revenue that was previously constrained under ASC 606 and recognizing sublicense revenue from SGI. Additional increases in collaboration revenue relates to $0.4 million for ramping up activity with Janssen partly offset by $0.1 million for reducing activity from other programs.

	Six Months Ended June 30,		2018 to 2019	
(Dollars in thousands)	2019	2018	$ change	% change
Collaboration revenue	$ 14,503	$ 4,753	$ 9,750	*

* *Greater than 100%*

Collaboration revenue increased by $9.8 million during the six months ended June 30, 2019 as compared to the six months ended June 30, 2018. The increase in collaboration revenue primarily relates to increased revenue of $9.1 million recognized upon execution of Amendment 3 with Ultragenyx, increased revenue associated with CureVac for revenue that was previously constrained under ASC 606 and recognizing sublicense revenue from SGI. Additional increases in collaboration revenue of $1.0 million relates to ramping up activity with Janssen and a one-time increase in labor reimbursements from Providence partly offset by $0.3 million for reducing activity from other programs.

Our operating expenses consist of research and development and general and administrative expenses.

	Three Months Ended June 30,		2018 to 2019		Six Months Ended June 30,		2018 to 2019	
(Dollars in thousands)	2019	2018	$ change	% change	2019	2018	$ change	% change
Operating expenses:								
Research and development, net	$ 7,269	$ 4,225	$ 3,044	72.0%	$ 14,593	$ 8,166	$ 6,427	78.7%
General and administrative	$ 3,456	$ 8,233	$ (4,777)	-58.0%	$ 6,990	$ 13,331	$ (6,341)	-47.6%
Total	$ 10,725	$ 12,458	$ (1,733)	-13.9%	$ 21,583	$ 21,497	$ 86	0.4%

The following table presents our total research and development expenses by category:

	Three Months Ended June 30,		2018 to 2019		Six Months Ended June 30,		2018 to 2019	
(Dollars in thousands)	2019	2018	$ change	% change	2019	2018	$ change	% change
External pipeline development expenses:								
LUNAR-OTC (ARCT-810)	$ 2,100	$ 725	$ 1,375	*	$ 5,830	$ 1,372	$ 4,458	*
LUNAR-CF, net	$ 260	$ 113	$ 147	*	$ 451	$ 31	$ 420	*
Discovery technologies	$ 1,331	$ 957	$ 374	39.1%	$ 1,929	$ 2,115	$ (186)	-8.8%
External platform development expenses:								
Partnered discovery technologies	$ 386	$ 561	$ (175)	-31.2%	$ 691	$ 1,199	$ (508)	-42.4%
Total development expenses	$ 4,077	$ 2,356	$ 1,721	73.0%	$ 8,901	$ 4,717	$ 4,184	88.7%
Personnel related expenses	$ 2,445	$ 1,467	$ 978	66.7%	$ 4,524	$ 2,800	$ 1,724	61.6%
Facilities and equipment expenses	$ 747	$ 402	$ 345	85.8%	$ 1,168	$ 649	$ 519	80.0%
Total research and development expenses, net	$ 7,269	$ 4,225	$ 3,044	72.0%	$ 14,593	$ 8,166	$ 6,427	78.7%

* *Greater than 100%*

Research and Development Expenses, net

Our development expenses consist primarily of external manufacturing costs, in-vivo research studies performed by contract research organizations, clinical and regulatory consultants, and laboratory supplies related to conducting research and development activities.

Our LUNAR-OTC (ARCT-810) program is expected to achieve IND submission by early 2020. We expect that the program costs will continue to increase as was the case during the three and six-month periods, whereby the programs costs increased by $1.4 million and $4.5 million for the three and six months ended June 30, 2019 as compared to 2018, respectively.

Our Lunar-CF program during the 2017 and 2018 previously reported periods was primarily funded by our Company. As a result of the new CF agreement that was executed during July 2019, we expect that our development efforts and our portion of the costs will increase as we move towards the IND submission expected in late 2020. During the three and six months ended June 30, 2018 as compared to 2017, our costs increased in this program by $0.1 million and $0.4 million, respectively.

Discovery technologies represents our efforts to expand our product pipeline and are expected to continually increase over the near future. During the three months ended June 30, 2019 as compared to 2018, our costs increased by $0.4 million as we focused our efforts on the discovery and development of our next programs. For the six months ended June 30, 2019 as compared to 2018, our expenditures were relatively flat.

Within our platform development expenses, our partnered discovery expenses with our current partners are expected to fluctuate based on the needs of our collaboration partners. During the three and six months ended June 30, 2019 as compared to 2018, the expenses were lower by $0.2 million and $0.5 million, respectively, as a result of the stage of the collaboration partners.

Personnel related expenses increased by $1.0 million and $1.7 million during the three and six months ended June 30, 2019 and 2018, respectively, associated with increased headcount necessary to advance our external pipeline and platform efforts. We expect to continue to expand our headcount as required to meet our plan.

Facilities and equipment expenses increased by $0.3 million and $0.5 million during the three and six months ended June 30, 2019 and 2018, respectively, primarily as a result of higher rent and related costs associated with our new headquarters that we entered during early 2018.

General and Administrative Expenses

General and administrative expenses consist primarily of salaries and related benefits for our executive, administrative and accounting functions and professional service fees for legal and accounting services as well as other general and administrative expenses.

The decrease in general and administrative expenses of $4.8 million for the three months ended June 30, 2019 as compared to the three months ended June 30, 2018 was due to the substantial costs incurred during the three months ended June 30, 2018 of $4.9 million related to the proxy contest which was partly offset by an increase in facility related expenses of $0.1 million.

The decrease in general and administrative expenses of $6.3 million for the six months ended June 30, 2019 as compared to the six months ended June 30, 2018 was due to substantial costs incurred of $7.3 million related to proxy contest during fiscal year 2018 which was partly offset by $0.2 million of facilities related expenses, $0.3 million of redomiciliation related expenses and $0.5 million of personnel related expenses.

Finance (expense) income, net

	Three Months Ended June 30,		2018 to 2019		Six Months Ended June 30,			
(Dollars in thousands)	2019	2018	$ change	% change	2019	2018	$ change	% change
Finance (expense) income, net:								
Interest income	$ 93	$ 131	$ (38)	-29.0%	$ 208	$ 230	$ (22)	*
Interest expense	(206)	(9)	(197)	*	(409)	(7)	(402)	*
Total	$ (113)	$ 122	$ (235)	*	$ (201)	$ 223	$ (424)	*

* *Greater than 100%*

Interest income is generated on cash and cash equivalents. Interest expense was incurred in conjunction with our long-term debt agreement which was executed during the fourth quarter of 2018.

Critical Accounting Policies and Estimates

We prepare our condensed consolidated financial statements in conformity with accounting principles generally accepted in the United States, or U.S. GAAP. As such, we make certain estimates, judgements and assumptions that we believe are reasonable, based upon information available to us. These judgements involve making estimates about the effect of matters that are inherently uncertain and may significantly impact our results of operations and financial condition. We describe our significant accounting policies more fully in Note 2 to our consolidated financial statements for the year ended December 31, 2018.

The following are our significant accounting policies which we believe are the most critical to aid in fully understanding and evaluating our reported financial results.

Revenue Recognition

Effective January 1, 2019, the Company adopted *ASU 2014-09, Revenue from Contracts with Customers (Topic 606)*, or Topic 606, using the modified retrospective transition method. Topic 606 provides a unified model to determine how revenue is recognized. We determine revenue recognition for arrangements within the scope of Topic 606 by performing the following five steps: (i) identify the contract; (ii) identify the performance obligations in the contract; (iii) determine the transaction price; (iv) allocate the transaction price to the performance obligations in the contract; and (v) recognize revenue when, or as, we satisfy a performance obligation.

The terms of our collaborative research and development agreements include license fees, upfront payments, milestone payments when and if certain research or technology transfer milestones are achieved, development milestones and reimbursement for research and development activities, option exercise fees, other contingent payments for the achievement of defined collaboration objectives and certain preclinical, clinical, regulatory and sales-based events, as well as royalties on sales of commercialized products. Arrangements that include upfront payments are recorded as deferred revenue upon receipt or when due and may require deferral of revenue recognition to a future period until we perform obligations under these arrangements. We record research funding as accounts receivable when the right to consideration is unconditional. The event-based milestone payments represent variable consideration, and we use the most likely amount method to estimate this variable consideration because we will either receive the milestone payment or

we will not, which makes the potential milestone payment a binary event. The most likely amount method requires us to determine the likelihood of earning the milestone payment. Given the high degree of uncertainty around achievement of these milestones, we determine the milestone amounts to be fully constrained and do not recognize revenue until the uncertainty associated with these payments is resolved. We will recognize revenue from sales-based royalty payments when or as the sales occur. We will re-evaluate the transaction price in each reporting period as uncertain events are resolved and other changes in circumstances occur.

A performance obligation is a promise in a contract to transfer a distinct good or service to the collaborative partner and is the unit of account in Topic 606. A contract's transaction price is allocated to each distinct performance obligation based on relative standalone selling price and recognized as revenue when, or as, the performance obligation is satisfied. Under Topic 606, we elected to use the practical expedients permitted related to adoption, which does not require us to disclose certain information regarding certain remaining performance obligations as of the end of the reporting period. Topic 606 is applicable for revenue recognized in accordance with the practical expedient for measuring progress toward satisfaction of a performance obligation, and variable consideration classified as a sales-based or usage-based royalty promised in exchange for a license.

Leases

In February 2016, the FASB issued ASU 2016-02, Leases (Topic 842), which requires lessees to recognize most leases on the balance sheet as lease liabilities with corresponding right-of-use assets and to disclose key information about leasing arrangements. We adopted Topic 842 on its effective date in the first quarter of 2019 using a modified retrospective approach. We elected the available package of practical expedients upon adoption, which allowed us to carry forward our historical assessment of whether existing agreements contained a lease and the classification of our existing operating leases. We continue to report our financial position as of December 31, 2018 under the former lease accounting standard (Topic 840) in our condensed consolidated balance sheet.

The adoption impact was due to the recognition of operating lease liabilities with corresponding right-of-use assets based on the present value of remaining minimum lease payments. The difference between these amounts was recorded as a reduction of the right-of-use asset by the existing balance of deferred rent obligation with no impact to retained earnings.

Contractual Obligations

None

Item 3. Quantitative and Qualitative Disclosures About Market Risk.

Our primary exposure to market risk is interest income sensitivity, which is affected by changes in the general level of United States interest rates. Due to the nature of our cash and cash equivalents, we believe that we are not subject to any material market risk exposure. We do not have any foreign currency or other derivative financial instruments.

Item 4. Controls and Procedures.

Evaluation of Disclosure Controls and Procedures

As required by Rule 13a-15(b) and Rule 15d-15(b) of the Exchange Act, our management, including our principal executive officer, our principal financial officer and our principal accounting officer, conducted an evaluation as of the end of the period covered by this Quarterly Report on Form 10-Q of the effectiveness of the design and operation of our disclosure controls and procedures. Based on that evaluation, management has concluded that as of June 30, 2019, the Company's disclosure controls and procedures were effective at the reasonable assurance level and we believe the condensed consolidated financial statements included in this Form 10-Q for the six months ended June 30, 2019 present, in all material respects, our financial position, results of operations, comprehensive loss, statements of stockholders' equity and cash flows for the periods presented in conformity with U.S. generally accepted accounting principles.

Changes in Internal Control over Financial Reporting

As required by Rule 13a-15(d) and Rule 15d-15(d) of the Exchange Act, our management, including our principal executive officer, our principal financial officer and our principal accounting officer, conducted an evaluation of the internal control over financial reporting to determine whether any other changes occurred during the period covered by this Quarterly Report on Form 10-Q that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting. Based on that evaluation, our principal executive officer, principal financial officer and principal accounting officer concluded that there were no changes in our internal controls over financial reporting during the period covered by this Quarterly Report on Form 10-Q that materially affected, or were reasonably likely to materially affect, our internal control over financial reporting.

PART II—OTHER INFORMATION

Item 1. Legal Proceedings.

None.

Item 1A. Risk Factors.

Our business is subject to various risks, including those described in Item 1A of our Annual Report on Form 10-K for the fiscal year ended December 31, 2018, which we strongly encourage you to review. As of the filing of this report, there have been no material changes from the risk factors disclosed in Item 1A of our Form 10-K.

Item 2. Unregistered Sales of Equity Securities and Use of Proceeds.

None.

Item 3. Defaults Upon Senior Securities.

None.

Item 4. Mine Safety Disclosures.

Not applicable.

Item 5. Other Information.

None.

Item 6. Exhibits.

Exhibit No.	Description
2.1	Share Exchange Agreement, dated as of February 11, 2019, by and between the Company and Arcturus Therapeutics Holdings Inc. Incorporated by reference to Exhibit 10.13 to the Company's Annual Report on Form 10-K for the year ended December 31, 2018 filed with the SEC on March 18, 2019.
3.1	Articles of Association of the Company. Incorporated by reference to Exhibit No. 4.1 to the Company's Registration Statement on Form S-8 filed with the SEC on November 30, 2017 (File No. 333-221830).
4.1†	Arcturus Therapeutics Ltd. 2018 Omnibus Equity Incentive Plan. Incorporated by reference to Exhibit 99.3 to the Company's Report of Foreign Private Issuer on Form 6-K filed with the SEC on July 27, 2018 (File No. 001-35932).
4.2†	Arcturus Therapeutics Ltd. Amended and Restated Compensation Policy for Company Office Holders. Incorporated by reference to Exhibit 99.2 to the Company's Report of Foreign Private Issuer on Form 6-K filed with the SEC on July 27, 2018 (File No. 001-35932).
4.3	Agreement and Plan of Merger and Reorganization among Alcobra Ltd., Aleph MergerSub, Inc. and Arcturus Therapeutics, Inc., dated as of September 27, 2017. Incorporated by reference to Exhibit 99.2 to the Company's Report of Foreign Private Issuer on Form 6-K filed with the SEC on September 28, 2017 (File No. 001-35932).
4.4	Form of Indemnification Agreement. Incorporated by reference to Exhibit 10.4 to the Company's Form F-1/A filed with the SEC on February 19, 2013 (File No. 333-186003).
4.5†	Alcobra Ltd. Amended and Restated 2010 Incentive Option Plan. Incorporated by reference to Exhibit 4.3 to the Company's Form 20-F filed with the SEC on April 28, 2017 (File No. 001-35932).
4.6†	2013 Equity Incentive Plan of Arcturus Therapeutics, Inc. Incorporated by reference to Exhibit 99.1 to the Company's Form S-8 filed with the SEC on November 30, 2017 (File No. 333-221830).
10.1	Loan and Security Agreement, dated October 12, 2018, by and between Western Alliance Bank and Arcturus Therapeutics, Inc. Incorporated by reference to Exhibit 10.1 to the Company's Report of Foreign Private Issuer on Form 6-K filed with the SEC on October 15, 2018 (File No. 001-35932).
10.2	Sales Agreement, dated October 15, 2018, by and between Arcturus Therapeutics Ltd. and Leerink Partners LLC. Incorporated by reference to Exhibit 10.2 to the Company's Report of Foreign Private Issuer on Form 6-K filed with the SEC on October 15, 2018 (File No. 001-35932).
10.3	Amended and Restated Amendment to Development and Option Agreement, dated as of September 28, 2018, by and between CureVac AG and Arcturus Therapeutics Inc. Incorporated by reference to Exhibit 99.2 to the Company's Report of Foreign Private Issuer on Form 6-K filed with the SEC on October 1, 2018 (File No. 001-35932).
10.4	Research Collaboration and License Agreement, by and between Arcturus Therapeutics, Inc. and Janssen Pharmaceuticals, Inc., dated October 18, 2017. Incorporated by reference to Exhibit 4.7 to Form 20-F filed with the SEC on May 14, 2018 (File No. 001-35932).
10.5	Research and Exclusive License Agreement, by and between Arcturus Therapeutics, Inc. and Synthetic Genomics, Inc., effective October 24, 2017. Incorporated by reference to Exhibit 4.8 to Form 20-F filed with the SEC on May 14, 2018 (File No. 001-35932).
10.6	Research Agreement, by and between Arcturus Therapeutics, Inc. and Millennium Pharmaceuticals, Inc., a wholly-owned subsidiary of Takeda Pharmaceutical Company Limited, effective December 6, 2016, as amended December 21, 2017. Incorporated by reference to Exhibit 4.9 to Form 20-F filed with the SEC on May 14, 2018 (File No. 001-35932).
10.7	Research Collaboration and License Agreement, by and between Arcturus Therapeutics, Inc. and Ultragenyx Pharmaceutical Inc., entered into as of October 26, 2015, as amended October 17, 2017 and April 20, 2018. Incorporated by reference to Exhibit 4.10 to Form 20-F filed with the SEC on May 14, 2018 (File No. 001-35932).
10.8	Letter Agreement, by and between Arcturus Therapeutics, Inc. and Cystic Fibrosis Foundation Therapeutics, Inc., dated May 16, 2017. Incorporated by reference to Exhibit 4.11 to Form 20-F filed with the SEC on May 14, 2018 (File No. 001-35932).
10.9	Development and Option Agreement, by and between Arcturus Therapeutics, Inc. and CureVac AG, dated January 1, 2018, as amended May 3, 2018. Incorporated by reference to Exhibit 4.12 to Form 20-F filed with the SEC on May 14, 2018 (File No. 001-35932).

10.10	Co-Development and Co-Commercialization Agreement, by and between Arcturus Therapeutics, Inc. and CureVac AG, dated January 1, 2018. Incorporated by reference to Exhibit 4.13 to Form 20-F filed with the SEC on May 14, 2018 (File No. 001-35932).
10.11	License Agreement, by and between Arcturus Therapeutics, Inc., as successor-in-interest to Marina Biotech, Inc., and Protiva Biotherapeutics Inc., dated as of November 28, 2012. Incorporated by reference to Exhibit 4.14 to Form 20-F/A filed with the SEC on July 10, 2018 (File No. 001-35932).
10.12	Patent Assignment and License Agreement, by and between Arcturus Therapeutics, Inc. and Marina Biotech, Inc., dated as of August 9, 2013. Incorporated by reference to Exhibit 4.15 to Form 20-F filed with the SEC on May 14, 2018 (File No. 001-35932).
10.13	Share Exchange Agreement, dated as of February 11, 2019, by and between Arcturus Therapeutics Ltd. and Arcturus Therapeutics Holdings Inc. Incorporated by reference to Exhibit 10.13 to the Company's Annual Report on Form 10-K for the year ended December 31, 2018 filed with the SEC on March 18, 2019.
10.14	Amended and Restated Joint Venture, Research Collaboration and License Agreement, dated as of July 14, 2018 by and between Arcturus Therapeutics, Inc. and Providence Therapeutics, Inc. Incorporated by reference to Exhibit 10.14 to the Company's Amendment No. 1 to Annual Report on Form 10-K for the year ended December 31, 2018 filed with the SEC on April 10, 2019.
10.15	Research Collaboration Agreement, dated as of March 8, 2019 by and between Arcturus Therapeutics, Inc. and Millennium Pharmaceuticals, Inc., a wholly-owned subsidiary of Takeda Pharmaceutical Company Limited. Incorporated by reference to Exhibit 10.15 to the Company's Annual Report on Form 10-K for the year ended December 31, 2018 filed with the SEC on March 18, 2019.
10.16*+	Amendment dated as of August 1, 2019, by and between Arcturus Therapeutics, Inc. and Cystic Fibrosis Foundation to that certain Development Program Letter Agreement of May 16, 2017.
10.17	Letter Agreement, dated July 26, 2019, between the Company and the Placement Agent. Incorporated by reference to Exhibit 1.1 to the Company's Current Report on Form 8-K dated August 2, 2019.
10.18	Securities Purchase Agreement, dated August 1, 2019, between the Company and the Investors party thereto. Incorporated by reference to Exhibit 10.1 to the Company's Current Report on Form 8-K dated August 2, 2019.
10.19	Securities Purchase Agreement, dated August 2, 2019, between the Company and the Investors party thereto. Incorporated by reference to Exhibit 10.1 to the Company's Current Report on Form 8-K dated August 5, 2019.
10.20*+	Amendment to Development and Option Agreement, dated July 26, 2019, by and between Arcturus Therapeutics, Inc. and CureVac AG.
10.21*	Termination Agreement, dated July 26, 2019, by and between Arcturus Therapeutics, Inc. and CureVac AG.
10.22	Registration Rights Agreement, dated June 18, 2019, between the Company and Ultragenyx Pharmaceutical Inc. Incorporated by reference to Exhibit 4.1 to the Company's Current Report on Form 8-K dated June 20, 2019.
10.23	Equity Purchase Agreement, dated June 18, 2019, between the Company and Ultragenyx Pharmaceutical Inc. Incorporated by reference to Exhibit 10.1 to the Company's Current Report on Form 8-K dated June 20, 2019.
10.24	Third Amendment, dated June 18, 2019 to Research Collaboration and License Agreement, dated October 26, 2015, as amended on October 17, 2017 and April 20, 2018, between the Company and Ultragenyx Pharmaceutical Inc. Incorporated by reference to Exhibit 10.2 to the Company's Current Report on Form 8-K dated June 20, 2019.
31.1*	Certification of Principal Executive Officer Pursuant to Rules 13a-14(a) and 15d-14(a) under the Securities Exchange Act of 1934, as Adopted Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.
31.2*	Certification of Principal Financial Officer Pursuant to Rules 13a-14(a) and 15d-14(a) under the Securities Exchange Act of 1934, as Adopted Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.
32.1*	Certification of Principal Executive Officer Pursuant to 18 U.S.C. Section 1350, as Adopted Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.
32.2*	Certification of Principal Financial Officer Pursuant to 18 U.S.C. Section 1350, as Adopted Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.
101.INS	XBRL Instance Document

101.SCH	XBRL Taxonomy Extension Schema Document
101.CAL	XBRL Taxonomy Extension Calculation Linkbase Document
101.DEF	XBRL Taxonomy Extension Definition Linkbase Document
101.LAB	XBRL Taxonomy Extension Labels Linkbase Document
101.PRE	XBRL Taxonomy Extension Presentation Linkbase Document

* Filed herewith.

\+ Portions of this exhibit, marked by brackets, have been omitted pursuant to Item 601(b)(10)(iv) of Regulation S-K under the Securities Act of 1933, as amended, because they are both (i) not material and (ii) would likely cause competitive harm to the registrant if publicly disclosed.

† Management compensatory plan, contract or arrangement.

SIGNATURE

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, thereunto duly authorized.

ARCTURUS THERAPEUTICS HOLDINGS INC.

Date: August 14, 2019

By: /s/ Andrew Sassine
Andrew Sassine
Chief Financial Officer

Exhibit 10.16

REDACTED
Certain identified information, indicated by [***], has been excluded from the exhibit because it is both (i) not material and (ii) would likely cause competitive harm if publicly disclosed.

AMENDMENT NO. 2 TO LETTER AGREEMENT

This Amendment No. 2 ("Amendment No. 2") to the Development Program Letter Agreement of May 16, 2017 is entered into and effective as of August 1, 2019 (the "Amendment No. 2 Effective Date") by and between Arcturus Therapeutics, Inc. ("Arcturus") and the Cystic Fibrosis Foundation ("CFF").

WHEREAS, Arcturus and an CFF affiliate, Cystic Fibrosis Foundation Therapeutics, Inc. ("CFFT"), entered into the Development Program Letter Agreement of May 16, 2017, as amended by Amendment No. 1 dated July 13, 2018 (the "Agreement"); and

WHEREAS, CFFT assigned the Agreement to CFF; and

WHEREAS, the parties wish to further amend the Agreement by this Amendment No. 2.

NOW, THEREFORE, in consideration of the mutual covenants set forth in the Agreement and this Amendment No. 2 and for other good and valuable consideration, the receipt and sufficiency of which the parties acknowledge, the parties agree as follows:

1. Increased Award and Matched Funds. The parties acknowledge that a total of $20 million is required to advance LUNAR-CF through the opening of an Investigational New Drug ("IND"). In order to cover such costs, the Agreement is amended as follows:

    (a) The "Amount of Award" specified in the Agreement is increased to $15 million and, as specified in Exhibit B-2 (attached to this Amendment No. 2), the Award shall be disbursed by CFF in accordance with the following schedule:

        (i) $4 million upon the execution of this Amendment No. 2;

        (ii) $2 million each within thirty (30) days after receiving an invoice from Arcturus for January 1, April 1, July 1, and October 1, 2020, respectively, to allow Arcturus to complete the goals set forth in Exhibit B-2; and

    (b) $3 million within thirty (30) days after receiving an invoice (on or about November 15, 2020), to allow Arcturus to complete the Good Manufacturing Practice ("GMP") activities included in Exhibit A-2 budget, and an IND application has been opened. This $3 million payment will be reduced by the Prior Award.

    (c) Arcturus shall provide $5 million (the "Matching Funds") as required to pay the remaining budgeted costs in accordance with Exhibit A-2.

2. Amendments to Section 2 of Agreement. Section 2 of the Agreement is hereby deleted and the following inserted in lieu thereof:

"2. Royalties. In consideration of CFF's Award under this Agreement and CFF's license and transfer of intellectual property and CFF Know-How pursuant to this Agreement, Arcturus shall pay to CFF the following royalties:

(a) (i) **[***]** of Net Sales of CF Products and the first three (3) Pulmonary Products approved for commercial sale (collectively "Covered Products") in North America until **[***]** the Actual Award is payable to CFF; and (ii) **[***]** of Net Sales of Covered Products in the European Union (including the United Kingdom (even if it is no longer a member)) until **[***]** the Actual Award is payable to CFF.

(b) After the royalty set forth in subparagraph (a)(i) is fully paid:

(i) **[***]** of annual Net Sales of Covered Products up to **[***]**; and

(ii) **[***]** of annual Net Sales of Covered Products over **[***]**,

provided that, (A) the royalty rate specified in (i) above shall no longer be applicable and the royalty rate specified in (ii) above shall be applicable to all Net Sales of Covered Products after aggregate Net Sales of Covered Products exceed **[***]**; and (B) the royalties specified in this subparagraph (b) shall no longer be applicable in a country with respect to each CF Product or Pulmonary Product individually after the latest to occur of the following: (X) the date of expiration of the last valid patent claim in such country for such product; (Y) the expiration of the data exclusivity period conferred by a regulatory authority for such product in such country; and (Z) ten (10) years from the date of the first commercial sale of such product in such country.

(c) For products that are neither Covered Products nor OTC Products, that are approved for commercial sale in any country, **[***]** of annual Net Sales up to **[***]** the Actual Award. Any amount previously paid to CFF pursuant to this subparagraph (b) shall reduce the amount otherwise payable to CFF pursuant to this subparagraph (c), and any amount paid to CFF pursuant to this subparagraph (c) shall be subtracted from the amount otherwise due to CFF under subparagraph (b).

(d) In the event of a license, sale or other transfer of a Covered Product or Arcturus Development Program Technology (excluding Net Sales) or a Change of Control Transaction (collectively a "Disposition Transaction"), Arcturus and/or its shareholders shall pay to CFF the following (the "Disposition Payment"):

(i) if the Disposition Transaction occurs prior to the first patient being dosed in a Phase 1 study, **[***]** of the consideration received by Arcturus and its shareholders up to **[***]** the Actual Award; and

(ii) if the Disposition Transaction occurs on the date or subsequent to the first patient being dosed in a Phase 1 study, **[***]** of the consideration received by Arcturus and its shareholders up to **[***]** the Actual Award, and

(iii) for purposes of (i) and (ii) above the consideration received shall include both upfront and subsequent payments. whether received in cash or other property, including equity;

The Disposition Payment shall reduce any amount due to CFF under subparagraphs (a), (b) and (c) until the full amount of the Disposition Payment has been offset against any amount otherwise due to CFF under such subparagraphs. Any Disposition Transaction shall be null and void unless the third-party transferee in such transaction expressly assumes the joint and several obligation of the royalties specified in subparagraphs (a), (b) and (c), as such amount may be reduced in accordance with the preceding sentence.

(e) The payments due to CFF under subparagraphs (a), (b) and (c) of this Section 2 shall be reduced proportionately if CFF's Actual Award is less than $15 million by multiplying the respective percentages set forth in such subparagraphs by a fraction, the numerator of which is the Actual Award, and the denominator of which is $15 million.

(f) There shall be added to the Actual Award for purposes of determining the maximum payments to CFF under subparagraphs (a), (c) and (d) the Prior Award.

(g) The payments to CFF under this Section 2 shall be made within sixty (60) days following: (i) in the case of subparagraphs (a), (b), and (c), the quarter during which the Net Sales giving rise to the payments are made, and (ii) in the case of a Disposition Transaction, any payment that is received by Arcturus and/or its shareholders with respect to a Disposition Transaction."

3. Amendment to Section 9 of the Agreement. Section 9 of the Agreement is amended by re-designating subparagraph (b) as subparagraph (c), and inserting the following new subparagraph (b):

"(b) CFF may terminate this Agreement without cause effective after the first anniversary of the Amendment No. 2 Effective Date by providing at least thirty (30) days notice to Arcturus.

4. Exhibits. Exhibits A and B attached to the Agreement executed by the parties on May 16, 2017 are no longer applicable and are hereby replaced by revised Exhibits A-2 and B-2 attached to this Amendment No. 2. In the interest of time, Exhibit B-2 is left blank. The parties shall establish reasonable goals for development of the CF Product during 2019 and 2020 against which to measure actual progress at the first meeting of the PAG following the Amendment No. 2 Effective Date and shall agree on a reasonable series of activities that should be completed by Arcturus during such period and set forth such goals in Exhibit B-2 and the timing of Matching Funds. A completed Exhibit B-2 shall be incorporated into this Amendment No. 2 for such purposes immediately after such PAG meeting.

5. Amendment to Section 12 of the Agreement. The following definitions are amended or inserted as follows:

- "Actual Award" means the total amount of the Award actually paid to Arcturus excluding the Prior Award.
- "CF Product" shall mean native or chemically modified ribonucleotide sequence of cystic fibrosis transmembrane conductance regulator in any form, dosage or preparation in finished form, any derivative or combination product, and any successor product containing Arcturus Development Program Technology for treatment of lung disease, disorder, or syndrome.

- "Covered Product" shall have the meaning set forth in Section 2(a)(i).
- "Matching Funds" shall have the meaning set forth in Section 1(b) of Amendment No. 2.
- "OTC Product" means native or chemically modified ribonucleontide sequence of ornithine transcarbamylase protein in any form, dosage or preparation in finished form, any derivative or combination product, or any successor product of the treatment of ornithine transcarbamylase deficiency, ornithine carbarmyltransferase deficiency, or hyperammonemia due to ornithine transcarbamylase deficiency.
- The term "Net Sales": (i) for purposes of calculating the royalty specified in Section 2(c) (as amended by this Amendment No. 2) shall be calculated by reference solely to Net Sales of products that are subject to the royalty specified in such Section 2(c); and (ii) the term "in the Field" shall be deleted in such definition.
- "Prior Award" means $934,983.
- "Product" shall be deleted in the Agreement wherever it appears and the following inserted in lieu thereof: (i) as provided in this Amendment No. 2 in connection with Section 2 of the Agreement; (ii) with the term "CF Product" in all other places in the Agreement except as provided in (iii) and (iv) as follows: (iii) with the phrase "CF Product and Pulmonary Product" sections: 6, 7, 8, and (iv) in the definition of "Net Sales" with "Covered Products".
- "Pulmonary Product" shall mean native or chemically modified ribonucleotide sequence of a mammalian protein in any form, dosage or preparation in finished form, any derivative or combination product, or any successor product containing Arcturus Development Program Technology for treatment of lung disease, disorder, or syndrome.
- "Royalty Cap" is deleted.
- "Surviving Royalties" is deleted.

6. References to CFFT. All references to "Cystic Fibrosis Foundation Therapeutics, Inc" and "CFFT" shall be deleted from the Agreement, and the "Cystic Fibrosis Foundation" and "CFF", respectively, shall be inserted, in lieu thereof.

7. Continuing Effect. Except as set forth in this Amendment No. 2, the Agreement shall remain in full force and effect and capitalized terms shall have the same meaning as ascribed to such terms in the Agreement.

8. Counterparts. This Amendment No. 2 may be executed in any number of counterparts, each of which shall be an original instrument and all of which, when taken together shall constitute one and the same agreement.

[signature page follows]

IN WITNESS WHEREOF. The undersigned have executed this Amendment No. 2 as of the Amendment No. 2 Effective Date.

Cystic Fibrosis Foundation

/s/ Vera Twigg
Name: Vera Twigg
Title: EVP & CFO

/s/ Chris Gegelys
Name: Chris Gegelys
Title: SVP & Chief Legal Officer

Arcturus Therapeutics, Inc.

/s/ Joseph E. Payne
Name: Joseph E. Payne
Title: President & CEO

Exhibit 10.20

REDACTED
Certain identified information, indicated by [***], has been excluded from the exhibit because it is both (i) not material and (ii) would likely cause competitive harm if publicly disclosed.

THIS THIRD AMENDMENT (this "Third Amendment") to the Development and Option Agreement dated January 1, 2018 (the "Original Agreement"), is entered into by and between CureVac AG, a German stock corporation with offices at Paul-Ehrlich-Strasse 15, 72076 Tubingen, Germany ("CureVac"), and Arcturus Therapeutics Inc., a Delaware corporation with offices at 10628 Science Center Drive #200, San Diego, CA 92121, USA ("Arcturus"; each of CureVac and Arcturus individually a "Party" and together the "Parties") as of July 26, 2019 (the "Third Amendment Date").

RECITALS

WHEREAS, the Parties have previously amended the Original Agreement by (i) a first amendment dated May 3, 2018 (the "First Amendment") and (ii) a second amendment amending and restating the First Amendment in its entirety dated September 28, 2018 (the "Second Amendment"; the Original Agreement, as amended to the date hereof by the First Amendment and the Second Amendment, being referred to as the "Development and Option Agreement").

WHEREAS, the Parties desire to amend the Development and Option Agreement effective as of the Third Amendment Date.

NOW, THEREFORE, in consideration of the foregoing and the promises and mutual agreements contained in this Third Amendment, and for other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, and intending to be legally bound, the Parties agree as follows:

1. DELETION OF SECTION 5 AND SECTION 6 OF THE SECOND AMENDMENT

(a) Section 5 of the Second Amendment is hereby deleted in its entirety and shall have no further force and effect. Section 3.2(a) of the Original Agreement shall be restored as to its substance from and after the Third Amendment Date, and, for clarification purposes, is hereby amended and restated as follows:

"**(a)** ***Generally.*** Arcturus will perform the Work under the Work Plan, and as part of the Program CureVac will fund up to three (3) scientists per year at Arcturus to perform the Work as defined and in accordance with the Work Plan for a period of up to twenty-four (24) months beginning at the Third Amendment Date at the FTE Costs. The Parties may agree to extend the performance of Work by Arcturus for an additional year."

(b) Section 6 of the Second Amendment is hereby deleted in its entirety and shall have no further force and effect. Section 4.2(d)(ii) (Maximum Number Reserved Targets) and Section 5.1(a) (Maximum Options) of the Original Agreement are hereby restored with the effect that the maximum number of Reserved Targets and the total number of Options to enter into a maximum number of licenses under the Arcturus LMD Technology are reduced from [***].

2. AMENDMENT OF ARTICLE 9 OF THE DEVELOPMENT AND OPTION AGREEMENT

(a) Section 9.1(a) and Section 9.1 (b) of the Development and Option Agreement are hereby amended and restated in their entirety as follows:

"**(a)** This Agreement will commence as of the Effective Date and, unless sooner terminated or extended in accordance with the terms hereof or by mutual written consent, will continue for a period of four (4) years from the Third Amendment Date, (the "Initial Term", as may be extended pursuant to Section 9.1(b), the "Term").

(b) At any time during the Initial Term, CureVac shall have the option to extend the Initial Term for eighteen (18) months, by providing written notice to Arcturus, subject to payment by CureVac to Arcturus of a non-refundable extension fee of [***], payable within fifteen (15) Business Days after notice of the exercise of such option. If the [***] payment is not made within such fifteen (15) Business Day period the Term will be the Initial Term without extension."

(b) Section 9.1(c) of the Development and Option Agreement is hereby amended and restated in its entirety as "Intentionally Omitted".

(c) Section 9.2, first paragraph of the Development and Option Agreement is hereby amended and restated in its entirety as follows:

"**(9.2) Termination by CureVac.**

(a) Breach, Change of Control. CureVac will have the right to terminate this Agreement in full or on a Program-by-Program basis upon delivery of written notice to Arcturus in the event of

(i) any material breach by Arcturus

(A) of any terms and conditions of this Agreement, provided that such breach has not been cured within sixty (60) days after written notice thereof is given by CureVac to Arcturus specifying in reasonable detail the nature of the alleged breach; or

(B) in particular the failure of the Trusted Arcturus Employee to send the Target Response Notice within the period provided for in Section 4.2(c)(i), provided that such failure has not been cured neither within a first cure period of five (5) Business Days after written notice thereof is given by CureVac to Arcturus nor within a second cure period of five (5) Business Days after written notice of the lapse of the first cure period is given by CureVac to Arcturus, or

(ii) a Change of Control of Arcturus."

3. AMENDMENT OF ARTICLE 4 OF THE OPTION AND DEVELOPMENT AGREEMENT

Article 4 of the Development and Option Agreement is hereby amended and restated in its entirety as follows:

"ARTICLE 4
Reserved Targets

4.1 Generally. CureVac will select the Targets that will be the subject of the Works to be performed as part of a Program from the Reserved Target List. CureVac shall have the right, but not the obligation, to reserve Targets (or replace a Reserved Target with a new Target) in accordance with this Article 4.

4.2 Restricted Target List.

(a) Pre-existing Restrictions. Arcturus shall ensure that the Trusted Arcturus Employee has access to an updated list of Targets that are subject to Pre-Existing Restrictions at any time (the "Restricted Target List"). The Restricted Target List will identify for each Target listed in the Restricted Target List whether the Target is subject to Third Party rights or is under development at Arcturus. If the Target is subject to Third Party rights, the Restricted Target List will identify whether the Pre-Existing Restrictions are exclusive, non-exclusive or co-exclusive. If the Target is under development at Arcturus, Arcturus will provide the Trusted Arcturus Employee with Proof of Concept Data. Arcturus represents, warrants and covenants to CureVac that (i) the Restricted Target List is and will at all times be accurate in accordance with this Section 4.2(a); and (ii) Arcturus will not add any Reserved Targets to the Restricted Target List and will not engage in any research, development or other activities with respect to a Reserved Target or grant to any Third Party any licenses or options under the Arcturus LMD Technology with respect to the then current Reserved Target List that would preclude Arcturus from entering into a License Agreement with respect to such Reserved Target as set forth herein.

(b) ***Target Notices***.

From time to time during the Term, if CureVac desires to include a Target as a Reserved Target hereunder, CureVac will notify the Trusted Arcturus Employee in writing of the Targets for potential inclusion on the Reserved Target List, which notice will provide (i) the information on the Target Reservation Request Form attached hereto as **Exhibit 4.2**; and (ii) the identity of each Reserved Target (if any) that CureVac desires to remove as a Reserved Target (each such notice, a " Target Notice"). For clarity, the Target Notices shall not include more Targets than the Maximum Targets then available (taking into consideration any removed Targets previously reserved) and shall be deemed to be a request for an exclusive license at the outset unless there is a Pre-Existing Restriction. For clarity, CureVac's rights to enter into a Non-Exclusive License Agreement shall apply only if the Pre-Existing Restriction permits a non-exclusive license right to such proposed Reserved Target.

In addition to the formal Target reservation mechanism described in Section 4.2(b)(i), the Trusted Arcturus Employee will in good faith respond to any interim requests (not to exceed three (3) requests per month) on whether certain Targets can be reserved as Reserved Targets, in order to assist CureVac in planning of development projects. For clarity, the interim requests shall not include more than the Maximum Target then available (taking into consideration any removed Targets previously reserved).

(c) ***Target Response Notices.***

(i) The Trusted Arcturus Employee, on behalf of Arcturus, will review each Target Notice provided by CureVac hereunder to determine whether or not any such proposed Target is on the Restricted Target List and if listed, the applicable Pre-Existing Restriction as of the date of such Target Notice. Within ten (10) Business Days of the Trusted Arcturus Employee's receipt of a Target Notice, the Trusted Arcturus Employee will provide CureVac with written notice that includes the information set forth in subsection (c)(ii) and (iii) (each such notice, a "Target Response Notice").

If, as of the date of CureVac's Target Notice for a Target, such Target is on the Restricted Target List and is listed as being subject to Pre-Existing Restrictions, then such Target shall not be available to become a Reserved Target. The Target Response Notice issued for such Target will certify to CureVac that such Target is on the Restricted Target List and is listed as being subject to Pre-Existing Restrictions. The Target Response Notice issued for such Target shall identify whether the Target is subject to Third Party rights or is under development at Arcturus. If the Target is subject to Third Party rights, the Target Response Notice shall identify whether the Pre-Existing Restrictions are exclusive, non-exclusive or co-exclusive. If the Target is under development at Arcturus, upon CureVac's request, Arcturus shall provide to CureVac Proof of Concept Data within five (5) Business Days following such request in order to enable CureVac to confirm that the Proof of Concept Data is sufficient for Arcturus to reject the qualification of the Target as Reserved Target.

If, as of the date of CureVac's Target Notice for a Target, such Target is not listed on the Restricted Target List, then such Target will become a Reserved Target and will be added to the Reserved Target List subject to the Concurrent Reserved List Limits set forth in subsection (d) below. To the extent that the Pre-Existing Restriction is non-exclusive, then such Target may be added by CureVac to the Reserved Target List, but CureVac shall only have the right to enter into a Non-Exclusive License Agreement.

(iv) In case of a dispute between the Parties as to whether a Target is eligible to become a Reserved Target, the Parties will involve an independent Third Party qualified scientist mutually agreed upon by both Parties (the "Auditor") within ten (10) Business Days as of the date of the Target Response Notice. Promptly upon the Auditor's designation, Arcturus shall submit to the Auditor all documents and materials which are necessary for the Auditor to identify the Pre-Existing Restrictions. The Auditor shall determine whether the Target is eligible to become a Reserved Target in accordance with the applicable provisions of this Agreement. The Auditor's determination shall be binding upon the Parties. The Auditor shall be required to enter into a reasonably acceptable confidentiality agreement and will not share any information provided by Arcturus to CureVac or any Third Party.

(d) Concurrent Reserved List Limits and Removal of Targets. The following concurrent reserved list limits will apply to all Reserved Targets ("Concurrent Reserved List Limits").

(i) Reserved Targets and Removal thereof. CureVac may select Reserved Targets up to the totals allowed for in subparagraph (ii) below, in accordance with the process specified in Sections 4.2(b) and (c). CureVac shall have the right to remove a Target or replace a Target on the Reserved Target List with another Target, in accordance with the process specified in Section 4.2(b), provided (A) the total number of Targets on the Reserved Target List does not exceed the Maximum Targets at any one time; and (B) a newly nominated Target is not on the Restricted Target List. Any abandoned Target(s) revert(s) back to Arcturus.

(ii) Maximum Number Reserved Targets. CureVac will have the right to select up to [***] at any one time to be placed on the Reserved Target List as Reserved Targets; provided that the [***] total shall be reduced by each delivery of an Acceptance Notice (the "Maximum Targets") (e.g., if [***] License Agreements have been executed, then the total number of Reserved Targets shall be reduced to [***]), with such reduction in the total Targets applying from and after the date of exercise of an Acceptance Notice.

4.3 **Expiration of Pre-Existing Restrictions.** If any Pre-Existing Restrictions identified in a Target Response Notice that precluded Arcturus from granting CureVac a license (whether or not CureVac has elected to designate such Target on the Reserved Target List on a non-exclusive basis subject to the Pre-Existing Restriction) under the Arcturus LMD Technology later expire or otherwise are modified or terminated such that Arcturus is no longer precluded under the terms of the applicable Third Party agreement from granting a license to CureVac with respect to such Target, the Trusted Arcturus Employee will notify CureVac of such event and CureVac will have an exclusive option, for a period of thirty (30) days following delivery of notice to CureVac, to add (or extend its rights) such Target to the Reserved Target List as a Reserved Target in accordance with Section 4.2(c), subject to the Concurrent Reserved List Limits. For clarity, CureVac will at all times thereafter have the right to provide a Target Notice for such Target to the Trusted Arcturus Employee pursuant to Section 4.2(b) but such Target Notice will be subject to any intervening Pre-Existing Restrictions.

4.4 **Trusted Arcturus Employee.** Arcturus shall ensure that the Trusted Arcturus Employee abides by the terms set forth herein. On the Third Amendment Date, (i) Arcturus shall communicate the name, title and contact details of the Trusted Arcturus Employee to CureVac and (ii) Arcturus and CureVac will terminate – if - any existing Escrow Agreement and jointly instruct and permit the Escrow Agent to send the current Reserved Target List to the Trusted Arcturus Employee. Arcturus shall ensure that only the Trusted Arcturus Employee knows the identity of Reserved Targets and that the Trusted Arcturus Employee is bound by obligations of confidentiality obliging the Trusted Arcturus Employee to keep the Reserved Target List and the identity of Reserved Targets confidential. All costs and expenses incurred through the Trusted Arcturus Employee after the Third Amendment Date will be borne by Arcturus. If Arcturus appoints a new Arcturus employee to serve as the Trusted Arcturus Employee after the Third Amendment Date, Arcturus shall promptly notify CureVac of such appointment.

4. FURTHER AMENDMENTS

(a) Section 1.69 of the Development and Option Agreement (Definition of Pre-Existing Restrictions) is hereby amended and restated in its entirety as follows:

(b) "**1.69**"Pre-Existing Restrictions" means, with respect to a Target on the Restricted Target List pursuant to Section 4.2(a), that (i) Arcturus or its Affiliates have granted to a Third Party with respect to such Target a non-exclusive, co-exclusive or an exclusive license or option pursuant to a *bona fide* written agreement that is in effect at the date of the Target Notice by CureVac pursuant to Section 4.2 , restricting Arcturus from granting the applicable license to CureVac under the LMD Technology with respect to such Target, or (ii) such Target is under development at Arcturus and Arcturus has completed, at minimum, preclinical *in vivo* Proof of Concept Data with respect to such Target.

(c) Section 1.77 of the Development and Option Agreement (Definition of Reserved Target) is hereby amended and restated in its entirety as follows:

"**1.77** "Reserved Target" means a Target (i) which is included in the Reserved Target List on the Third Amendment Date or (ii) with respect to which CureVac shall have delivered to the Trusted Arcturus Employee a Target Notice and in response thereto the Trusted Arcturus Employee shall have delivered to CureVac a Target Response Notice under Section 4.2(c)(i) for such Target to become a Reserved Target. A Reserved Target that is abandoned or replaced pursuant to Section 4.2 will no longer be deemed a Reserved Target."

(d) The following Sections are inserted immediately following Section 1.97 of the Development and Option Agreement:

"**1.98** "Trusted Arcturus Employee" means an employee (not on the C-Level or business development) of Arcturus designated by Arcturus, being the only individual in the Arcturus' organization who knows the CureVac Reservation List, steering the Target Response Notice.

1.99 "Proof of Concept Data" means any of the following: (i) data for two mRNAs encoding a Target with positive results (i.e. a biological and/or pharmacological effect) in at least one *in vivo* study (i.e. in animals); or (ii) data for two mRNAs encoding a Target demonstrating *in vivo* expression of the encoded Target.

1.100 "Auditor" has the meaning set forth in Section 4.2(c)(iv).

5. Disclosure

The Parties will mutually agree upon a Form 8-K to be filed by Arcturus with the Securities and Exchange Commission to disclose this Third Amendment (the "**Form 8-K**"). Except for the Form 8-K, unless required by applicable law, neither Party will disclose any information relating to the circumstances which have led to the amendment of the Development and Option Agreement or the amendment of the Development and Option Agreement (including the terms of this Third Amendment).

7. Non-Disparagement

Neither Party or any of its Affiliates shall make any statements, verbal or written, or cause or encourage others to make any statements, verbal or written, that defame, disparage, or in any way criticize the personal or business reputation, practices, or conduct of, the other Party or its shareholders, directors, officers, employees, or agents, including but not limited to statements made regarding the past relationship and past interactions between the Parties. This prohibition extends to statements, verbal or written, made to anyone, including but not limited to, the news media, investors, potential investors, any board of directors or advisory board of directors, industry analysts, competitors, strategic partners, vendors, employees (past and present), and clients. Any breach of this paragraph shall be a material breach of the Development and Option Agreement. For the avoidance of any doubt, this Section 7 shall not prohibit the disclosure of any factual statements required by applicable Law.

8. Representations and Warranties

Each Party represents and warrants to the other as of the Third Amendment Date that (a) it is a corporation duly organized, validly existing, and in good standing under the Laws of the jurisdiction in which it is incorporated, (b) it has the legal right and power to enter into this Third Amendment, to extend the rights and licenses granted or to be granted to the other in the Development and Option Agreement, and to fully perform its obligations hereunder, (c) it has taken all necessary corporate action on its part required to authorize the execution and delivery of this Third Amendment and the performance of its obligations under the Development and Option Agreement (d) this Third Amendment has been duly executed and delivered on behalf of such Party, and constitutes a legal, valid, and binding obligation of such Party that is enforceable against it in accordance with its terms, and (e) the execution, delivery and performance by a Party of this Third Amendment and the consummation of the transactions contemplated hereby will not result in any violation of, conflict with, result in a breach of or constitute a default under any understanding, contract or agreement to which such Party is a party or by which it is bound.

9. Ratification of Development and Option Agreement

Except as expressly provided in this Third Amendment, all of the terms, covenants, and other provisions of the Development and Option Agreement are hereby ratified and confirmed and shall continue to be in full force and effect in accordance with their respective terms. From and after the date hereof, all references to the Development and Option Agreement shall refer to the Development and Option Agreement as amended by this Third Amendment. Capitalized terms used but not defined in this Amendment shall have the meanings assigned to them in the Development and Option Agreement.

10. Governing Law

This Third Amendment shall be governed by and construed in accordance with the Laws of the State of New York, USA, without respect to its conflict of Laws rules. In the event of a dispute arising out of or relating to this Third Amendment, the provisions of Section 10.1 of the Development and Option Agreement shall govern the resolution of such dispute.

11. Counterparts

This Third Amendment may be executed and in one or more counterparts, each of which will be deemed an original, and all of which together will be deemed to be one and the same instrument. Facsimile or PDF execution and delivery of this Third Amendment by either Party will constitute a legal, valid and binding execution and delivery of this Third Amendment by such Party.

[signature page follows]

IN WITNESS WHEREOF, the Parties intending to be bound have caused this Third Agreement to be executed by their duly authorized representatives as of the Effective Date.

Arcturus Therapeutics, Inc.

By: /s/ Joseph Payne

Name: Joseph Payne
Title: Chief Executive Officer

CureVac AG

By: /s/ Daniel Menichella

Name: Daniel Menichella
Title: Chief Executive Officer

By: /s/ Dr. Franz-Werner Haas

Name: Dr. Franz-Werner Haas
Title: Chief Operating Officer

Exhibit 10.21

This TERMINATION AGREEMENT (the "**Termination Agreement**") is made as of July 26, 2019 (the "**Effective Termination Date**"), by and between **Arcturus Therapeutics, Inc.**, a Delaware corporation with offices at 10628 Science Center Drive, Suite 200, San Diego, California 92121, U.S. ("**Arcturus**"), and **CureVac AG**, a German stock corporation with offices at Paul-Ehrlich-Strasse 15, 72076 Tuebingen, Germany ("**CureVac**"). CureVac and Arcturus are referred to in this Termination Agreement individually as a "**Party**" and collectively as the "**Parties**".

RECITALS

WHEREAS, on January 1, 2018, the Parties entered into a Co-Development and Co-Commercialization Agreement (the "**Co-Development Agreement**").

WHEREAS, the Parties mutually desire to terminate the Co-Development Agreement.

NOW, THEREFORE, in consideration of the foregoing premises and the mutual covenants contained herein, the receipt and sufficiency of which are hereby acknowledged, the Parties hereby agree as follows:

ARTICLE 1
DEFINITIONS

The terms in this Termination Agreement with initial letters capitalized shall have the meanings designated throughout this Agreement or, if not defined herein, shall have the same meaning as provided in the Co-Development Agreement.

ARTICLE 2
TERMINATION OF THE CO-DEVELOPMENT AGREEMENT

2.1 Termination. Subject to Section 2.2, the Parties hereby terminate the Co-Development Agreement and acknowledge and agree that, as a result of such termination, their respective rights and obligations under the Co-Development Agreement are terminated as of the Effective Termination Date.

2.2 Survival. Section 11.4 of the Co-Development Agreement (survival) shall not survive the termination of the Co-Development Agreement except that the obligations of confidentiality under Article 10 of the Co-Development Agreement shall continue to apply beyond the Effective Termination Date.

ARTICLE 3
ONE-TIME PAYMENT

CureVac shall make, five (5) Business Days following the date of the Effective Termination Date a one-time payment of U.S. dollar four million (USD 4,000,000) to Arcturus by wire transfer to the bank account designated by Arcturus.

ARTICLE 4
MUTUAL RELEASE

Arcturus and CureVac hereby release and forever discharge one another, and all of their respective employees, agents, successors, assigns, legal representatives, Affiliates, directors and officers from and against any and all actions, claims, suits, demands, payment obligations or other obligations or liabilities of any nature whatsoever, whether known or unknown, which the other Party or any of its employees, agents, successors, assigns, legal representatives, Affiliates, directors and officers have had, now have or may have in the future directly or indirectly arising out of (or in connection with) the Co-Development Agreement, including without limitation any and all potential or asserted claims related to the OTC Preclinical Development Plan and the termination thereof.

ARTICLE 5
NO ADMISSION OR LIABILITY

This Termination Agreement and compliance with it shall not operate or be construed as an admission by either Party of any liability, misconduct or wrongdoing whatsoever against the other Party or any party released herein, and shall not be construed as an admission of a violation of the rights of any Party, or as a violation of any law, rule, regulation or ordinance.

ARTICLE 6
DISCLOSURE

The Parties will mutually agree upon a Form 8-K to be filed by Arcturus with the Securities and Exchange Commission to disclose the Termination Agreement (the "**Form 8-K**"). Except for the Form 8-K, unless required by applicable law, neither Party will disclose any information relating to the circumstances which have led to the termination of the Co-Development Agreement or the actual termination of the Co-Development Agreement (including the terms of this Termination Agreement).

ARTICLE 7
NON-DISPARAGEMENT

Neither Party or any of its Affiliates shall make any statements, verbal or written, or cause or encourage others to make any statements, verbal or written, that defame, disparage, or in any way criticize the personal or business reputation, practices, or conduct of, the other Party or its shareholders, directors, officers, employees, or agents, including but not limited to statements

made regarding the past relationship and past interactions between the Parties. This prohibition extends to statements, verbal or written, made to anyone, including but not limited to, the news media, investors, potential investors, any board of directors or advisory board of directors, industry analysts, competitors, strategic partners, vendors, employees (past and present), and clients. Any breach of this paragraph shall be a material breach of this Termination Agreement. For the avoidance of any doubt, this Article 7 shall not prohibit the disclosure of any factual statements required by applicable Law.

ARTICLE 8
GENERAL PROVISIONS

8.1 Severability. If any one or more of the provisions contained in this Termination Agreement is held invalid, illegal or unenforceable in any respect, the validity, legality and enforceability of the remaining provisions contained herein shall not in any way be affected or impaired thereby, unless the absence of the invalidated provision(s) adversely affects the substantive rights of the Parties. The Parties shall in such an instance use their best efforts to replace the invalid, illegal or unenforceable provision(s) with valid, legal and enforceable provision(s) which, insofar as practical, implement the purposes of this Termination Agreement.

8.2 Successors and assigns. This Termination Agreement, and in particular the mutual release contained herein, shall be binding on all successors and assigns of each Party.

8.3 Governing Law. This Termination Agreement shall be governed by and construed in accordance with and any dispute under this Termination Agreement shall be resolved in accordance with the laws of the State of New York, USA, without reference to any rules of conflict of laws.

8.4 Dispute Resolution.

(a) ***Dispute Escalation.*** In the event of a dispute between the Parties arising out of or in connection with this Termination Agreement, the Parties will first attempt in good faith to resolve such dispute by negotiation and consultation between themselves. In the event that such dispute is not resolved on an informal basis within thirty (30) days, any Party may, by written notice to the other, have such dispute referred to each Party's Chief Executive Officer or his or her designee (who will be a senior executive with the appropriate authority to determine the mater for such Party), who will attempt in good faith to resolve such dispute by negotiation and consultation for a thirty (30) days period following receipt of such written notice.

(b) ***Dispute Resolution.***

(i) In the event the Chief Executive Officers of the Parties are not able to resolve such dispute as set forth above, the Parties agree to try to solve such dispute amicably by mediation. The Parties shall conduct a mediation procedure according to the Mediation Rules of the World Intellectual Property Organization (WIPO) in effect on the date of the commencement of the mediation proceedings. The location of the mediation proceedings will be New York City, New York, USA. The number of mediators will be one (1). The language of the mediation proceedings will be English.

(ii) If the dispute has not been settled pursuant to the said rules within sixty (60) days following the filing of a request for mediation or within such other period as the Parties may agree in writing, either Party may submit the dispute to final and binding arbitration. Any dispute relating to the validity performance, construction or interpretation of this Termination Agreement, which cannot be resolved amicably between the Parties after following the procedure set forth in this Section 8.4, shall be submitted to arbitration in accordance with the Arbitration Rules of WIPO in effect on the date of the commencement of the arbitration proceedings. The location of the arbitration proceedings will be New York City, New York, USA. The number of arbitrators will be three (3). The language of the arbitration proceeding will be English. The decision of the arbitrators shall be final and binding upon the Parties (absent manifest error on the part of the arbitrator(s)) and enforceable in any court of competent jurisdiction.

8.5 Entire Agreement; Amendments. This Termination Agreement contains the entire understanding of the Parties regarding the termination of the Co-Development Agreement. Any other express or implied agreements and understandings, negotiations, writings and commitments, either oral or written, in respect to the termination of the Co-Development Agreement are superseded by the terms of this Termination Agreement.

8.6 Waiver of Rule of Construction. Each Party has had the opportunity to consult with counsel in connection with the review, drafting and negotiation of this Termination Agreement. Accordingly, the rule of construction that any ambiguity in this Termination Agreement shall be construed against the drafting Party shall not apply.

8.7 Counterparts. This Termination Agreement may be executed in two or more counterparts by original signature, facsimile or PDF files, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

[SIGNATURE PAGE FOLLOWS]

IN WITNESS WHEREOF, the Parties intending to be bound have caused this Termination Agreement to be executed by their duly authorized representatives as of the Effective Termination Date.

Arcturus Therapeutics, Inc.

By: /s/ Joseph Payne

Name:Joseph Payne
Title: Chief Executive Officer

CureVac AG

By: /s/ Daniel Menichella

Name:Daniel Menichella
Title: Chief Executive Officer

By: /s/ Dr. Franz-Werner Haas

Name:Dr. Franz-Werner Haas
Title: Chief Operating Officer

Exhibit 31.1

CERTIFICATION OF PRINCIPAL EXECUTIVE OFFICER

I, Joseph E. Payne, certify that:

1. I have reviewed this Quarterly Report on Form 10-Q of Arcturus Therapeutics Holdings Inc.;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

   (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

   (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

   (c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

   (d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

   (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

   (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: August 14, 2019

By: /s/ Joseph E. Payne

Joseph E. Payne
President and Chief Executive Officer

Exhibit 31.2

CERTIFICATION OF PRINCIPAL FINANCIAL OFFICER

I, Andrew Sassine, certify that:

1. I have reviewed this Quarterly Report on Form 10-Q of Arcturus Therapeutics Holdings Inc.;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

   (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

   (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

   (c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

   (d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

   (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

   (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: August 14, 2019

By: /s/ Andrew Sassine

Andrew Sassine
Chief Financial Officer

Exhibit 32.1

CERTIFICATION OF PRINCIPAL EXECUTIVE OFFICER
PURSUANT TO
18 U.S.C. SECTION 1350
AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

The undersigned, the President and Chief Executive Officer of Arcturus Therapeutics Holdings Inc. (the "Company"), hereby certifies on the date hereof, pursuant to 18 U.S.C. 1350(a), as adopted pursuant to Section 906 of The Sarbanes-Oxley Act of 2002, that the Quarterly Report on Form 10-Q for the period ended June 30, 2019 (the "Form 10-Q"), filed concurrently herewith by the Company, fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended, and that the information contained in the Form 10-Q fairly presents, in all material respects, the financial condition and results of operations of the Company.

Date: August 14, 2019

By: /s/ Joseph E. Payne
Joseph E. Payne
President and Chief Executive Officer

Exhibit 32.2

CERTIFICATION OF PRINCIPAL FINANCIAL OFFICER
PURSUANT TO
18 U.S.C. SECTION 1350
AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

The undersigned, the Chief Financial Officer of Arcturus Therapeutics Holdings Inc. (the "Company"), hereby certifies on the date hereof, pursuant to 18 U.S.C. 1350(a), as adopted pursuant to Section 906 of The Sarbanes-Oxley Act of 2002, that the Quarterly Report on Form 10-Q for the period ended June 30, 2019 (the "Form 10-Q"), filed concurrently herewith by the Company, fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended, and that the information contained in the Form 10-Q fairly presents, in all material respects, the financial condition and results of operations of the Company.

Date: August 14, 2019

By: /s/ Andrew Sassine
Andrew Sassine
Chief Financial Officer