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 March 31, 2021

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 May 5, 2021, the registrant had 26,320,274 shares of voting common stock outstanding.

ARCTURUS THERAPEUTICS HOLDINGS INC. AND ITS SUBSIDIARIES

TABLE OF CONTENTS

Special Note Regarding Forward-Looking Statements

This Quarterly Report on Form 10-Q, or this quarterly report, including the section entitled "Management's Discussion and Analysis of Financial Condition and Results of Operations," and the documents incorporated by reference herein may contain "forward-looking statements" within the meaning of the federal securities laws made pursuant to the safe harbor provisions of the Private Securities Litigation Reform Act of 1995. Our actual results could differ materially from those anticipated in these forward-looking statements as a result of various factors, including those set forth below under Part II, Item 1A, "Risk Factors" in this quarterly report. Except as required by law, we assume no obligation to update these forward-looking statements, whether as a result of new information, future events or otherwise. These statements, which represent our current expectations or beliefs concerning various future events, may contain words such as "may," "will," "expect," "anticipate," "intend," "plan," "believe," "estimate" or other words indicating future results, though not all forward-looking statements necessarily contain these identifying words. Such statements may include, but are not limited to, statements concerning the following:

- the initiation, cost, timing, progress and results of, and our expected ability to undertake certain activities and accomplish certain goals with respect to, our research and development activities, preclinical studies and clinical trials;
- our ability to obtain and maintain regulatory approval of our product candidates, and any related restrictions, limitations, and/or warnings in the label of an approved product candidate;
- our ability to obtain and deploy funding for our operations;
- our ability to continue as a going concern;
- our plans to research, develop and commercialize our product candidates;
- our strategic alliance partners' election to pursue development and commercialization of any programs or product candidates that are subject to our collaboration and license agreements with such partners;
- our ability to attract collaborators with relevant development, regulatory and commercialization expertise;
- future activities to be undertaken by our strategic alliance partners, collaborators, joint ventures and other third parties;
- our ability to avoid, settle or be victorious at costly litigation with shareholders, former executives or others, should these situations arise;
- our ability to obtain and maintain intellectual property protection for our product candidates;
- the size and growth potential of the markets for our product candidates, and our ability to serve those markets;
- our ability to successfully commercialize, and our expectations regarding future therapeutic and commercial potential with respect to, our product candidates;
- the rate and degree of market acceptance of our product candidates;
- our ability to develop sales and marketing capabilities, whether alone or with potential future collaborators;
- regulatory developments in the United States and foreign countries;
- our ability to attract and retain experienced and seasoned scientific and management professionals;
- the performance of our third-party suppliers and manufacturers;
- the success of competing therapies that are or may become available; and
- the accuracy of our estimates regarding future expenses, future revenues, capital requirements and need for additional financing.

Such forward-looking statements involve known and unknown risks, uncertainties and other factors that may cause actual results or performance to differ materially from those projected. These statements are only current predictions and are subject to known and unknown risks, uncertainties, and other factors that may cause our or our industry's actual results, levels of activity, performance or achievements to be materially different from those anticipated by the forward-looking statements. In addition, historic results of scientific research, preclinical and clinical trials do not guarantee that future research or trials will suggest the same conclusions, nor that historic results referred to herein will be interpreted the same in light of additional research, preclinical and clinical trial results. The forward-looking statements contained in this quarterly report are subject to risks and uncertainties, including those discussed in our other filings with the United States Securities and Exchange Commission, or the SEC. Readers are cautioned not to place undue reliance on these forward-looking statements, which speak only as of the date hereof. Although we believe that the expectations reflected in the forward-looking statements are reasonable, we cannot guarantee future results, levels of activity, performance, or achievements. Except as required by law, we assume no obligation to update or revise these forward-looking statements for any reason, even if new information becomes available in the future.

PART I—FINANCIAL INFORMATION

Item 1. Financial Statements.

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

	March 31, 2021 (unaudited)	December 31, 2020
Assets		
Current assets:		
Cash and cash equivalents	$ 466,839	$ 462,895
Accounts receivable	2,007	2,125
Prepaid expenses and other current assets	1,150	2,769
Total current assets	469,996	467,789
Property and equipment, net	3,427	3,378
Operating lease right-of-use asset, net	6,690	5,182
Equity-method investment	1,248	—
Non-current restricted cash	107	107
Total assets	$ 481,468	$ 476,456
Liabilities and stockholders' equity		
Current liabilities:		
Accounts payable	$ 5,597	$ 10,774
Accrued liabilities	29,800	20,639
Deferred revenue	17,936	18,108
Total current liabilities	53,333	49,521
Deferred revenue, net of current portion	11,313	12,512
Long-term debt, net of current portion	58,147	13,845
Operating lease liability, net of current portion	5,710	4,025
Other long-term liabilities	358	—
Total liabilities	$ 128,861	$ 79,903
Stockholders' equity		
Common stock: $0.001 par value; 60,000 shares authorized; 26,319 issued and outstanding at March 31, 2021 and 26,192 issued and outstanding at December 31, 2020	26	26
Additional paid-in capital	552,743	540,343
Accumulated deficit	(200,162)	(143,816)
Total stockholders' equity	352,607	396,553
Total liabilities and stockholders' equity	$ 481,468	$ 476,456

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)
(in thousands except per share data)

	Three Months Ended March 31,	
	2021	**2020**
Collaboration revenue	$ 2,127	$ 2,646
Operating expenses:		
Research and development, net	50,050	7,917
General and administrative	9,743	4,191
Total operating expenses	59,793	12,108
Loss from operations	(57,666)	(9,462)
Gain (loss) from equity-method investment	1,248	(163)
Gain from foreign currency	430	—
Finance expense, net	(358)	(152)
Net loss	$ (56,346)	$ (9,777)
Net loss per share, basic and diluted	$ (2.15)	$ (0.67)
Weighted-average shares outstanding, basic and diluted	26,243	14,521
Comprehensive loss:		
Net loss	$ (56,346)	$ (9,777)
Comprehensive loss	$ (56,346)	$ (9,777)

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)
in thousands

Three Months Ended March 31, 2021

	Common Stock Shares	Common Stock Amount	Additional Paid-In Capital	Accumulated Deficit	Total Stockholders' Equity
BALANCE - December 31, 2020	**26,192**	**$ 26**	**$ 540,343**	**$ (143,816)**	**$ 396,553**
Net loss	—	—	—	(56,346)	(56,346)
Issuance of common stock related to acquired in-process research and development	75	—	5,000	—	5,000
Share-based compensation	—	—	6,987	—	6,987
Issuance of common stock upon exercise of stock options	52	—	413	—	413
BALANCE – March 31, 2021	**26,319**	**$ 26**	**$ 552,743**	**$ (200,162)**	**$ 352,607**

Three Months Ended March 31, 2020

	Common Stock Shares	Common Stock Amount	Additional Paid-In Capital	Accumulated Deficit	Total Stockholders' Equity
BALANCE - December 31, 2019	**15,138**	**$ 15**	**$ 97,445**	**$ (71,668)**	**$ 25,792**
Net loss	—	—	—	(9,777)	(9,777)
Share-based compensation	—	—	849	—	849
Issuance of common stock upon exercise of stock options	19	—	118	—	118
BALANCE – March 31, 2020	**15,157**	**$ 15**	**$ 98,412**	**$ (81,445)**	**$ 16,982**

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)
in thousands

	Three Months Ended March 31,	
	2021	2020
OPERATING ACTIVITIES:		
Net loss	$ (56,346)	$ (9,777)
Adjustments to reconcile net loss to net cash used in operating activities:		
Depreciation and amortization	307	182
Share-based compensation expense	6,987	849
Acquired in-process research and development expense	5,000	—
(Gain) Loss from equity-method investment	(1,248)	163
Foreign currency transaction gain	(440)	—
Other non-cash expenses	696	274
Changes in operating assets and liabilities		
Accounts receivable	118	(172)
Prepaid expense and other assets	1,619	(1,179)
Accounts payable	(5,415)	(2,276)
Accrued liabilities	7,143	1,746
Deferred revenue	(1,371)	(1,668)
Net cash used in operating activities	(42,950)	(11,858)
INVESTING ACTIVITIES:		
Acquisition of property and equipment	(118)	(142)
Net cash used in investing activities	(118)	(142)
FINANCING ACTIVITIES:		
Proceeds from debt	46,599	—
Proceeds from exercise of stock options	413	118
Net cash provided by financing activities	47,012	118
NET INCREASE (DECREASE) IN CASH, CASH EQUIVALENTS AND RESTRICTED CASH	3,944	(11,882)
Cash, cash equivalents and restricted cash at beginning of the period	463,002	71,460
Cash, cash equivalents and restricted cash at end of the period	$ 466,946	$ 59,578

	Three Months Ended March 31,	
	2021	2020
Supplemental disclosure of cash flow information		
Cash paid for interest	$ 169	$ 228
Non-cash investing activities		
Right-of-use asset obtained in exchange for lease liabilities	$ 1,828	$ 674
Acquisition of in-process research and development through issuance of common stock	$ 5,000	$ —
Purchase of property and equipment in accounts payable	$ 238	$ 262

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. (the "Company") is a global clinical-stage messenger RNA medicines company focused on development of infectious disease vaccines and significant opportunities within liver and respiratory rare diseases. The Company became a clinical stage company during 2020 when it announced that its Investigational New Drug ("IND") application for ornithine transcarbamylase ("OTC") deficiency was deemed allowed to proceed by the U.S. Food and Drug Administration ("FDA"), and its Clinical Trial Application ("CTA") candidate LUNAR-COV19 was approved to proceed by the Singapore Health Sciences Authority.

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, 2020.

These condensed consolidated financial statements are prepared in accordance with GAAP, which requires management to make estimates and assumptions regarding the valuation of debt instruments, the equity-method investment, share-based compensation, accruals for liabilities, income taxes, revenue and deferred revenue, leases, 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 has incurred significant operating losses since its inception. As of March 31, 2021 and December 31, 2020, the Company had an accumulated deficit of $200.2 million and $143.8 million, respectively.

The Company's activities since inception have consisted principally of research and development activities, general and administrative 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. From the Company's inception through the three months ended March 31, 2021, the Company has funded its operations principally with the sale of capital stock, revenues earned through collaboration agreements, and proceeds from long-term debt. During the first quarter of 2021, the Company elected to borrow and the Economic Development Board of the Republic of Singapore (the "EDB") agreed to make a term loan of S$62.1 million (approximately USD$46.6 million) to support the manufacture of the LUNAR-COV19 vaccine candidate. Additionally, through underwritten public offerings during fiscal year 2020, the Company raised net proceeds of $423.8 million, after deducting underwriting discounts, commissions, and offering expenses.

Management believes that it has sufficient working capital on hand to fund operations through at least the next twelve months from the date these condensed consolidated financial statements were available to be issued. There can be no assurance that the Company will be successful in securing additional funding, that the Company's projections of its future working capital needs will prove accurate, or that any additional funding would be sufficient to continue operations in future years.

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

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, and reimbursement for research and development activities, option exercise fees, and 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 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.

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

Leases

See *"Note 9, Commitments and Contingences"* for specific details surrounding the Company's leases.

Research and Development, Net

All research and development costs are expensed as incurred. Research and development costs consist primarily of salaries, employee benefits, costs associated with preclinical studies and clinical trials (including amounts paid to clinical research organizations and other professional services), in process research and development expenses and license agreement expenses, net of any grants and prelaunch inventory. Payments made prior to the receipt of goods or services to be used in research and development are capitalized until the goods or services are received.

The Company records accruals for estimated research and development costs, comprising payments for work performed by third party contractors, laboratories, participating clinical trial sites, and others. Some of these contractors bill monthly based on actual services performed, while others bill periodically based upon achieving certain contractual milestones. For the latter, the Company accrues the expenses as goods or services are used or rendered. Clinical trial site costs related to patient enrollment are accrued as patients enter and progress through the trial.

Pre-Launch Inventory

Prior to obtaining initial regulatory approval for an investigational product candidate, the Company expenses costs relating to production of inventory as research and development expense in its condensed consolidated statements of operations, in the period incurred. When the Company believes regulatory approval and subsequent commercialization of an investigational product candidate is probable, and the Company also expects future economic benefit from the sales of the investigational product candidate to be realized, it will then capitalize the costs of production as inventory.

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)	March 31, 2021	March 31, 2020
Cash and cash equivalents	$ 466,839	$ 59,471
Non-current restricted cash	107	107
Total cash, cash equivalents and restricted cash shown in the statement of cash flows	$ 466,946	$ 59,578

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.

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 if and when certain research and development milestones or technology transfer milestones are achieved, royalties on approved product sales and reimbursement for research and development activities. The Company's costs of performing these services are included within research and development expenses. 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 models, lead candidate identification, and completion of IND-enabling toxicology studies. Clinical milestones may, for example, include successful enrollment of the first patient in or completion of Phase 1, 2 and 3 clinical trials, and commercial milestones are 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 three months ended March 31, 2021 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, 2020	$ 2,125
Additions for revenue recognized from billings	756
Deductions for cash collections	(874)
BALANCE – March 31, 2021	$ 2,007

(in thousands)	Contract Liabilities
BALANCE - December 31, 2020	$ 30,620
Additions for advanced billings	756
Deductions for promised services provided in current period	(2,127)
BALANCE – March 31, 2021	$ 29,249

The following table summarizes the Company's collaboration revenues for the periods indicated (in thousands).

	For the Three Months Ended March 31,	
(Dollars in thousands)	**2021**	**2020**
Collaboration Partner – Janssen	$ 824	$ 897
Collaboration Partner – Ultragenyx	925	911
Collaboration Partner – CureVac	225	309
Collaboration Partner – Takeda and other	153	529
Total collaboration revenue	$ 2,127	$ 2,646

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") to collaborate on developing candidates for treating HBV with RNA therapeutics. The 2017 Agreement allocated discovery, development, funding obligations, and ownership of related intellectual property among the Company and Janssen Pharmaceuticals, Inc. ("Janssen"). The Company received an upfront payment of $7.7 million and may receive preclinical, development and sales milestone payments of up to $56.5 million, as well as royalty payments on any future licensed product sales. The next potential milestone to be achieved relates to demonstrating *in vivo* efficacy and safety. 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 will pay royalties as a low to mid-single digit percentage of net sales of licensed products, 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.

In evaluating the 2017 Agreement in accordance with Accounting Standards Codification ("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 2017 Agreement: (i) research services, (ii) license to use Arcturus technology and (iii) participation in a 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.

As of March 31, 2021, the remaining transaction price consisting of upfront consideration received and budgeted reimbursable out-of-pocket costs, is expected to be recognized using an input method over the remaining research period of 18 months. None of the development and commercialization milestones were included in the transaction price as they are 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.

Total deferred revenue as of each of March 31, 2021 and December 31, 2020 for Janssen was $5.9 million.

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 to certain Arcturus technology, which is in effect only during the reserve target exclusivity term as discussed in the following paragraphs. This collaboration agreement was amended in 2017, 2018 and during the second quarter of 2019. 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 such period.

As part of the Ultragenyx Agreement and related amendments, Ultragenyx has paid $27.9 million in upfront fees, exclusivity extension fees and additional consideration. Ultragenyx also reimburses the Company for all internal and external development costs incurred. Pursuant to the Ultragenyx Agreement, Ultragenyx is required to make additional payments upon exercise of the Ultragenyx expansion option or exclusivity extension (if any) and if Ultragenyx achieves certain, clinical, regulatory and sales milestones, then the Company is eligible to receive royalty payments. 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 and ranges from $0.5 million to $1.5 million. During the fourth quarter of 2020, Ultragenyx exercised its option to move forward with Preclinical Candidate Designation for its development target, Glycogen Storage Disease III, and paid an option fee to the Company of $0.5 million.

The current potential development, regulatory and commercial milestone payments for the existing development targets as of March 31, 2021 are $138.0 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 March 31, 2021, Ultragenyx has not yet reached the clinical phase of the contract.

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. Along with the equity purchase, Ultragenyx received an option to purchase 0.6 million additional shares of common stock at $16.0 per share. In May 2020, the option was exercised.

The consideration received from Ultragenyx as a result of Amendment 3 was equal to $30.0 million and was 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. 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 were initially restricted for up to two years. These restrictions have since expired.

In evaluating the Ultragenyx Agreement in accordance with ASC Topic 606, the Company concluded that the contract counterparty, Ultragenyx, is a customer. The Company has identified the following promised goods/services as part of the initial agreement and subsequent amendments: (i) research services, (ii) license to use Arcturus technology, (iii) exclusivity and (iv) participation in a 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 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.

As of March 31, 2021, the transaction price included the upfront consideration received, option payments, exclusivity extension payments and additional consideration received pursuant to Amendment 3. The Company recognizes the reimbursement of labor and expenses as costs are incurred and 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 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.

Amendment 3 was deemed a contract modification and accounted for as part of the original Ultragenyx Agreement and the Company recorded a cumulative catch-up adjustment of $1.1 million on the modification date. The transaction price is 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. Total deferred revenue at March 31, 2021 and December 31, 2020 from Ultragenyx was $8.3 million and $9.2 million, respectively.

Collaboration Partner - CureVac

In January 2018, the Company entered into a Development and Option Agreement (the “Development and Option Agreement”) with CureVac AG (“CureVac”). Under the terms of the Development and Option Agreement, the parties 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 LUNAR delivery technology (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 (as 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 eight years (which was subsequently amended, as discussed below), the Development and Option Agreement also includes an option to extend the term on an annual basis for up to three years, subject to payment by CureVac to Arcturus of a non-refundable annual extension fee. The Development and Option Agreement includes potential milestone payments from CureVac to the Company for selected targets. The current potential milestone payments for the remaining targets as of March 31, 2021 are $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 March 31, 2021, CureVac has not yet reached the clinical phase of the contract. Pursuant to a May 2018 amendment to the Development and Option Agreement (and 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 as of August 4, 2019, and the re-assumption by the Company of the worldwide rights thereto. As a result, Arcturus reassumed 100% global rights for clinical development candidate ARCT-810, a mRNA drug to treat OTC deficiency.

On July 26, 2019, the Company entered into an amendment ("CureVac Amendment") to its Development and Option Agreement with CureVac (as amended, the "Development and Option Agreement"), pursuant to which the Company and CureVac agreed to shorten the time period during which CureVac may select potential targets to be licensed from the Company from eight years to four years, and to reduce the overall number of maximum targets that may be reserved and licensed.

In connection with the July 2019 CureVac Amendment, the Company and CureVac also entered into a Termination Agreement (the "Termination Agreement") terminating the January 1, 2018 Co-Development Agreement between the Company and CureVac. Pursuant to the Termination Agreement, CureVac agreed to make a one-time payment to Arcturus in the amount of $4.0 million, which was made in July 2019.

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 has identified the following promised goods/services as part of the initial agreement with CureVac and subsequent amendments: (i) research services, (ii) license to use Arcturus technology, (iii) exclusivity and (iv) participation in a 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.

As of March 31, 2021, the transaction price included the upfront consideration received. The Company recognizes the reimbursement of labor and expenses as costs are incurred and 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. For the three months ended March 31, 2021, no adjustments were made to the transaction price.

The upfront consideration 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 remaining 28 month contractual term as of March 31, 2021. As a result of Amendment 3, the Company recorded a cumulative catch up adjustment of $0.4 million on the modification date, July 26, 2019. Total deferred revenue as of March 31, 2021 and December 31, 2020 for CureVac was $2.1 million and $2.3 million, respectively.

Other Agreements

Other Collaboration Revenue

The remaining revenue from smaller collaboration agreements and material transaction agreements primarily relates to the agreement with Millennium Pharmaceuticals, Inc., a wholly owned subsidiary of Takeda Pharmaceutical Company Limited ("Takeda"). Total deferred revenue as of March 31, 2021 and December 31, 2020 for Takeda was $0.3 million and $0.4 million, respectively. The current agreement was entered into on March 18, 2019 and is expected to be completed during fiscal year 2021.

Israeli Ministry of Health

On August 17, 2020, the Company entered into an agreement with the Israeli Ministry of Health ("MOH") to supply the Company's COVID-19 vaccine candidate to Israel (the "Israel Supply Agreement") subject to certain conditions, including applicable regulatory approvals. In October 2020, and in association with the Israel Supply Agreement, the Company received a non-refundable payment of $12.5 million from the MOH which is included in deferred revenue as of March 31, 2021. This payment of $12.5 million is associated with a specified clinical trial milestone and serves as an initial reserve payment for a specified number of doses of the LUNAR-COV19 vaccine candidate pursuant to the Israel Supply Agreement. As a result of the making of this payment, the MOH became bound to purchase an initial quantity of 500,000 reserved vaccine doses, as set forth in and subject to the terms and conditions of the Israel Supply Agreement.

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 March 31, 2021 and December 31, 2020, all assets measured at fair value on a recurring basis consisted of cash equivalents and 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

Property and equipment, net balances as of March 31, 2021 and December 31, 2020 consisted of the following:

(in thousands)	March 31, 2021	December 31, 2020
Research equipment	$ 5,895	$ 5,539
Computers and software	284	284
Office equipment and furniture	574	574
Leasehold improvements	44	44
Total	6,797	6,441
Less accumulated depreciation and amortization	(3,370)	(3,063)
Property and equipment, net	$ 3,427	$ 3,378

Depreciation and amortization expense was $0.3 million and $0.2 million for the three months ended March 31, 2021 and 2020, respectively.

Accrued liabilities consisted of the following as of March 31, 2021 and December 31, 2020:

(in thousands)	March 31, 2021	December 31, 2020
Accrued compensation	$ 3,834	$ 2,097
Cystic Fibrosis Foundation Liability (Note 9)	5,913	6,585
Singapore Economic Development Board liability	—	1,761
Current portion of operating lease liability	1,443	1,630
Current portion of long-term debt	3,125	1,250
Clinical accruals	7,217	4,067
Other accrued research and development expenses	8,268	3,249
Total	$ 29,800	$ 20,639

Note 5. Debt

Manufacturing Supply Agreement

On November 7, 2020, the Company's wholly-owned subsidiary, Arcturus Therapeutics, Inc., entered into a Manufacturing Support Agreement (the "Support Agreement") with the Economic Development Board of the Republic of Singapore (the "EDB"). Pursuant to the Support Agreement, the EDB agreed to make a term loan of S$62.1 million to the Company, subject to the satisfaction of customary deliveries, to support the manufacture of the LUNAR-COV19 vaccine candidate (the "Singapore Loan"). The Singapore Loan and the related side letter includes certain loan covenants requiring (i) unused funds as of June 30, 2021 to be subsequently returned within thirty days, subject to the agreed upon extension of the reconciliation date, (ii) the Company to provide a quarterly reconciliation report within forty-five days of each financial quarter end, (iii) an external audit to be completed by September 26, 2021, (iv) the Company to deliver 10 grams of LUNAR-COV19 vaccine candidate suitable for use in a phase 3 trial in two shipments with a partial shipment by June 30, 2021 and a remaining shipment by September 30, 2021, (v) the Company to provide EDB with a right of first refusal on GMP manufacturing slots of the LUNAR-COV19 vaccine candidate up to an agreed-upon maximum amount, (vi) and the obligation to repay the Singapore Loan will be secured by an interest in the raw materials and manufacturing equipment purchased by the Company with the funds from the Singapore Loan in form and substance satisfactory to the EDB in its sole discretion. The Company elected to borrow the full amount available under the Support Agreement of S$62.1 million on January 29, 2021.

The Singapore Loan accrues interest at a rate of 4.5% per anum calculated on a daily basis. Subject to certain exceptions, the Singapore Loan is intended to be a limited recourse loan that will be repaid solely through a royalty payment of 10% of net sales proceeds of the LUNAR-COV19 vaccine candidate, up to the amount of the outstanding principal and interest under the Singapore Loan. However, all unpaid principal and interest under the Singapore Loan will be due and payable five years after draw date, if net sales of the LUNAR-COV19 vaccine exceed a certain minimum threshold during this five year period or the Company obtains clearance to sell the vaccine in specified jurisdictions. Unpaid principal and interest under the Singapore Loan will also become due and payable upon an event of default under the Support Agreement. The first vaccine sales, including the amount of net sales, shall be reported to EDB within 10 days of delivery and quarterly reports of aggregate vaccine sales, including net sales proceeds shall be provided within 30 days after quarter end.

The Singapore Loan is forgivable if the Company has not obtained regulatory approval by the final repayment date and net sales of LUNAR-COV19 are less than $100 million. If, any portion of the Singapore Loan is required to be forgiven pursuant to the terms of the Support Agreement, the EDB has the right to take ownership of certain raw materials and equipment that were purchased by the Company with proceeds of the Singapore Loan (the "Specified Assets"). The Company entered into a security agreement (the "Security Agreement") for the benefit of the EDB to provide that repayment of the Singapore Loan and related obligations are secured by a lien on the Specified Assets.

In connection with the entry into the Support Agreement, the Company entered into a consent agreement with Western Alliance Bank (the "Bank") and an amendment to the Loan and Security Agreement, dated as of October 12, 2018, between Western Alliance Bank and the Company (the "Loan"), to exclude the Specified Assets from Western Alliance Bank's lien on certain assets of the Company.

The Singapore Loan was initially recorded as long-term debt at $46.6 million, the amount of cash proceeds at the time the Company received the funding. As of March 31, 2021, the debt balance was adjusted to reflect the current exchange rate resulting in a decreased debt balance of $46.2 million and a foreign currency transaction gain of $0.4 million. For the three months ended March 31, 2021, the Company recorded interest expense and a corresponding liability of $0.4 million. As of March 31, 2021, the Company was in compliance with all covenants under the Singapore Loan.

Long-term debt with Western Alliance Bank

On October 12, 2018, Arcturus Therapeutics, Inc. entered into the Loan with the Bank, whereby it received $10.0 million.

The Loan is collateralized by all of the assets of Arcturus Therapeutics, Inc., 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 Arcturus Therapeutics, Inc.'s ability to dispose of assets, merge with or acquire other entities, incur indebtedness and make distributions to holders of its capital stock. In addition, Arcturus Therapeutics, Inc. is required to maintain at least 100% of its consolidated, unrestricted cash, or $15.0 million, whichever is lower, with the Bank.

On October 30, 2019, Arcturus Therapeutics, Inc. and the Bank entered into a Third Amendment (the "Third Amendment") to the Loan (as amended, the "Loan Agreement").

Pursuant to the amendment, the Bank agreed to make a term loan to Arcturus Therapeutics, Inc. on October 30, 2019, in the amount of $15.0 million (the "Term Loan"). The resulting net increase in the indebtedness of Arcturus Therapeutics, Inc. was $5.0 million. The Term Loan bears interest at a floating rate ranging from 1.25% to 2.75% above the prime rate. The amendment further

provides that the Term Loan has a maturity date of October 30, 2023. Arcturus Therapeutics, Inc. will make monthly payments of interest only until October 1, 2021.

Arcturus Therapeutics, Inc. paid a loan origination fee of $54,000 which was recorded as a debt discount along with the remaining loan origination fee from the Loan and is being accreted over the term of the Term Loan. In addition, Arcturus Therapeutics, Inc. is required to pay a fee of $525,000 upon certain change of control events.

The Term Loan may be prepaid in full at any time, subject to a prepayment fee ranging from 0.50% to 2.00% of the prepaid principal amount depending upon the date of the prepayment.

Upon maturity or prepayment (as previously discussed), Arcturus Therapeutics, Inc. will be required to pay a 2% fee as a result of the FDA's approval to proceed with the Company's LUNAR-OTC program based on its IND submission. Such fee is accreted to the long-term debt balance using the effective interest method over the term of the Loan Agreement.

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 Agreement. As of March 31, 2021, the Company was in compliance with all covenants under the Loan Agreement.

Principal payments, including the final payment due at repayment, on the long-term debt are as follows as of March 31, 2020:

2021	$	1,250,000
2022		7,500,000
2023		6,550,000
Total	$	15,300,000

The Company recognized interest expense related to its long-term debt of $0.2 million and $0.3 million during the quarters ended March 31, 2021 and 2020, respectively

Note 6. Stockholders' Equity

Alexion Pharmaceuticals License Agreement

On February 17, 2021, the Company entered into an exclusive license agreement with Alexion Pharmaceuticals, Inc. ("Alexion") pursuant to which Alexion granted to the Company an exclusive, worldwide license to exploit certain specified Alexion patent applications. In accordance with the terms of the license agreement, and in exchange for the license, the Company issued 74,713 shares of its common stock to Alexion on February 19, 2021 valued at approximately $5.0 million. The number of shares issued under the agreement was calculated by dividing (i) five million dollars ($5.0 million) by (ii) the volume-weighted average price per share of the Company's common stock on the Nasdaq Global Market for the thirty (30) trading days immediately preceding the Effective Date (rounded to the nearest whole share). The Company recorded the transaction as an asset purchase as management concluded that all of the value received was related to a single identifiable asset. Further, the Company concluded that there was no alternative future use for the asset and recorded a charge at the closing of the transaction for the full $5.0 million value assigned to the shares issued in connection with the license agreement. This non-cash charge was recorded as acquired in-process research and development expense in the statements of operations and comprehensive loss for the quarter ended March 31, 2021.

Net Loss per Share

Dilutive securities that were not included in the calculation of diluted net loss per share for the three months ended March 31, 2021 and 2020 as they were anti-dilutive totaled 1,320,390 and 316,957, respectively.

For the three months ended March 31, 2020, the calculation of the weighted-average number of shares outstanding excludes 622,667 unvested restricted shares of common stock. There were no unvested restricted shares for the three months ended March 31, 2021.

Note 7. Share-Based Compensation

In June 2020, the stockholders of the Company approved an increase to the number of shares authorized for use in making awards under the 2019 Omnibus Equity Incentive Plan (the "2019 Plan") by 2,400,000 shares to 5,000,000. Accordingly, as of March 31, 2021, a total of 968,095 shares remain available for future issuance under the 2019 Plan, subject to the terms of the 2019 Plan.

Employee Stock Purchase Plan

In June 2020, the stockholders of the Company approved the 2020 Employee Stock Purchase Plan ("2020 Plan") which provides for 600,000 shares of Company common stock reserved for future issuance. The first accumulation period under the 2020 Plan commenced on August 17, 2020.

Under the 2020 Plan, eligible employees may purchase shares of the Company's common stock at a discount annually, subject to a maximum of $25,000 per year. The discounted purchase price is equal to the lower of 85% of (i) the market value per share of the common stock on the first day of the accumulation period or (ii) the market value per share of common stock on the purchase date. Share-based compensation expense recognized under the ESPP was $0.1 million for the three months ended March 31, 2021.

Stock Options

Share-based compensation expense included in the Company's condensed consolidated statements of operations and comprehensive loss for the three months ended March 31, 2021 and 2020 were:

	For the Three Months Ended March 31,	
(in thousands)	**2021**	**2020**
Research and development	$ 3,246	$ 266
General and administrative	3,741	583
Total	$ 6,987	$ 849

Note 8. Income Taxes

The Company is subject to taxation in the United States and various states. The Company computes its quarterly income tax provision by using a forecasted annual effective tax rate and adjusts for any discrete items arising during the quarter. The primary difference between the effective tax rate and the federal statutory tax rate relates to the valuation allowances on the Company's net operating losses.

For the three months ended March 31, 2021, the Company recorded no income tax expense. No tax benefit was provided for losses incurred in United States because those losses are offset by a full valuation allowance.

Note 9. Commitments and Contingencies

COVID-19 Vaccine Development

On March 4, 2020, the Company was awarded a grant ("Grant 1") from the Singapore EDB to support the co-development of a potential COVID-19 vaccine with the Duke-NUS Medical School. The Grant provides for up to S$14.0 million (approximately US$10.0 million using the exchange rate at the time the grant contract was entered into) in grants to support the development of the vaccine. The Company entered into an amendment to the Grant on September 24, 2020 to update certain delivery and milestone timelines. The Grant has been paid in full by the EDB as a result of the achievement of certain milestones related to the progress of the development of the vaccine, as set forth in the award agreement. The funds received have been recognized as contra research and development expense in proportion to the percentage covered by the EDB of the overall budget. The Company is liable for certain expenses during the program and is also subject to certain conditions including the completion of an external audit within 183 days of the conclusion of the claim period on February 20, 2021, or August 22, 2021, and delivery of 10 grams of LUNAR-COV19 vaccine candidate suitable for use in a phase 3 trial in two shipments with a partial shipment by June 30, 2021 and a remaining shipment by September 30, 2021. Additionally, the Company is required to pay an agreed upon royalty rate to Duke-NUS on future net sales of the LUNAR-COV19 vaccine candidate in markets or jurisdictions outside of Singapore. For the three months ended March 31, 2021 and 2020, the Company recognized $1.3 million and $0.5 million, respectively, of contra expense for Grant 1. At March 31, 2021, no amount remained in accrued expenses.

On October 2, 2020, the Company was awarded another grant ("Grant 2") from the Singapore EDB to support the further development of a potential COVID-19 vaccine. The grant provides for up to S$9.3 million (approximately US$6.7 million) to support the development of the vaccine candidate for costs incurred in Singapore subject to certain conditions including (i) completing an external audit within 183 days from March 31, 2021, or September 30, 2021, (ii) delivering 10 grams of LUNAR-COV19 vaccine candidate suitable for use in a phase 3 trial in two shipments with a partial shipment by June 30, 2021 and a remaining shipment by September 30, 2021 and (iii) creating an entity in Singapore which was completed during the fourth quarter of 2020. The grant will be paid in two installments upon the achievement of certain milestones related to the progress of the development of the vaccine candidate. The Company received the first installment of $3.6 million in the fourth quarter of 2020. The funds received are recognized as contra research and development expense as costs are incurred. For the three months ended March 31, 2021, the Company recognized $0.5 million, the remaining amount of the first installment, as contra expense for Grant 2. The Company is currently in the process of negotiating amendments to Grant 1 and Grant 2 with the Singapore EDB.

Cystic Fibrosis Foundation Agreement

On August 1, 2019, the Company amended its Development Program Letter Agreement, dated May 16, 2017 and as amended July 13, 2018, with the Cystic Fibrosis Foundation ("CFF"). Pursuant to the amendment, (i) CFF increased the amount it will award to advance LUNAR-CF to $15.0 million from approximately $3.2 million, (ii) the Company will provide $5.0 million in matching funds for remaining budgeted costs and (iii) the related disbursement schedule from CFF to Arcturus was modified such that (a) $4.0 million was disbursed upon execution of the CFF Amendment, (b) $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 (c) the last payment of $3.0 million less the prior award previously paid out, equaling approximately $2.3 million, will be disbursed upon Arcturus Therapeutics, Inc. invoicing CFF to meet good manufacturing practices and opening an Investigational New Drug ("IND") application. The funds received from CFF will be recognized as contra research and development expense in proportion to the percentage covered by CFF of the overall budget. For the three months ended March 31, 2021 and 2020, the Company recognized $0.6 million and $2.0 million, respectively, of contra expense with $6.0 million remaining in accrued expenses.

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 through March 2025. 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 received 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.

In February 2020, the Company entered into a non-cancellable operating lease agreement for office space near its current headquarters. The lease extended for 13 months from the commencement date and included a right to extend the lease for one twelve-month period. In February 2021, the Company opted to extend the lease through March 2025 to coincide with the lease term of the Company's headquarters.

In February 2021, the Company entered into a third non-cancellable operating lease agreement for office space near its current headquarters. The lease extends for 12 months from the commencement date with monthly base rent of approximately $11,000.

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 March 31, 2021, the payments of the operating lease liability were as follows:

(in thousands)	Remaining Lease Payments
2021 (remaining)	$ 1,534
2022	1,987
2023	2,185
2024	2,250
Thereafter	521
Total remaining lease payments	8,477
Less: imputed interest	(1,324)
Total operating lease liabilities	$ 7,153
Weighted-average remaining lease term	4 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 $0.4 million and $0.4 million for the three months ended March 31, 2021 and 2020, respectively.

Note 10. Related Party Transactions

Ultragenyx

On June 17, 2019, Arcturus and Ultragenyx executed Amendment 3 to the Ultragenyx Agreement. Pursuant to the amended Ultragenyx Agreement, the Company also granted Ultragenyx a two-year option to purchase up to 600,000 additional shares of common stock at a price of $16.00 per share. Ultragenyx exercised the option in May 2020, and as a result, owns 8.4% of the outstanding common stock of the Company as of March 31, 2021. For both quarters ended March 31, 2021 and 2020, the Company recognized revenue of $0.9 million related to the Ultragenyx Agreement. As of March 31, 2021 and 2020, the Company holds accounts receivable balances of negligible amounts related to the Ultragenyx Agreement.

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 Vallon Pharmaceuticals, Inc. (“Vallon”) in consideration for the sale of the ADAIR technology. The Company has no requirement to invest further in Vallon. Vallon completed an initial public offering and began trading on The Nasdaq Stock Market under the ticker “VLON” in February 2021. Immediately after this offering, Arcturus owned 843,750 shares of Vallon, or approximately 12%. Based on the Company’s ownership and the Vallon board of directors seat held by an executive of the Company, the Company has the ability to exercise significant influence over the operating and financial policies of Vallon; therefore, the Company accounts for this investment as an equity-method investment. The Company accounts for its share of the earnings or losses of the investee with a reporting lag of three months, as the financial statements of the investee are not completed on a basis that is sufficient for the Company to apply the equity method on a current basis. The offering was at a share price of $8.00, greater than the initial investment which resulted in the Company recording a gain in its equity-method investment. The gain has been offset by losses incurred by Vallon through December 31, 2020. For the three months ended March 31, 2021, the gain recorded by the Company was $1.2 million.

Note 11. Subsequent Events

In April 2021, the Company’s wholly-owned subsidiary, Arcturus Therapeutics, Inc., and Axcelead, Inc., a company existing under the laws of Japan (“Axcelead”), formed a joint venture entity, named Arcalis, Inc. (“JV Entity”), which operates as a corporation under the laws of Japan. Axcelead is an integrated drug discovery solutions provider to the pharmaceutical industry in Japan, having succeeded to a portion of the drug discovery research department of Takeda Pharmaceutical Company Limited in July 1, 2017. The goal of the joint venture entity is to be a contract development and manufacturing organization focused on mRNA manufacturing that would provide manufacturing services to the Company and also to third parties. The joint venture includes a shareholders agreement setting forth initial funding of the JV Entity and rights of the shareholders, including certain approval rights of Arcturus Therapeutics, Inc. As part of the joint venture Arcturus Therapeutics, Inc. entered into a License and Technology Transfer Agreement with the JV Entity, pursuant to which Arcturus Therapeutics, Inc. grants to JV Entity a nonexclusive license to certain intellectual property for use at the JV Entity’s facilities, and obligates Arcturus Therapeutics, Inc. to conduct certain technology transfer activities.

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-month period ended March 31, 2021. Unless otherwise specified herein, references to the "Company," "Arcturus," "we," "our" and "us" mean Arcturus Therapeutics Holdings Inc. and its consolidated subsidiaries. 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, 2020 (the "2020 Annual Report"), which was filed with the U.S. Securities and Exchange Commission (the "Commission") on March 1, 2021. Unless otherwise defined herein, capitalized words and expressions used herein shall have the same meanings ascribed to them in the 2020 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.

Overview

Arcturus is a global clinical-stage messenger RNA medicines company focused on the development of infectious disease vaccines and significant opportunities within liver and respiratory rare diseases. In addition to our mRNA platform, our proprietary lipid nanoparticle delivery system, LUNAR, has the potential to enable multiple nucleic acid medicines, and our proprietary STARR technology has the potential to provide longer-lasting RNA and sustained protein expression.

Our 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. We believe that the versatility of our platform to target multiple tissues, its compatibility with various nucleic acid therapeutics, and our expertise in developing scalable manufacturing processes put us in a good position to deliver on the next generation of nucleic medicines.

In August 2020, we announced the dosing of all subjects in the first cohort of the Phase 1 clinical study of our LUNAR-COV19 vaccine candidate (ARCT-021). The study was conducted with CTI Clinical Trial and Consulting Services, a global CRO, and in collaboration with Duke-NUS Medical School in Singapore. In December 2020, we announced that we received approval from the Singapore HSA to proceed with a Phase 2 clinical study of ARCT-021. In January 2021, we announced that we received FDA allowance to proceed with a Phase 2 study of ARCT-021 in the United States. In March 2021, we completed enrollment of the Phase 2 study, with 580 subjects randomized and dosed. We have completed two interim analyses of the Phase 2 safety data, which have been reviewed by the Data and Safety Monitoring Board and support continuation of the Phase 2 trial without amendment. In addition, interim immunogenicity data demonstrate >90% seroconversion for IgG antibodies binding the full-length spike protein following a single 5µg dose. These favorable safety and single-dose immunogenicity data support the rationale to initiate a Phase 3 efficacy study and we are in discussions with multiple regulatory authorities.

In November 2020, we completed our ARCT-810 Phase 1, dose escalation study in healthy subjects, at doses up to 0.4 mg/kg.

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 March 31, 2021, we had an accumulated deficit of $200.2 million.

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, 2020. 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 and government agencies that may contain upfront payments, license fees for research and development arrangements, research and development funding, milestone payments, option exercise and exclusivity fees and royalties on future sales. The following table summarizes our total revenues for the periods indicated (in thousands):

	Three Months Ended March 31,		2020 to 2021	
(Dollars in thousands)	**2021**	**2020**	**$ change**	**% change**
Collaboration revenue	$ 2,127	$ 2,646	$ (519)	-19.6%

Collaboration revenue decreased by $0.5 million during the three months ended March 31, 2021 as compared to the three months ended March 31, 2020. The decrease in collaboration revenue primarily relates to decreased revenue from our collaboration with Takeda.

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

	Three Months Ended March 31,		2020 to 2021	
(Dollars in thousands)	**2021**	**2020**	**$ change**	**% change**
Operating expenses:				
Research and development, net	$ 50,050	$ 7,917	$ 42,133	*
General and administrative	9,743	4,191	5,552	*
Total	$ 59,793	$ 12,108	$ 47,685	*

** Greater than 100%*

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

	Three Months Ended March 31,		2020 to 2021	
(Dollars in thousands)	**2021**	**2020**	**$ change**	**% change**
External pipeline development expenses:				
LUNAR-OTC	$ 3,086	$ 3,692	$ (606)	-16.4%
LUNAR-CF, net	1,404	336	1,068	*
LUNAR-COVID, net	29,312	131	29,181	*
Discovery technologies	463	481	(18)	-3.7%
External platform development expenses:				
Partnered discovery technologies	7,845	371	7,474	*
Total development expenses	$ 42,110	$ 5,011	$ 37,099	*
Personnel related expenses	$ 6,909	$ 2,203	$ 4,706	*
Facilities and equipment expenses	1,031	703	328	46.7%
Total research and development expenses, net	$ 50,050	$ 7,917	$ 42,133	*

** Greater than 100%*

Research and Development Expenses, net

Our research and development expenses consist primarily of external manufacturing costs, in-vivo research studies performed by contract research organizations, clinical and regulatory consultants, personnel related expenses and laboratory supplies related to conducting research and development activities. Costs to acquire and manufacture pre-launch inventory, mRNA supply for preclinical studies and clinical trials are recognized and included in external pipeline development expenses for the specific program.

LUNAR-OTC expenses decreased by $0.6 million, from $3.6 million for the three months ended March 31, 2020 to $3.0 million for the three months ended March 31, 2021. The decrease was due to non-recurring expenses in 2020 in preparation for submitting an IND for LUNAR-OTC.

LUNAR-CF expenses increased by $1.1 million, from $0.3 million for the three months ended March 31, 2020 to $1.4 million for the three months ended March 31, 2021. The current quarter amount was partially offset with funds awarded by the CFF. The increase in LUNAR-CF expenses was due primarily to increased research and development cost incurred in association with the amendment to the CFF Agreement executed in July 2019, and we expect that our development efforts and associated costs will increase over the next several years as the LUNAR-CF program moves toward expected CTA submission in the fourth quarter of 2021.

LUNAR-COV19 expenses increased by $29.2 million, from $0.1 million for the three months ended March 31, 2020 to $29.3 million for the three months ended March 31, 2021. The increase is due to the fact that the LUNAR-COV19 program did not commence until late in the first quarter of 2020 and is now in clinical trials. Expenses related to pre-launch inventory represent $16.3 million of the increase. We expect that the program costs and pre-launch inventory costs will continue to increase as clinical trials progress and we advance program development.

Partnered discovery technologies represents our efforts to expand our product pipeline and are expected to continually increase in the near future. Partnered discovery technologies increased by $7.5 million from $0.4 million for the three months ended March 31, 2021 2020 to $7.9 million for the three months ended March 31, 2021. The increase is primarily due to (i) the acquisition of an exclusive license from Alexion Pharmaceuticals to certain intellectual property for approximately $5.0 million of Company common stock and (ii) the addition of several new discovery programs during 2020.

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 and was relatively flat year over year. We expect partnered discovery technologies expenses to fluctuate based on the needs of our collaboration partners.

Personnel related expenses, net of funds received from CFF and the Singapore EDB, for the three months ended March 31, 2021 increased by $4.7 million as compared to the prior period in 2020. This increase was associated with increased headcount necessary to advance our external pipeline and platform efforts. The increase in personnel related expenses during the period ended March 31, 2021 as compared to the period ended March 31, 2020 was primarily due to increased share-based compensation expense.

Facilities and equipment expenses increased by $0.4 million during the three months ended March 31, 2021 as compared to the three months ended March 31, 2020. The increase resulted primarily from higher rent and related costs associated with an additional lease that we entered into in February 2020.

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.

General and administrative expenses for the three months ended March 31, 2021 as compared to the three months ended March 31, 2020 increased by $5.6 million. The increase resulted primarily from personnel expense due to increased headcount and increased share-based compensation expense.

Finance (expense) income, net

	Three Months Ended March 31,		2020 to 2021	
(Dollars in thousands)	**2021**	**2020**	**$ change**	**% change**
Interest income	$ 188	$ 102	$ 86	84.3%
Interest expense	(546)	(254)	(292)	*
Total	$ (358)	$ (152)	$ (206)	*

** Greater than 100%*

Interest income is generated on cash and cash equivalents, and increased for the three months ended March 31, 2021 as compared to the prior year period as a result of the increased cash and cash equivalents balance. Interest expense was incurred in conjunction with our Loan and Security Agreement with Western Alliance Bank and the Singapore Loan, and increased for the three months ended March 31, 2021 as compared to the prior year period primarily as a result of additional accrued interest expense related to the Singapore Loan that was funded in January 2021.

Other income and expense

Other income and expense items relate to gain and loss from foreign currency and equity-method investment. We recorded a gain of $0.4 million for foreign currency transactions under the Singapore Loan. Additionally, we recorded a gain of $1.2 million in connection with our equity-method investment in Vallon Pharmaceuticals, Inc., of which we hold approximately 12%.

Off-balance sheet arrangements

Through March 31, 2021, we have not entered into and did not have any relationships with unconsolidated entities or financial collaborations, such as entities often referred to as structured finance or special purpose entities, established for the purpose of facilitating off-balance sheet arrangements or other contractually narrow or limited purposes.

Liquidity and Capital Resources

From the Company's inception through the quarter ended March 31, 2021, the Company has funded its operations principally with the proceeds from the sale of capital stock, long-term debt and revenues earned through collaboration agreements. At March 31, 2021, we had $466.9 million in unrestricted cash and cash equivalents.

On October 12, 2018, we entered into a Loan and Security Agreement with Western Alliance Bank whereby we received gross proceeds of $10.0 million under a long-term debt agreement (the "Loan").

On October 30, 2019, we and the Bank entered into a Third Amendment (the "Third Amendment") to the Loan and Security Agreement dated as of October 12, 2018 (as amended, the "Loan Agreement").

Pursuant to the Third Amendment, the Bank agreed to make a term loan to us on October 30, 2019, in the amount of $15.0 million (the "Term Loan"). The resulting net increase in the indebtedness of us was $5.0 million. The Term Loan bears interest at a floating rate ranging from 1.25% to 2.75% above the prime rate. The amendment further provides that the Term Loan has a maturity date of October 30, 2023. We shall make monthly payments of interest only until the interest-only end date of October 1, 2021 and thereafter shall make monthly payments of principal and interest during a 24-month amortization period. Upon maturity or prepayment, we will be required to pay a 2% fee as a result of the FDA's approval to proceed with the Company's LUNAR-OTC (ARCT-810) program based on its IND submission.

On March 4, 2020, we were awarded a grant (the "Grant") from the Economic Development Board of the Republic of Singapore (the "EDB") to support the co-development of a potential COVID-19 vaccine with the Duke-NUS Medical School. The Grant provides for up to S$14.0 million (approximately US$10.0 million using the exchange rate at the time the grant contract was entered into) in grants to support the development of the vaccine. We entered into an amendment to the Grant on September 24, 2020 to update certain delivery and milestone timelines. The Grant has been paid in full by the EDB as a result of the achievement of certain milestones related to the progress of the development of the vaccine, as set forth in the award agreement. The funds received have been recognized as contra research and development expense in proportion to the percentage covered by the EDB of the overall budget. We are liable for certain expenses during the program and are also subject to certain conditions, including (i) completing an external audit within 183 days of the conclusion of the claim period on February 20, 2021, or August 22, 2021, and (ii) delivering 10 grams of LUNAR-COV19 vaccine candidate suitable for use in a phase 3 trial in two shipments with a partial shipment by June 30, 2021 and a remaining shipment by September 30, 2021. Additionally, we are required to pay an agreed upon royalty rate to Duke-NUS on future net sales of the LUNAR-COV19 vaccine candidate in markets or jurisdictions outside of Singapore.

On October 2, 2020, we were awarded another grant from the EDB to support the further development of a potential COVID-19 vaccine. The grant provides for up to S$9.3 million (approximately US$6.7 million) to support the development of the vaccine candidate for costs incurred in Singapore subject to certain conditions including (i) completing an external audit within 183 days from March 31, 2021, or September 30, 2021, (ii) delivering 10 grams of LUNAR-COV19 vaccine candidate suitable for use in a phase 3 trial in two shipments with a partial shipment by June 30, 2021 and a remaining shipment by September 30, 2021 and (iii) creating an entity in Singapore which was completed during the fourth quarter of 2020. The grant will be paid in two installments upon the achievement of certain milestones related to the progress of the development of the vaccine candidate. We received the first installment of $3.6 million in the fourth quarter of 2020. We are currently in the process of negotiating amendments to the grants with the EDB.

On November 7, 2020, we entered into a Manufacturing Support Agreement (the "Support Agreement") with the EDB. Pursuant to the Support Agreement, the EDB agreed to make a term loan of S$62.1 million, subject to the satisfaction of customary deliveries, to support the manufacture of the LUNAR-COV19 vaccine candidate (the "Singapore Loan"). The Singapore Loan and the related side letter includes certain loan covenants requiring (i) unused funds as of June 30, 2021 to be subsequently returned within thirty days, subject to the agreed upon extension of the reconciliation date, (ii) us to provide a quarterly reconciliation report within forty-five days of each financial quarter end, (iii) an external audit to be completed by September 26, 2021, (iv) us to deliver 10 grams of the LUNAR-COV19 vaccine candidate suitable for use in a phase 3 trial in two shipments with a partial shipment by June 30, 2021 and a remaining shipment by September 30, 2021, and (v) us to provide EDB with a right of first refusal on GMP manufacturing slots of the LUNAR-COV19 vaccine candidate up to an agreed-upon maximum amount. We elected to borrow the full amount available under the Support Agreement of S$62.1 million, or $46.6 million, as a result of applicable exchange rates, on January 29, 2021.

The Singapore Loan accrues interest at a rate of 4.5% per annum calculated on a daily basis. Subject to certain exceptions, the Singapore Loan is intended to be a limited recourse loan that will be repaid solely through a royalty payment of 10% of net sales proceeds of the LUNAR-COV19 vaccine candidate, up to the amount of the outstanding principal and interest under the Singapore Loan. However, all unpaid principal and interest under the Singapore Loan will be due and payable five years after the borrowing date, if net sales of the LUNAR-COV19 vaccine exceed a certain minimum threshold during this five year period or we obtain clearance to sell the vaccine in specified jurisdictions. Unpaid principal and interest under the Singapore Loan will also become due and payable upon an event of default under the Support Agreement. The first vaccine sales, including the amount of net sales, shall be reported to EDB within 10 days of delivery and quarterly reports of aggregate vaccine sales, including net sales proceeds shall be provided within 30 days after quarter end.

The Singapore Loan is forgivable if the Company has not obtained regulatory approval by the final repayment date and net sales of LUNAR-COV19 are less than $100 million. If any portion of the Singapore Loan is required to be forgiven pursuant to the terms of the Support Agreement, the EDB has the right to take ownership of certain raw materials and equipment that were purchased by us with proceeds of the Singapore Loan (the “Specified Assets”). We entered into a security agreement (the “Security Agreement”) for the benefit of the EDB to provide that repayment of the Singapore Loan and related obligations are secured by a lien on the Specified Assets.

In connection with the entry into the Support Agreement, we entered into a consent agreement with Western Alliance Bank and an amendment to the Loan and Security Agreement, dated as of October 12, 2018, to exclude the Specified Assets from Western Alliance Bank’s lien on certain assets of Arcturus.

A significant portion of our current cash and cash equivalents balance of $466.9 million is expected to be utilized during fiscal year 2021 to fund (i) the Phase 2 trial and anticipated Phase 3 trial of our LUNAR-COV19 vaccine candidate, (ii) the continued Phase 1 trial and anticipated Phase 2 trial of ARCT-810, our LUNAR-OTC candidate, (iii) advancing our new LUNAR-FLU program toward submission of an IND, (iv) and other programs and administrative costs.

The Phase 3 trial of our LUNAR-COV19 vaccine candidate is expected to be funded primarily or exclusively through our cash reserves. If we achieve emergency use authorization to market our LUNAR-COV19 vaccine candidate, we will need to raise additional funds through equity financing, additional debt or prepayments from potential customers, among other options, to fund commercialization of LUNAR-COV19. We anticipate that a Phase 3 trial would continue through 2021, and that we would continue to monitor subjects in the Phase 3 trial into 2022 (whether or not we would receive emergency use authorization for ARCT-021 during 2021).

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 additional 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. Our future capital requirements are difficult to forecast and will depend on many factors.

We expect to continue to incur additional losses for the foreseeable future, and we will need to raise additional debt or equity financing or enter into additional partnerships to fund development. The ability of our Company to transition to profitability is dependent on identifying and developing successful mRNA drug candidates. In the near future, if we are not able to achieve planned milestones, incur costs in excess of our forecasts, or do not meet covenant requirements of our debt, we will need to reduce discretionary spending, discontinue the development of some or all of our products, which will delay part of our development programs, all of which will have a material adverse effect on our ability to achieve our intended business objectives.

Overview

The following table shows a summary of our cash flows for the three months ended March 31, 2021 and 2020 (in thousands):

	Three Months Ended March 31,	
(Dollars in thousands)	**2021**	**2020**
Cash provided by (used in):		
Operating activities	$ (42,950)	$ (11,858)
Investing activities	(118)	(142)
Financing activities	47,012	118
Net increase (decrease) in cash, cash equivalents and restricted cash	$ 3,944	$ (11,882)

Operating Activities

Our primary use of cash is to fund operating expenses, which consist mainly of research and development and general and administrative expenditures. We have incurred significant expenses which have been partially offset by cash collected through our collaboration agreements. Cash collections under the collaboration agreements can vary from year to year depending on the terms of

the 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 used in operating activities was $42.9 million on a net loss of $56.3 million for the three months ended March 31, 2021, compared to net cash used of $11.9 million on a net loss of $9.8 million for the three months ended March 31, 2020. Adjustments for non-cash charges which includes share-based compensation expense and depreciation and amortization were $11.3 million and $1.5 million for the three months ended March 31, 2021 and 2020, respectively. Changes in working capital resulted in adjustments to operating net cash inflows of $2.1 million and outflows of $3.5 million for the three months ended March 31, 2021 and 2020, respectively. Changes in working capital for the three months ended March 31, 2021 were primarily driven by an increase in accounts payable and accrued liabilities and a decrease in prepaid expenses, partly offset by a decrease in deferred revenue. Changes in working capital for the three months ended March 31, 2020 were primarily driven by decreases in deferred revenue as well as accounts payable and accrued liabilities, and increases account receivable and prepaid expenses.

Investing Activities

Net cash used in investing activities of $0.2 million and $0.1 million for the three months ended March 31, 2021 and 2020, respectively, reflected cash used to purchase property and equipment.

Financing Activities

Net cash provided by financing activities of $47.0 million for the three months ended March 31, 2021 consisted of net proceeds from debt related to the Singapore Loan of $46.6 million and proceeds from the exercises of stock options of $0.4 million. Net cash provided by financing activities for the three months ended March 31, 2020 reflected proceeds from the exercise of stock options of $0.1 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 demonstration of safety and efficacy of our product candidates, particularly ARCT-021, in ongoing clinical trials;
- 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.

Critical Accounting Policies and Estimates

We prepare our condensed consolidated financial statements in conformity with 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, 2020.

There have been no material changes to our critical accounting policies and estimates from the information provided in Item 7, Management's Discussion and Analysis of Financial Condition and Results of Operations, included in our Annual Report on Form 10-K for the year ended December 31, 2020.

Item 3. Quantitative and Qualitative Disclosures About Market Risk.

Our primary exposure to market risk is interest income and expense sensitivity and foreign currency exchange rates. Interest income and expense sensitivity is affected by changes in the general level of interest rates in the United States. Foreign exchange market risks relate to the grants and loan from the Singapore Economic Development Board which is discussed in this Quarterly Report in "Notes to Condensed Consolidated Financial Statements, Note 1. Description of Business." When deemed appropriate, we may manage our exposure to foreign exchange market risks through the use of derivative financial instruments. We may utilize such derivative financial instruments for hedging or risk management purposes. Due to the nature of our cash and cash equivalents and our evaluation of the potential impact of foreign currency exchange rates, we believe that we are not currently subject to any material market risk exposure.

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 March 31, 2021, 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 quarterly period ended March 31, 2021 fairly 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.

On December 13, 2019, a former employee of the Company filed a complaint in San Diego County Superior Court, captioned Adonary Munoz v. Arcturus Therapeutics, Inc., et al, Case No. 37-2019-00066358-CU-PO-CTL. The lawsuit alleges sexual assault by an acquaintance of one of our employees and seeks to hold the Company liable on a number of causes of action. On January 17, 2020, a second amended complaint ("SAC") was filed seeking $30.0 million in damages, including punitive damages and damages for emotional distress. The plaintiff has agreed to stipulate to arbitration for the claims being alleged against the Company. On May 5, 2021, the parties settled the dispute, and the parties agreed to dismiss the legal proceedings. The settlement is not expected to result in any material liability to the Company as the settlement payment is covered by the Company's insurance.

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, 2020, which we strongly encourage you to review. Other than as set forth below, there have been no material changes to the risk factors described in our Annual Report on Form 10-K for the year ended December 31, 2020 filed with the SEC on March 1, 2021.

Our competitors, which have substantially greater financial, scientific and other resources than us have completed the development of and sold hundreds of millions of doses of their COVID-19 vaccine candidates, making it more difficult for us to establish ARCT-021 as a viable candidate.

A large number of vaccine manufacturers, academic institutions and other organizations currently have programs to develop COVID-19 vaccine candidates and are further along in development of their vaccine candidates. Moderna, AstraZeneca and Johnson & Johnson, and several other companies, have received emergency use authorization from the FDA or other government authorities for their COVID-19 vaccines and are already commercializing them and have vaccinated hundreds of millions of people. As more people in the United States and globally are vaccinated by COVID-19 vaccines developed by our competitors, the demand for ARCT-021 will decline. As our development may be delayed, the number of vaccinated individuals will increase and the need for our vaccine, if developed, may decline further.

We are planning a Phase 3 clinical trial for our COVID-19 vaccine candidate, ARCT-021. If we are unable to initiate the trial or generate successful results, or experience significant delays in doing so, we may be unable to market and sell a COVID-19 vaccine.

We commenced a Phase 2 trial of ARCT-021 and are in discussions with multiple regulatory authorities in different parts of the world regarding a Phase 3 trial. We anticipate that a Phase 3 trial would continue through 2021, and that we would continue to monitor subjects in the Phase 3 trial into 2022 (whether or not we receive emergency use authorization for ARCT-021 during 2021). We will need to identify additional funding sources to complete any Phase 3 trial that is commenced. The data received to date, although providing sufficient information to allow us to proceed further is not complete enough to provide conclusive evidence with respect to safety and potential efficacy of ARCT-021. In December 2020, our CTA application to proceed with our Phase 2 clinical study was accepted by the HSA and the IND for the same trial received a "safe to proceed" from the FDA. Clinical trial results are inherently uncertain, and a significant portion of our success and business prospects depend on the progress of this program. Our failure to demonstrate safety or obtain positive clinical trial results, inability to meet the expected timeline for release of data for this trial, or failure to successfully develop a single-dose vaccine could have an adverse effect on our business operations and financial condition. Furthermore, we will not have a detailed understanding of the efficacy of ARCT-021 until infection of a sufficient number of subjects in a Phase 3 trial, enrollment for which may be delayed or prevented by rollout of competing vaccines for COVID-19, competing clinical trials and the refusal of certain countries' regulatory authorities to allow placebo-controlled trials for COVID-19 vaccine candidates. We cannot be certain if we will receive approval to proceed with a Phase 3 study, when we will begin enrollment, or the nature of the protocols that may eventually be approved. If our data is not positive or is inconclusive, we may not be able to continue our studies or identify additional funding to continue the studies. No assurance can be given that the results of the trials will produce adequate results to allow us to commence or continue expected trials or that that adequate efficacy will be demonstrated such that ARCT-021 will be a viable commercial product.

If government bodies in the United States or elsewhere implement a waiver on patents on COVID-19 vaccines, there could be a significant adverse effect on our business.

On May 5, 2021, the Biden Administration announced that it supports a waiver for patents on vaccines protecting against the coronavirus. Any action by governments of the United States or other countries, or by global governmental authorities, that limit the ability of companies to enforce their patents or other technology could limit the value of the Company's intellectual property and revenue potential for the Company's product candidates.

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 Index

Exhibit Number	Description
1.1	Underwriting Agreement, dated December 7, 2020, by and among Arcturus Therapeutics Holdings Inc., Piper Sandler & Co., Guggenheim Securities, LLC and Wells Fargo Securities, LLC. Incorporated by reference to Exhibit 1.1 to Current Report on Form 8-K filed on December 8, 2020 (File No. 001-38942).
3.1	Certificate of Incorporation. Incorporated by reference to Annex B to the proxy statement/prospectus which forms part of the Registration Statement on Form S-4 filed on March 18, 2019 (File No. 333-230353).
3.2	Certificate of Amendment, dated November 25, 2020. Incorporated by reference to Exhibit 3.1 to Form 8-K filed on November 25, 2020 (File No. 001-38942).
3.3	Bylaws of Arcturus Therapeutics Holdings Inc. Incorporated by reference to Exhibit 3.2 to the Company's Registration Statement on Form S-3, filed with the SEC on May 8, 2020 (File No. 333-238139).
4.1	Description of Registrant's Securities. Incorporated by reference to Exhibit 4.1 to the Company's Annual Report on Form 10-K for the year ended December 31, 2020 filed on March 1, 2020 (File No. 001-38942).
10.1†	Form of Indemnification Agreement. Incorporated by reference to Exhibit 10.1 to the Company's Annual Report on Form 10-K for the year ended December 31, 2019 filed on March 16, 2020 (File No. 001-38942).
10.2†	Amended and Restated 2019 Omnibus Equity Incentive Plan. Incorporated by reference Exhibit 4.3 to the Registration Statement on Form S-8 filed on August 5, 2020 (File No. 001-38942).
10.3†	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 on July 27, 2018 (File No. 001-35932).
10.4**	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 on October 15, 2018 (File No. 001-35932).
10.5**	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 on October 1, 2018 (File No. 001-35932).
10.6**	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 on May 14, 2018 (File No. 001-35932).
10.7**	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 on May 14, 2018 (File No. 001-35932).
10.8**	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 on May 14, 2018 (File No. 001-35932).
10.9**	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 on May 14, 2018 (File No. 001-35932).
10.10**	Third Amendment to Research Collaboration and License Agreement, by and between Arcturus Therapeutics, Inc. and Ultragenyx Pharmaceutical Inc., effective June 18, 2019. Incorporated by reference to Exhibit 10.2 to Form 8-K filed on June 20, 2019 (File No. 001-38942).
10.11**	Letter Agreement, by and between Arcturus Therapeutics, Inc. and the Cystic Fibrosis Foundation, dated May 16, 2017. Incorporated by reference to Exhibit 4.11 to Form 20-F filed on May 14, 2018 (File No. 001-35932).
10.12**	Amendment No. 2 to Letter Agreement, by and between Arcturus Therapeutics, Inc. and the Cystic Fibrosis Foundation, dated August 1, 2019. Incorporated by reference to Exhibit 10.16 to Form 10-Q filed on August 14, 2019.

10.13**	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 on May 14, 2018 (File No. 001-35932).
10.14**	Third Amendment to Development and Option Agreement, by and between Arcturus Therapeutics, Inc. and CureVac AG, dated July 26, 2019. Incorporated by reference to Exhibit 10.20 to Form 10-Q filed on August 14, 2019 (File No. 001-38942).
10.15**	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 on May 14, 2018 (File No. 001-35932).
10.16	Termination Agreement, by and between Arcturus Therapeutics, Inc. and CureVac AG, dated July 26, 2019. Incorporated by reference to Exhibit 10.21 to Form 10-Q filed on August 14, 2019 (File No. 001-38942).
10.17**	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 on July 10, 2018 (File No. 001-35932).
10.18**	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 on May 14, 2018 (File No. 001-35932).
10.19	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 on March 18, 2019 (File No. 001-35932).
10.20**	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 on April 10, 2019 (File No. 001-35932).
10.21**	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 on March 18, 2019 (File No. 001-35932).
10.22	Lease Agreement, by and between Arcturus Therapeutics, Inc. and ARE-SD Region No. 44, LLC, dated October 4, 2017. Incorporated by reference to Exhibit 4.6 to Form 20-F filed on May 14, 2018 (File No. 001-35932).
10.23	First Amendment to Lease Agreement, by and between Arcturus Therapeutics Holdings Inc. and ARE-SD Region No. 44, LLC dated February 1, 2020. Incorporated by reference to Exhibit 10.23 to the Company's Annual Report on Form 10-K for the year ended December 31, 2019 filed on March 16, 2020 (File No. 001-38942).
10.24**	Acceptance Letter, dated March 4, 2020, by and between Arcturus Therapeutics Holdings Inc. and the Economic Development Board of Singapore. Incorporated by reference to Exhibit 10.24 to the Company's Annual Report on Form 10-K for the year ended December 31, 2019 filed on March 16, 2020 (File No. 001-38942).
10.25**	Supply Agreement, dated August 17, 2020, by and between Arcturus Therapeutics, Inc. and the Israeli Ministry of Health. Incorporated by reference to Exhibit 10.32 to Quarterly Report on Form 10-Q filed on November 9, 2020 (File No. 001-38942).
10.26**	Manufacturing Support Agreement, dated November 7, 2020, by and between Arcturus Therapeutics Holdings Inc. and the Economic Development Board of Singapore. Incorporated by reference to Exhibit 10.33 to Quarterly Report on Form 10-Q filed on November 9, 2020 (File No. 001-38942).
10.27	Fourth Amendment to Loan and Security Agreement, dated December 1, 2020, by and between Arcturus Therapeutics, Inc. and Western Alliance Bank. Incorporated by reference to Exhibit 10.1 to Form 8-K filed on December 7, 2020 (File No. 001-38942).
10.28†	2020 Employee Stock Purchase Plan. Incorporated by reference to Exhibit 4.3 to Form S-8 filed on August 5, 2020 (File No. 001-38942).
10.29	Second Amendment to Lease, by and between Arcturus Therapeutics, Inc. and ARE-SD Region No. 44, LLC, dated November 13, 2020. Incorporated by reference to Exhibit 10.29 to the Company's Annual Report on Form 10-K for the year ended December 31, 2020 filed on March 1, 2020 (File No. 001-38942).

10.30*	Third Amendment to Lease, by and between Arcturus Therapeutics, Inc. and ARE-SD Region No. 44, LLC, dated February 25, 2021. Incorporated by reference to Exhibit 10.30 to the Company's Annual Report on Form 10-K for the year ended December 31, 2020 filed on March 1, 2020 (File No. 001-38942).
10.31	Arcturus Therapeutics Holdings Inc. Severance Policy for Executives. Incorporated by reference to Exhibit 10.1 to Current Report on Form 8-K filed on April 26, 2021 (File No. 001-38942).
31.1*	Certification by Principal Executive Officer pursuant to Rule 13a-14(a) or 15d-14(a) under the Securities Exchange Act of 1934, as amended.
31.2*	Certification by Principal Financial Officer pursuant to Rule 13a-14(a) or 15d-14(a) under the Securities Exchange Act of 1934, as amended.
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*	The following financial statements and footnotes from the Registrant's Quarterly Report on Form 10-Q for the fiscal quarter ended March 31, 2021 formatted in Inline Extensible Business Reporting Language (Inline XBRL): 101.INS Inline XBRL Instance Document - the instance document does not appear in the Interactive Data File because its XBRL tags are embedded within the Inline XBRL document 101.SCH Inline XBRL Taxonomy Extension Schema 101.CAL Inline XBRL Taxonomy Extension Calculation Linkbase 101.DEF Inline XBRL Taxonomy Extension Definition Linkbase 101.LAB Inline XBRL Taxonomy Extension Label Linkbase 101.PRE Inline XBRL Taxonomy Extension Presentation Linkbase
104	Cover Page Interactive Data File (embedded within the Inline XBRL document)

* Filed herewith.

** Certain confidential portions of this exhibit have been redacted from the publicly filed document because such portions are (i) not material and (ii) would be competitively harmful of 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: May 10, 2021

By: /s/ Andy Sassine
Andy Sassine
Chief Financial 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: May 10, 2021

By: /s/ Joseph E. Payne

Joseph E. Payne
President and Chief Executive Officer

Exhibit 31.2

CERTIFICATION OF PRINCIPAL FINANCIAL OFFICER

I, Andy 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: May 10, 2021

By: /s/ Andy Sassine

Andy 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 March 31, 2021 (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: May 10, 2021

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 March 31, 2021 (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: May 10, 2021

By: /s/ Andy Sassine

Andy Sassine
Chief Financial Officer