UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, DC 20549

FORM 10-Q

(Mark One)

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

For the quarterly period ended June 30, 2022

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: 001-38537

AVROBIO, INC.
(Exact Name of Registrant as Specified in its Charter)

Delaware	**81-0710585**
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification No.)**
100 Technology Square Sixth Floor Cambridge, MA	**02139**
(Address of principal executive offices)	**(Zip Code)**

Registrant's telephone number, including area code: (617) 914-8420

One Kendall Square
Building 300, Suite 201
Cambridge, MA 02139

(Former name, former address and former fiscal year, if changed since last report)

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, $0.0001 par value per share	**AVRO**	**Nasdaq Global Select Market**

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

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

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

Large accelerated filer	☐	Accelerated filer	☐
Non-accelerated filer	☒	Smaller reporting company	☒
		Emerging growth company	☒

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

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

As of August 2, 2022, the registrant had 43,773,896 shares of common stock, $0.0001 par value per share, outstanding.

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Summary of Risk Factors

Our business is subject to numerous risks and uncertainties that you should be aware of in evaluating our business. These risks include, but are not limited to, the following:

- We have incurred net losses since inception. We expect to incur net losses for the foreseeable future and may never achieve or maintain profitability.
- We will need additional funding, which may not be available on acceptable terms, or at all. Failure to obtain this necessary capital when needed may force us to delay, limit or terminate our product development efforts or other operations.
- Our term loan agreement contains restrictions that potentially limit our flexibility in operating our business, and we may be required to make a prepayment or repay our outstanding indebtedness earlier than we expect. In addition, as a result of the deprioritization of our Fabry program, we can no longer draw $20.0 million of term loans that were contingent upon the achievement of certain milestones related to our development of AVR-RD-01 for Fabry disease.
- Business interruptions resulting from the ongoing coronavirus disease ("COVID-19") pandemic or similar public health crises have caused and may continue to cause a disruption of the development of our product candidates and adversely impact our business.
- Our hematopoietic stem cell ("HSC") gene therapy product candidates are based on a novel technology, which makes it difficult to predict the time and cost of product candidate development and of subsequently obtaining regulatory approval.
- Our product candidates and the process for administering our product candidates may cause undesirable side effects or have other properties that could delay or prevent their regulatory approval, limit their commercial potential or result in significant negative consequences following any potential marketing approval.
- Success in preclinical studies or early clinical trials may not be indicative of results obtained in later trials.
- We may find it difficult to enroll patients in our clinical trials, which could delay or prevent us from proceeding with clinical trials of our product candidates.
- We may encounter substantial delays in our clinical trials or we may fail to demonstrate safety and efficacy to the satisfaction of applicable regulatory authorities.
- Even if we complete the necessary preclinical and clinical studies, we cannot predict when or if we will obtain regulatory approval to commercialize a product candidate and the approval may be for a narrower indication than anticipated.
- Only one of our clinical trials utilizes our plato® platform.
- We face significant competition in our industry and there can be no assurance that our product candidates, if approved, will achieve acceptance in the market over existing established therapies. In addition, our competitors may develop therapies that are more advanced or effective than ours, which may adversely affect our ability to successfully market or commercialize any of our product candidates.
- Gene therapies are novel, complex and difficult to manufacture. We could experience production problems that result in delays in our development or commercialization programs or otherwise adversely affect our business.
- We expect to rely on third parties to conduct some or all aspects of our vector production, product manufacturing, protocol development, research and preclinical and clinical testing, and these third parties may not perform satisfactorily.
- We currently rely, and expect to continue to rely, on sole source suppliers for our automated, closed cell processing system; vector supply; plasmid supply; cell culture media supply; and drug product manufacturing. In addition, we are dependent on a limited number of suppliers for some of our other components and materials used in our product candidates.
- Third-party claims of intellectual property infringement may prevent or delay our development and commercialization efforts.
- Our rights to develop and commercialize our product candidates are subject, in part, to the terms and conditions of licenses granted to us by others.

- If we experience material weaknesses or deficiencies in the future or otherwise fail to establish and maintain effective internal controls, we may be unable to produce timely and accurate financial statements, and we may conclude that our internal control over financial reporting is not effective, which could adversely impact our investors' confidence and our stock price.

The summary risk factors described above should be read together with the text of the full risk factors below, in the section entitled "Risk Factors" and the other information set forth in this Quarterly Report on Form 10-Q, including our consolidated financial statements and the related notes, as well as in other documents that we file with the Securities and Exchange Commission (the "SEC"). The risks summarized above or described in full below are not the only risks that we face. Additional risks and uncertainties not precisely known to us, or that we currently deem to be immaterial may also materially adversely affect our business, financial condition, results of operations and future growth prospects.

Note Regarding Forward-looking Statements

This Quarterly Report on Form 10-Q contains forward-looking statements which are made pursuant to the safe harbor provisions of Section 27A of the Securities Act of 1933, as amended (the "Securities Act"), and Section 21E of the Securities Exchange Act of 1934, as amended (the "Exchange Act"). These statements may be identified by such forward-looking terminology as "aims," "anticipates," "believes," "continue," "could," "designed to," "estimates," "expects," "intends," "may," "plans," "potential," "predicts," "strives," "should," or the negative of these terms or other comparable terminology. Our forward-looking statements are based on a series of expectations, assumptions, estimates and projections about our company, are not guarantees of future results or performance and involve substantial risks and uncertainty. We may not actually achieve the plans, intentions or expectations disclosed in our forward-looking statements. Actual results or events could differ materially from the plans, intentions and expectations disclosed in these forward-looking statements. Our business and our forward-looking statements involve substantial known and unknown risks and uncertainties, including the risks and uncertainties inherent in our statements regarding:

- the impact of the ongoing COVID-19 pandemic on our clinical trial programs, clinical supply and business generally, as well as our plans and expectations with respect to the timing and resumption of any development activities that were or may be temporarily paused as a result of the COVID-19 pandemic;
- the timing, progress and results of preclinical studies and clinical trials for our programs and product candidates, including statements regarding the timing of initiation and completion of studies or trials and related preparatory work, the period during which the results of the trials will become available and our research and development programs;
- the existence or absence of side effects or other properties relating to our product candidates which could delay or prevent their regulatory approval, limit their commercial potential, or result in significant negative consequences following any potential marketing approval;
- the durability of effects from our product candidates;
- the timing, scope or likelihood of regulatory filings and approvals;
- the anticipated regulatory pathway for our product candidates and planned interactions with regulatory agencies;
- our ability to develop and advance product candidates into, and successfully complete, clinical studies;
- our expectations regarding the size of the patient populations for our product candidates, if approved for commercial use;
- the implementation of our business model and our strategic plans for our business, product candidates, technology and plato platform;
- our commercialization, marketing and manufacturing capabilities and strategy;
- the pricing and reimbursement of our product candidates, if approved;
- the scalability and commercial viability of our manufacturing methods and processes, including our move to a closed, automated system;
- the rate and degree of market acceptance and clinical utility of our product candidates, in particular, and gene therapy, in general;
- our ability to establish or maintain collaborations or strategic relationships or obtain additional funding;
- our competitive position;
- the scope of protection we and/or our licensors are able to establish and maintain for intellectual property rights covering our current and future product candidates, as well as any statements as to whether we do or do not infringe, misappropriate or otherwise violate any third-party intellectual property rights;
- our financial performance;
- our ability to retain the continued service of our key professionals and to identify, hire and retain additional qualified professionals;
- developments and projections relating to our competitors and our industry, including other lentiviral or HSC-based gene therapy companies;
- our expectations related to the use of our cash reserves;
- our estimates regarding expenses, future revenue, capital requirements and needs for additional financing;
- our ability to comply with the terms of our term loan agreement;

- our ability to avoid any findings of material weaknesses or significant deficiencies in the future;
- the impact of laws and regulations, including without limitation recently enacted tax reform legislation;
- our expectations regarding the time during which we are an emerging growth company under the Jumpstart Our Business Startups Act of 2012, or JOBS Act; and
- other risks and uncertainties, including those listed under the caption "Risk Factors."

All of our forward-looking statements are as of the date of this Quarterly Report on Form 10-Q only. In each case, actual results may differ materially from such forward-looking information. We can give no assurance that such expectations or forward-looking statements will prove to be correct. An occurrence of or any material adverse change in one or more of the risk factors or risks and uncertainties referred to in this Quarterly Report on Form 10-Q or included in our other public disclosures or our other periodic reports or other documents or filings filed with or furnished to the Securities and Exchange Commission (the "SEC") could materially and adversely affect our business, prospects, financial condition and results of operations. Except as required by law, we do not undertake or plan to update or revise any such forward-looking statements to reflect actual results, changes in plans, assumptions, estimates or projections or other circumstances affecting such forward-looking statements occurring after the date of this Quarterly Report on Form 10-Q, even if such results, changes or circumstances make it clear that any forward-looking information will not be realized. Any public statements or disclosures by us following this Quarterly Report on Form 10-Q that modify or impact any of the forward-looking statements contained in this Quarterly Report on Form 10-Q will be deemed to modify or supersede such statements in this Quarterly Report on Form 10-Q.

Note Regarding Trademarks

All brand names or trademarks appearing in this Quarterly Report are the property of their respective holders. Unless the context requires otherwise, references in this Quarterly Report to the "Company," "we," "us," and "our" refer to AVROBIO, Inc.

PART I—FINANCIAL INFORMATION

Item 1. Financial Statements.

CONDENSED CONSOLIDATED BALANCE SHEETS
(unaudited)
(in thousands, except per share data)

	June 30, 2022	December 31, 2021
Assets		
Current assets:		
Cash and cash equivalents	$ 132,409	$ 189,567
Prepaid expenses and other current assets	9,672	9,578
Total current assets	142,081	199,145
Property and equipment, net	3,618	4,126
Restricted cash	492	492
Other assets	53	74
Total assets	$ 146,244	$ 203,837
Liabilities and stockholders' equity		
Current liabilities:		
Accounts payable	$ 28	$ 3,486
Accrued expenses and other current liabilities	12,574	15,638
Deferred rent	183	262
Total current liabilities	12,785	19,386
Note payable, net of discount	15,104	14,945
Deferred rent, net of current portion	12	30
Total liabilities	27,901	34,361
Commitments and contingencies (Note 6)		
Stockholders' equity:		
Common stock, $0.0001 par value; 150,000 shares authorized; 43,696 and 43,652 shares issued and outstanding as of June 30, 2022 and December 31, 2021, respectively	4	4
Additional paid-in capital	559,768	553,014
Accumulated deficit	(441,429)	(383,542)
Total stockholders' equity	118,343	169,476
Total liabilities and stockholders' equity	$ 146,244	$ 203,837

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

CONDENSED CONSOLIDATED STATEMENTS OF OPERATIONS AND COMPREHENSIVE LOSS
(unaudited)
(in thousands, except per share data)

	Three Months Ended June 30,		Six Months Ended June 30,	
	2022	2021	2022	2021
Operating expenses:				
Research and development	$ 18,877	$ 22,544	$ 38,130	$ 41,024
General and administrative	8,897	8,831	19,062	17,235
Total operating expenses	27,774	31,375	57,192	58,259
Loss from operations	(27,774)	(31,375)	(57,192)	(58,259)
Other (expense) income:				
Interest (expense) income, net	(285)	9	(655)	19
Other expense, net	5	(21)	(40)	(46)
Total other (expense), net	(280)	(12)	(695)	(27)
Net loss	$ (28,054)	$ (31,387)	$ (57,887)	$ (58,286)
Comprehensive loss	$ (28,054)	$ (31,387)	$ (57,887)	$ (58,286)
Net loss per share — basic and diluted	$ (0.64)	$ (0.74)	$ (1.32)	$ (1.39)
Weighted-average number of common shares outstanding — basic and diluted	43,696	42,510	43,696	42,067

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

CONDENSED CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY
(unaudited)
(in thousands)

	Three Months Ended June 30, 2021				
	Common Stock		Additional Paid-in Capital	Accumulated Deficit	Total Stockholders' Equity
	Shares	Amount			
Balance as of March 31, 2021	**41,766**	**$ 4**	**$ 524,241**	**$ (291,315)**	**$ 232,930**
Stock-based compensation expense	—	—	4,691	—	4,691
Issuance of common stock under ATM facility, net of offering costs of $67	1,829	—	14,550	—	14,550
Issuance of common stock under the 2018 employee stock purchase plan	28	—	208	—	208
Net loss	—	—	—	(31,387)	(31,387)
Balance as of June 30, 2021	**43,623**	**4**	**543,690**	**(322,702)**	**220,992**

	Six Months Ended June 30, 2021				
	Common Stock		Additional Paid-in Capital	Accumulated Deficit	Total Stockholders' Equity
	Shares	Amount			
Balance as of December 31, 2020	**41,569**	**$ 4**	**$ 518,756**	**$ (264,416)**	**$ 254,344**
Stock-based compensation expense	—	—	9,326	—	9,326
Exercise of stock options	197	—	850	—	850
Issuance of common stock under ATM facility, net of offering costs of $67	1,829	—	14,550	—	14,550
Issuance of common stock under the 2018 employee stock purchase plan	28	—	208	—	208
Net loss	—	—	—	(58,286)	(58,286)
Balance as of June 30, 2021	**43,623**	**4**	**543,690**	**(322,702)**	**220,992**

	Three Months Ended June 30, 2022				
	Common Stock		Additional Paid-in Capital	Accumulated Deficit	Total Stockholders' Equity
	Shares	Amount			
Balance as of March 31, 2022	**43,696**	**$ 4**	**$ 556,534**	**$ (413,375)**	**$ 143,163**
Stock-based compensation expense	—	—	3,234	—	3,234
Net loss	—	—	—	(28,054)	(28,054)
Balance as of June 30, 2022	**43,696**	**$ 4**	**$ 559,768**	**$ (441,429)**	**$ 118,343**

	Six Months Ended June 30, 2022				
	Common Stock		Additional Paid-in Capital	Accumulated Deficit	Total Stockholders' Equity
	Shares	Amount			
Balance as of December 31, 2021	**43,652**	**$ 4**	**$ 553,014**	**$ (383,542)**	**$ 169,476**
Stock-based compensation expense	—	—	6,611	—	6,611
Issuance of common stock under the 2018 employee stock purchase plan	44	—	143	—	143
Net loss	—	—	—	(57,887)	(57,887)
Balance as of June 30, 2022	**43,696**	**$ 4**	**$ 559,768**	**$ (441,429)**	**$ 118,343**

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

CONDENSED CONSOLIDATED STATEMENTS OF CASH FLOWS
(unaudited)
(in thousands)

	Six Months Ended June 30,	
	2022	2021
Cash flows from operating activities:		
Net loss	$ (57,887)	$ (58,286)
Adjustments to reconcile net loss to net cash used in operating activities:		
Stock-based compensation expense	6,611	9,326
Depreciation and amortization expense	753	589
Non-cash interest expense	159	—
Loss on disposal of property and equipment	9	—
Deferred rent expense	(97)	(106)
Changes in operating assets and liabilities:		
Prepaid expenses and other current assets	(94)	478
Other assets	21	343
Accounts payable	(3,458)	(653)
Accrued expenses and other current liabilities	(3,137)	1,005
Net cash used in operating activities	(57,120)	(47,304)
Cash flows from investing activities:		
Purchases of property and equipment	(181)	(1,344)
Net cash used in investing activities	(181)	(1,344)
Cash flows from financing activities:		
Proceeds from exercise of stock options	—	850
Proceeds from issuance of common shares upon completion of public offering, net of offering costs	—	—
Proceeds from issuance of common shares under ATM facility, net of offering costs paid	—	14,550
Payment of offering costs	—	(204)
Proceeds from issuance of ESPP shares	143	208
Net cash provided by financing activities	143	15,404
Net decrease in cash, cash equivalents and restricted cash	(57,158)	(33,244)
Cash, cash equivalents and restricted cash at beginning of period	190,059	260,174
Cash, cash equivalents and restricted cash at end of period	$ 132,901	$ 226,930
Supplemental disclosure of non-cash investing and financing activities:		
Purchases of property and equipment included in accounts payable and accrued expenses	$ 73	$ 171
Interest paid	628	—
Reconciliation of cash, cash equivalents and restricted cash reported within the condensed consolidated balance sheets:		
Cash and cash equivalents, end of period	$ 132,409	$ 226,438
Restricted cash	492	492
Cash, cash equivalents and restricted cash, end of period	$ 132,901	$ 226,930

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

1. Nature of the Business

AVROBIO, Inc. (the "Company" or "AVROBIO") is a clinical-stage gene therapy company focused on developing potentially curative hematopoietic stem cell ("HSC") gene therapies to treat rare diseases following a single dose treatment regimen.

The Company is subject to risks and uncertainties common to clinical-stage companies in the biotechnology industry, including but not limited to, risks associated with completing preclinical studies and clinical trials, developing and scaling a clinical and commercial supply chain, receiving regulatory approvals for product candidates, development by competitors of new biopharmaceutical products, dependence on key personnel, protection of proprietary technology, compliance with government regulations and the ability to secure additional capital to fund operations. Product candidates currently under development will require significant additional research and development efforts, including preclinical and clinical testing and regulatory approval, prior to commercialization. These efforts require significant amounts of additional capital, adequate personnel and infrastructure and extensive compliance-reporting capabilities. Even if the Company's product development efforts are successful, it is uncertain when, if ever, the Company will realize revenue from product sales.

The Company has incurred recurring losses since its inception, including net losses of $57,887 and $58,286 for the six months ended June 30, 2022 and 2021, respectively. In addition, as of June 30, 2022, the Company had an accumulated deficit of $441,429. The Company has primarily funded these losses through the proceeds from sales of common and preferred stock. In addition, in November 2021 the Company entered into the Term Loan Agreement. Although the Company has incurred recurring losses and expects to continue to incur losses for the foreseeable future, the Company expects that its existing cash and cash equivalents on hand as of June 30, 2022 of $132,409 will be sufficient to fund current planned operations and capital expenditure requirements for at least the next twelve months from the filing date of this Quarterly Report on Form 10-Q with the Securities and Exchange Commission ("SEC"). However, the future viability of the Company is dependent on its ability to raise additional capital to finance its operations. The Company's inability to raise capital as and when needed could have a negative impact on its financial condition and ability to pursue its business strategies. There can be no assurance that the current operating plan will be achieved or that additional funding will be available on terms acceptable to the Company, or at all.

2. Summary of Significant Accounting Policies

Basis of Presentation

The accompanying condensed consolidated financial statements (the "unaudited condensed consolidated financial statements") have been prepared in conformity with accounting principles generally accepted in the United States of America ("GAAP"). Any reference in these notes to applicable guidance is meant to refer to the authoritative United States generally accepted accounting principles as found in the Accounting Standards Codification ("ASC") and Accounting Standards Update ("ASU") of the Financial Accounting Standards Board ("FASB").

The unaudited condensed consolidated financial statements have been prepared on the same basis as the audited annual consolidated financial statements as of and for the year ended December 31, 2021, and, in the opinion of management, reflect all adjustments, consisting of normal recurring adjustments, necessary for the fair presentation of the Company's financial position as of June 30, 2022, and the results of its operations for the three and six months ended June 30, 2022 and 2021, its statements of stockholders' equity for the three and six months ended June 30, 2022 and 2021 and its statement of cash flows for the six months ended June 30, 2022 and 2021.

The results for the three and six months ended June 30, 2022 are not necessarily indicative of the results to be expected for the year ending December 31, 2022, any other interim periods, or any future year or period. These interim financial statements should be read in conjunction with the audited financial statements as of and for the year ended December 31, 2021, and the notes thereto, which are included in the Company's Annual Report on Form 10-K for the year ended December 31, 2021, filed with the SEC on March 17, 2022.

The unaudited condensed consolidated financial statements reflect the application of certain significant accounting policies as described below and elsewhere in these notes to the unaudited condensed consolidated financial statements. As of June 30, 2022, there have been no changes to the Company's significant accounting policies as described in the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2021.

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, or decision-making group, in making decisions on how to allocate resources and assess performance. The Company's chief operating decision maker is the chief executive officer ("CEO"). The Company and the CEO view the Company's operations and manage its business as one operating segment. All material long-lived assets of the Company reside in the United States.

Use of Estimates

The preparation of the unaudited condensed consolidated financial statements in conformity with GAAP requires that the Company make estimates and judgments that may affect the reported amounts of assets, liabilities and expenses and the related disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of expenses during the reporting periods. On an ongoing basis, the Company evaluates its estimates, judgments and methodologies. The Company bases its estimates on historical experience and on various other assumptions that are believed to be reasonable, the results of which form the basis for making judgments about the carrying values of assets and liabilities. Actual results may differ from these estimates. Changes in estimates are reflected in reported results in the period in which they become known.

Significant estimates relied upon in preparing the unaudited condensed consolidated financial statements include the determination of the fair value of share-based awards issued and the estimation of accrued research and development expenses.

Stock-based Compensation

For stock-based awards issued to employees and members of the Company's board of directors (the "Board") for their services on the Board, the Company measures the estimated fair value of the stock-based award on the date of grant and recognizes compensation expense for those awards over the requisite service period, which is generally the vesting period of the respective award. The Company issues stock-based awards with only service-based vesting conditions and records the expense for these awards using the straight-line method. The Company has not issued any stock-based awards with performance- or market-based vesting conditions. The Company accounts for forfeitures as they occur.

Prior to the adoption of Accounting Standards Update ("ASU") No. 2018-07, *Compensation-Stock Compensation (Topic 718): Improvements to Nonemployee Share-Based Payment Accounting*, the measurement date for non-employee awards was generally the date the services are completed, resulting in financial reporting period adjustments to stock-based compensation during the vesting terms for changes in the fair value of the awards. After adoption of ASU 2018-07, the measurement date for non-employee awards is the later of the adoption date of ASU 2018-07, or the date of grant, without change in the fair value of the award. For stock-based awards granted to nonemployees subject to graded vesting that only contain service conditions, the Company has elected to recognize stock-based compensation expense using the straight-line recognition method.

The Company classifies stock-based compensation expense in its consolidated statements of operations and comprehensive loss in the same manner in which the award recipient's cash compensation costs are classified.

The fair value of each stock option award is estimated on the date of grant using the Black-Scholes option pricing model. As there was no public market for its common stock prior to June 21, 2018, which was the first day of trading, and as the trading history of the Company's common stock was limited through December 31, 2021, the Company determined the volatility for awards granted up through December 31, 2021 based on an analysis of reported data for a group of guideline companies that issued options with substantially similar terms. Beginning with options granted in 2022, the Company estimates its expected stock volatility using a weighted-average calculation based on the historical volatility of the Company and publicly traded peer companies and expects to continue to do so until such time as it has adequate historical data regarding the volatility of its own traded stock price. The expected term of the Company's stock options has been determined utilizing the "simplified" method for awards that qualify as "plain-vanilla" options. The risk-free interest rate is determined by reference to the U.S. Treasury yield curve in effect at the time of grant of the award for time periods approximately equal to the expected term of the award. The Company has not paid, and does not anticipate paying, cash dividends on its common stock; therefore, the expected dividend yield is assumed to be zero.

Emerging Growth Company Status

The Company is an "emerging growth company," as defined in the Jumpstart Our Business Startups Act, or JOBS Act, and may take advantage of certain exemptions from various reporting requirements applicable to other public companies, which are not emerging growth companies. The Company may take advantage of these exemptions until the Company is no longer an "emerging growth company." Section 107 of the JOBS Act provides that an "emerging growth company" can take advantage of the extended transition period afforded by the JOBS Act for the implementation of new or revised accounting standards. The Company has elected to use the extended transition period for complying with new or revised accounting standards and as a result of this election, its consolidated financial statements may not be comparable to companies that comply with public company effective dates. The Company may take advantage of these exemptions up until the last day of the fiscal year following the fifth anniversary of its IPO or such earlier time that it is no longer an "emerging growth company."

Subsequent Event Considerations

The Company considers events or transactions that occur after the balance sheet date but prior to the issuance of the consolidated financial statements to provide additional evidence for certain estimates or to identify matters that require additional disclosure. Subsequent events have been evaluated as required.

Recently Issued Accounting Pronouncements

In February 2016, the FASB issued ASU No. 2016-02, *(Topic 842) Leases,* or ASU 2016-02. ASU 2016-02 requires an entity to recognize assets and liabilities arising from a lease for both financing and operating leases. The ASU will also require new qualitative and quantitative disclosures to help investors and other financial statement users better understand the amount, timing, and uncertainty of cash flows arising from leases. For public entities, ASU 2016-02 is effective for fiscal years beginning after December 15, 2018. As a result of the Company having elected the extended transition period for complying with new or revised accounting standards pursuant to Section 107(b) of the JOBS Act, ASU 2016-02 is effective for the Company for the year ended December 31, 2022, and all interim periods thereafter. Early adoption is permitted. The Company is currently evaluating the impact that the adoption of ASU 2016-02 will have on its consolidated financial statements. Based on this evaluation the Company currently expects that its operating lease commitments will be subject to the new standard and recognized as right-of-use assets and operating lease liabilities upon adoption of this standard, which will increase the Company's total assets and total liabilities.

In June 2016, the FASB issued ASU No. 2016-13, *Financial Instruments—Credit Losses (Topic 326): Measurement of Credit Losses on Financial Instruments*, or ASU 2016-13. ASU 2016-13 requires that credit losses be reported as an allowance using an expected losses model, representing the entity's current estimate of credit losses expected to be incurred. The accounting guidance currently in effect is based on an incurred loss model. For available-for-sale debt securities with unrealized losses, this standard now requires allowances to be recorded instead of reducing the amortized cost of the investment. ASU 2016-13 is effective for non-EGCs for fiscal years beginning December 15, 2019 and interim periods within those fiscal years, and will be effective for the Company for fiscal years beginning after December 15, 2022 and interim periods within those fiscal years, assuming the Company remains an EGC. Early adoption is permitted. The Company expects an immaterial impact to its financial statements.

In November 2019, the FASB issued ASU 2019-11, "*Codification Improvements to Topic 326, Financial Instruments – Credit Losses*," or ASU 2019-11. ASU 2019-11 is an accounting pronouncement that amends ASU 2016-13, "*Financial Instruments – Credit Losses (Topic 326): Measurement of Credit Losses on Financial Instruments*." The amendments update guidance on reporting credit losses for financial assets. These amendments affect loans, debt securities, trade receivables, net investments in leases, off balance sheet credit exposures, reinsurance receivables, and any other financial assets not excluded from the scope that have the contractual right to receive cash. The amendments in both ASU 2016-13 and ASU 2019-11 are effective for annual reporting periods beginning after December 15, 2019, including interim periods within those fiscal years. As a result of the Company having elected the extended transition period for complying with new or revised accounting standards pursuant to Section 107(b) of the JOBS Act, 2016-13 and ASU 2019-11 are effective for the Company for fiscal years beginning after December 15, 2022, and interim periods within those fiscal years. The Company is currently evaluating ASU 2016-13 and ASU 2019-11 and their impact on its consolidated financial statements and financial statement disclosures.

In December 2019, the FASB issued ASU No. 2019-12, *Simplifying the Accounting for Income Taxes*, or ASU 2019-12. ASU 2019-12 eliminates certain exceptions related to the approach for intraperiod tax allocation, the methodology for calculating income taxes in an interim period and the recognition of deferred tax liabilities for outside basis differences. It also clarifies and simplifies other aspects of the accounting for income taxes. ASU 2019-12 is effective for non-EGCs for fiscal years beginning after December

15, 2020 and interim periods within those fiscal years and will be effective for the Company for fiscal years beginning after December 15, 2021 and interim periods beginning after December 15, 2022, assuming the Company remains an EGC. Early adoption is permitted. The Company is currently evaluating the effects the adoption of ASU 2019-12 may have on its financial statements.

3. License Agreements

Agreement with The University of Manchester

On September 30, 2020, the Company entered into an agreement ("MPSII License Agreement") with The University of Manchester, England ("UoM"), whereby UoM granted to the Company an exclusive worldwide license under certain patent and other intellectual property rights, subject to certain retained rights, to develop, commercialize and sell an *ex vivo* lentiviral gene therapy for use in the treatment of Hunter syndrome, or mucopolysaccharidosis type II. As consideration for the MPSII License Agreement, the Company agreed to pay UoM an upfront, one-time fee of $8,000, which was recognized as research and development expense during the year ended December 31, 2020.

As part of the agreement, the Company is obligated to make milestone payments of up to an aggregate of $80,000 upon the achievement of specified development and regulatory milestones, to pay royalties, on a product-by-product and country-by-country basis, of a mid-single digit percentage based on net sales of products licensed under the agreement and to pay a low double-digit percentage of any sublicense fees received by the Company. The next anticipated payment milestones under the MPSII License Agreement include $2,000, which would become due following the date of regulatory approval of the clinical trial application for the investigator-sponsored Phase 1/2 clinical trial sponsored by UoM, and $4,000, upon the dosing of the first patient in the investigator-sponsored Phase 1/2 clinical trial sponsored by UoM.

Unless terminated earlier, the agreement expires upon the later of 15 years from the effective date or the expiration of the last valid claim of the licensed patents, subject to certain surviving rights and obligations. UoM and the Company can each terminate the agreement in the event of the bankruptcy or insolvency of the other party, or a material breach by the other party and failure to cure such breach within a certain period of time. UoM has the right to terminate the agreement in the event of certain actions relating to challenge or opposition to the licensed intellectual property brought by the Company or its affiliates or sublicensees.

Concurrently with the MPSII License Agreement, the Company entered into a collaborative research funding agreement with UoM ("CRFA"). Under the CRFA, the Company has agreed to fund the budgeted costs of an investigator-sponsored Phase 1/2 clinical trial to be sponsored by UoM in connection with the development activities under the MPSII License Agreement, which are currently expected to equal approximately £9,900 in the aggregate.

For the three months ended June 30, 2022 and 2021 the Company incurred $417 and $825, respectively, related to the CRFA. For the six months ended June 30, 2022 and 2021 the Company incurred $1,380 and $825, respectively, related to the CRFA.

Agreements with University Health Network ("UHN")

Fabry License Agreement—

On January 27, 2016, the Company entered into an agreement with UHN, pursuant to which UHN granted the Company an option to enter into an exclusive license under the UHN intellectual property related to Fabry disease in accordance with the pre-negotiated licensing terms. On November 4, 2016, the Company exercised its option and entered into a license agreement with UHN, pursuant to which UHN granted the Company an exclusive worldwide license under certain intellectual property rights and a non-exclusive worldwide license under certain know-how, in each case subject to certain retained rights, to develop, commercialize and sell products for use in the treatment of Fabry disease. In addition, for three years following the execution of the agreement, UHN granted the Company an exclusive option to obtain a license under certain improvements to the licensed intellectual property rights as well as an option to negotiate a license under certain other improvements.

Under this agreement, the Company paid an option fee of CAD $20, an upfront license fee of CAD $75, plus the annual license maintenance fee for the first year. Thereafter, the Company is also required to pay UHN future annual license maintenance fees until the first sale of a licensed product in certain markets. The Company is also obligated to make future milestone payments in an aggregate amount of up to CAD $2,450 upon the achievement of specified milestones as well as royalties on a country-by-country basis of a low to mid-single-digit percentage of annual net sales of licensed products and a lower single-digit royalty percentage in certain circumstances. Additionally, the Company has agreed to pay a low double-digit royalty percentage of all sublicensing revenue.

The agreement requires the Company to meet certain performance milestones within specified timeframes. UHN may terminate the agreement if the Company fails to meet these performance milestones despite using commercially reasonable efforts and the Company is unable to reach agreement with UHN on revised timeframes. The Company's royalty obligation expires on a licensed product-by-licensed product and country-by-country basis upon the latest to occur of the expiration or termination of the last valid claim under the licensed intellectual property rights in such country, the tenth anniversary of the first commercial sale of such licensed product in such country and the expiration of any applicable regulatory exclusivity in such country.

Unless terminated earlier, the agreement expires upon the expiration of the Company's royalty obligation for all licensed products. UHN can terminate the agreement if the Company fails to make any payments within a specified period after receiving written notice of such failure, or in the event that the Company fails to obtain or maintain insurance. Either the Company or UHN may terminate the license agreement in the event of a material breach by the other party and failure to cure such breach within a certain period of time. The Company can voluntarily terminate the agreement with prior notice to UHN.

For the three months ended June 30, 2022 and 2021, the Company recorded research and development expense related to this agreement with UHN of $0 and $24, respectively, which consists of reimbursable funded study trial costs. For the six months ended June 30, 2022 and 2021 the Company recorded research and development expense related to this agreement with UHN of $24 and $68, respectively, which consists of reimbursable funded study trial costs. No milestone or maintenance fees were incurred related to this agreement in the three and six months ended June 30, 2022 and 2021.

Interleukin 12 License Agreement—

On January 27, 2016, the Company entered into an exclusive license agreement with UHN, pursuant to which UHN granted the Company a license to certain patent rights for the commercial development, manufacture, distribution and use of any products or processes resulting from development of those patent rights related to Interleukin 12. Upon execution of this agreement, the Company paid an upfront license fee of CAD $264. In addition, as part of the initial consideration for the license, the Company issued to UHN 1,161,665 shares of the Company's common stock and agreed to pay UHN up to $2,000 upon the closing of an IPO if certain criteria are met. The fair value of the shares issued to UHN of $480 and the upfront fee was expensed upon the execution of the agreement. Upon the closing of the IPO in 2018, as the criteria were met, the Company paid UHN $2,000. The Company is also required to pay UHN future annual license maintenance fees of CAD $50 on each anniversary of the effective date of the license agreement prior to expiration or termination and potential future milestone payments of up to CAD $19,275 upon the achievement of specified clinical and regulatory milestones. The Company also agreed to pay UHN royalties of a low single-digit percentage of net sales of licensed products sold by the Company. If the Company grants any sublicense rights under the license agreement, the Company has agreed to pay UHN a low double-digit royalty percentage of any sublicense income received by the Company.

The agreement requires the Company to meet certain diligence requirements based upon specified milestones. The agreement expires on the later of the date the last patent rights expire in the last country or ten years from the date of first sale. UHN can terminate the agreement if the Company fails to make any payments within a specified period after receiving written notice of such failure, or in the event that the Company fails to obtain or maintain insurance. The Company can voluntarily terminate the agreement with prior notice to UHN. Either the Company or UHN may terminate the license agreement in the event of a material breach by the other party and failure to cure such breach within a certain period of time.

For the three months ended June 30, 2022 and 2021 the Company recorded research and development expense related to this agreement with UHN of $39 and $0, respectively. For the six months ended June 30, 2022 and 2021 the Company recorded $39 for both periods, which consists of license maintenance fees. No milestone fees were incurred related to this agreement in the three and six months ended June 30, 2022 and 2021.

Agreement with BioMarin Pharmaceutical Inc. ("BioMarin")

On August 31, 2017, the Company entered into a license agreement with BioMarin, pursuant to which BioMarin granted the Company an exclusive worldwide license under certain intellectual property rights owned or controlled by BioMarin to develop, commercialize and sell products for use in the treatment of Pompe disease. The license agreement was amended in February 2018 and again in January 2020 to, among things, provide that BioMarin would supply the Company with certain technology materials. As consideration for this agreement, the Company paid an upfront license fee of $500 in cash and issued 233,765 shares of Series B Preferred Stock to BioMarin at the time of the Company's Series B Preferred Stock financing in January 2018. The Company has a license agreement with BioMarin, pursuant to which BioMarin granted the Company an exclusive worldwide license under certain intellectual property rights owned or controlled by BioMarin to develop, commercialize and sell products for use in the treatment of Pompe disease. The Company is also obligated to make future milestone payments of up to $13,000 upon the achievement of certain specified milestones and agreed to pay BioMarin royalties of a low single-digit percentage of net sales of licensed products sold by the Company or its affiliates covered by patent rights in a relevant country.

The Company has recognized no expenses related to the license for the three and six months ended June 30, 2022 and 2021.

Unless terminated earlier, the agreement expires upon the expiration of the Company's royalty obligation for all licensed products throughout the world. BioMarin and the Company can terminate the agreement in the event of a material breach by the other party and failure to cure such breach within a certain period of time. The Company may terminate the agreement at will upon written notice to BioMarin. BioMarin has the right to terminate the agreement upon the Company's bankruptcy or insolvency, or in the event of any challenge or opposition to the licensed patent rights or related actions brought by the Company or its affiliates or sublicensees, or if the Company, its affiliates or sublicensees knowingly assist a third-party in challenging or otherwise opposing the licensed patent rights, except as required under a court order or subpoena.

Agreement with Papillon Therapeutics, Inc. (previously GenStem Therapeutics, Inc.)

On October 2, 2017, the Company entered into a license agreement with GenStem Therapeutics, Inc. ("GenStem"), pursuant to which GenStem granted the Company an exclusive worldwide license, subject to certain retained rights, under certain intellectual property rights owned or controlled by GenStem to develop, commercialize and sell products for use in the treatment of cystinosis. Under this agreement, the Company paid an upfront license fee of $1,000 and is required to make payments upon completion of certain milestones up to an aggregate of $16,000. The Company also agreed to pay GenStem a tiered mid to high single-digit royalty percentage on annual net sales of licensed products as well as a low double-digit percentage of sublicense income received from certain third-party licensees. The Company's royalty obligation expires on a licensed product-by-licensed product and country-by-country basis on the eleventh anniversary of the first commercial sale of such licensed product in such country or the expiration of the last valid claim under the licensed patent rights covering such licensed product in such country, whichever is later. Unless terminated earlier, the agreement expires upon the expiration of the Company's royalty obligation for all licensed products throughout the world. GenStem and the Company can terminate the agreement in the event of a material breach by the other party and failure to cure such breach within a certain period of time. The Company may terminate the agreement at will upon the specified prior written notice to GenStem. In October 2021, the Company received notice that the license agreement with GenStem had been assigned to Papillon Therapeutics, Inc. ("Papillon").

The Company has recognized no expenses related to this agreement for the three and six months ended June 30, 2022 and 2021.

Agreement with Lund University Rights Holders

On November 17, 2016, the Company entered into a license agreement with affiliates of Lund University, along with certain other relevant rights holders that may be added from time to time, pursuant to which such rights holders granted to the Company an exclusive worldwide license, subject to certain retained rights, under certain intellectual property rights to develop, commercialize and sell products in any and all uses relevant to Gaucher disease. As consideration for the license, the Company is required to make payments in connection with the achievement of certain milestones up to an aggregate of $550. The agreement expires on the latest of (i) the twentieth anniversary of the end of a certain research project the Company is funding pursuant to an agreement with Lund University, (ii) the expiration of the term of any patent filed on the licensed rights that covers a licensed product, (iii) the expiration of any applicable marketing exclusivity right and (iv) such time that neither the Company nor any sublicensees, partners or contractors are commercializing a licensed product. Either the Company or the rights holders acting together may terminate the license agreement if the other such party commits a material breach and fails to cure such breach within a certain period of time, or if the other party enters into liquidation, becomes insolvent, or enters into composition or statutory reorganization proceedings.

(in thousands, except share and per share data)

The Company has recognized no expenses related to this agreement for the three and six months ended June 30, 2022 and 2021.

4. Fair Value Measurement

The following table presents information about the Company's financial assets measured at fair value on a recurring basis and indicates the level of the fair value hierarchy utilized to determine such fair values as of June 30, 2022 and December 31, 2021:

	Fair Value Measurements as of June 30, 2022			
	Level 1	Level 2	Level 3	Total
Assets:				
Cash equivalents ─ money market funds	$ 131,379	$ —	$ —	$ 131,379
	$ 131,379	$ —	$ —	$ 131,379

	Fair Value Measurements as of December 31, 2021			
	Level 1	Level 2	Level 3	Total
Assets:				
Cash equivalents — money market funds	$ 189,332	$ —	$ —	$ 189,332
	$ 189,332	$ —	$ —	$ 189,332

The fair value of cash equivalents was determined through quoted prices by third-party pricing services.

During the six months ended June 30, 2022, there were no transfers between levels.

5. Supplemental Balance Sheet Information

Prepaid expenses and other current assets

Prepaid expenses and other current assets consisted of the following:

	June 30, 2022	December 31, 2021
Prepaid research and development expenses	$ 3,988	$ 4,496
Tax incentive refund	2,960	2,697
Prepaid insurance	1,823	112
Other current assets	555	1,698
Prepaid compensation benefits	346	575
	$ 9,672	$ 9,578

Property and equipment, net

Property and equipment, net consisted of the following:

	June 30, 2022	December 31, 2021
Laboratory and office equipment	$ 6,388	$ 6,162
Leasehold improvements	1,635	1,635
Computer equipment	168	149
	8,191	7,946
Less: Accumulated depreciation and amortization	(4,573)	(3,820)
Property and equipment, net	$ 3,618	$ 4,126

(in thousands, except share and per share data)

Depreciation and amortization expense was $354 and $299, respectively, for the three months ended June 30, 2022 and 2021. Depreciation and amortization expense was $753 and $589, respectively, for the six months ended June 30, 2022 and 2021.

Restricted cash

As of June 30, 2022 and December 31, 2021, the Company had restricted cash of $492, which consists of cash used to secure letters of credit for the benefit of the landlord in connection with the Company's lease agreements. The cash will be restricted until the termination or modification of the lease arrangement.

Accrued expenses and other current liabilities

Accrued expenses and other current liabilities consisted of the following:

	June 30, 2022	December 31, 2021
Research and development expenses	$ 6,368	$ 8,882
Compensation and benefit costs	5,304	5,579
Consulting and professional fees	771	999
Other liabilities	131	178
	$ 12,574	$ 15,638

6. Commitments and Contingencies

Legal Proceedings

The Company, from time to time, may be party to litigation arising in the ordinary course of business. The Company was not subject to any material legal proceedings during the six months ended June 30, 2022 and 2021 and to the best of the Company's knowledge, no material legal proceedings are currently pending or threatened.

Other

The Company is also party to various agreements, principally relating to licensed technology, that require future payments relating to milestones not met at June 30, 2022 and December 31, 2021, or royalties on future sales. No milestone or royalty payments under these agreements are expected to be payable in the immediate future, except as disclosed in Note 3 *"License Agreements."*

The Company enters into standard indemnification agreements in the ordinary course of business. Pursuant to the agreements, the Company agrees to indemnify, hold harmless, and to reimburse the indemnified party for losses suffered or incurred by the indemnified party, generally the Company's business partners, in connection with any U.S. patent or any copyright or other intellectual property infringement claim by any third-party with respect to the Company's products. Further, the Company indemnifies its directors and officers who are, or were, serving at the Company's request in such capacities. The Company's maximum exposure under these arrangements is unknown as of June 30, 2022. The Company does not anticipate recognizing any significant losses relating to these arrangements. The term of these indemnification agreements is generally perpetual any time after execution of the agreement. The maximum potential amount of future payments the Company could be required to make under these indemnification agreements is unlimited. The Company has never incurred costs to defend lawsuits or settle claims related to these indemnification agreements.

7. Note Payable

On November 2, 2021 (the "Closing Date"), the Company entered into a Loan and Security Agreement (the "Loan Agreement") with Silicon Valley Bank ("SVB") pursuant to which a term loan in an aggregate principal amount of up to $50,000 (the "Term Loan Facility") is available to the Company in three tranches, subject to certain terms and conditions. The first tranche of $15,000 was advanced to the Company on the Closing Date. Subject to the terms and conditions of the Loan Agreement, the first tranche allows the Company to borrow an additional $15,000 through October 31, 2023. Upon satisfaction of certain milestones, the second and third tranches are available under the Term Loan Facility which allows the Company to borrow an additional amount up to

$10,000 in each tranche through October 31, 2023. Additionally, the Company may seek to borrow up to an additional $15,000 at the sole discretion of the lender through the term of the Loan Agreement. The Loan Agreement matures on October 1, 2026 (the "Maturity Date"). The Company is required to pay an end of term fee ("End of Term Charge") equal to 9.00% of the aggregate principal amount of the Term Loan advances upon repayment.

Advances under the Term Loan Facility will bear interest at a rate equal to the greater of either (i) the Prime Rate (as reported in The Wall Street Journal) plus 4.85%, and (ii) 8.10%. The Company will make interest only payments through November 1, 2024. Following the interest only period, the Company will repay the principal balance and interest of the advances in equal monthly installments through October 1, 2026.

The Company may prepay advances under the Loan Agreement, in whole or in part, at any time subject to a prepayment charge (the "Prepayment Premium") equal to: (a) 1.50% of amounts so prepaid, if such prepayment occurs during the first year following the Closing Date; (b) 1.00% of the amount so prepaid, if such prepayment occurs during the second year following the Closing Date, and (c) 0.00% of the amount so prepaid, if such prepayment occurs after the second year following the Closing Date.

Upon prepayment or repayment of all or any of the term loans under the Term Loan Facility, the Company will pay (in addition to any Prepayment Premium) an end of term charge of 9.0% of the aggregate funded amount under the Term Loan Facility.

The Term Loan Facility is secured by substantially all of the Company's assets, other than the Company's intellectual property. The Company has agreed to not pledge or secure its intellectual property to others.

The End of Term Charge is recorded as a debt discount with an initial carrying balance of $1,350. During the year ended December 31, 2021 the Company recognized $103 of debt issuance costs related to legal expenses that has been included in the debt discount balance. The debt discount costs are being accreted to the principal amount of debt and being amortized from the date of issuance through the Maturity Date to interest expense using the effective-interest rate method. The effective interest rate of the outstanding debt under the Loan Agreement is approximately 11.12%.

As of June 30, 2022 the carrying value of the note payable consists of the following:

	June 30, 2022
	(in thousands)
Note payable, including End of Term Charge	$ 16,350
Debt discount, net of accretion	(1,246)
Note payable, net of discount, long-term	$ 15,104

As of June 30, 2022, the future principal payments due under the arrangement, excluding interest and the end of term charge, are as follows:

Year Ending December 31,	Principal
2022	$ —
2023	—
2024	1,875
2025	7,500
2026	5,625
Total	$ 15,000

During the three and six months ended June 30, 2022, the Company recognized $333 and $638, respectively, of interest expense related to the Loan Agreement which is reflected in interest (expense) income, net on the consolidated statements of operations and comprehensive loss. During the three and six months ended June 30, 2021, the Company recognized no interest expense related to the Loan Agreement.

(in thousands, except share and per share data)

8. Stockholders' Equity

Common Stock

As of June 30, 2022 and December 31, 2021, the authorized capital stock of the Company included 150,000,000 shares of common stock, $0.0001 par value and 10,000,000 shares of undesignated preferred stock. As of June 30, 2022 and December 31, 2021, no undesignated preferred stock was outstanding.

As of June 30, 2022, no cash dividends have been declared or paid.

Common Stock Reserved for Future Issuance

As of June 30, 2022 and December 31, 2021, the Company has reserved the following shares of common stock for future issuance:

	June 30, 2022	December 31, 2021
Shares reserved for exercise of outstanding stock options	8,913,316	7,423,777
Shares reserved for vesting of restricted stock units	893,259	599,850
Shares reserved for issuance under the 2018 Stock Option and Grant Plan	5,934,417	2,583,736
Shares reserved for issuance under the 2018 Employee Stock Purchase Plan	1,544,308	1,151,010
Shares reserved for issuance under the 2019 Inducement Plan	626,623	412,686
Shares reserved for issuance under the 2020 Inducement Plan	1,637,000	1,637,000
Total shares of authorized common stock reserved for future issuance	19,548,923	13,808,059

9. Stock-based Compensation

Stock Option Valuation

The assumptions that the Company used to determine the grant-date fair value of stock options granted to employees and members of the board of directors were as follows, presented on a weighted-average basis:

	Six Months Ended June 30,	
	2022	2021
Expected option life (years)	5.96	6.07
Risk-free interest rate	1.80%	0.76%
Expected volatility	80.22%	81.25%
Expected dividend yield	—%	—%

The following table summarizes the Company's stock option activity for the six months ended June 30, 2022:

	Number of Options	Weighted-Average Exercise Price	Weighted-Average Remaining Contractual Term (Years)	Aggregate Intrinsic Value
Outstanding as of December 31, 2021	7,423,777	$ 13.54	6.79	$ 1,469
Granted	3,455,157	$ 1.79		
Exercised	—	$ —		
Cancelled or forfeited	(1,965,618)	$ 14.09		
Outstanding as of June 30, 2022	8,913,316	$ 8.86	7.55	$ 112
Exercisable as of June 30, 2022	3,097,657	$ 12.71	5.92	$ 112

(in thousands, except share and per share data)

The aggregate intrinsic value of stock options is calculated as the difference between the exercise price of the underlying stock options and the estimated fair value of the Company's common stock for those stock options that had exercise prices lower than the estimated fair value of the Company's common stock.

The aggregate intrinsic value of options exercised during the six months ended June 30, 2021 was $1,729. No options were exercised during the six months ended June 30, 2022.

The weighted-average grant-date fair value of the Company's stock options granted during the six months ended June 30, 2022 and 2021 was $1.23 and $9.31, respectively.

Restricted Stock Units

The following table summarizes the Company's restricted common stock units for the six months ended June 30, 2022:

	Number of Shares	Weighted-Average Grant Date Fair Value
Issued and unvested as of December 31, 2021	599,850	$ 9.64
Granted	719,168	$ 1.75
Vested	(287)	$ 15.65
Forfeited, cancelled or expired	(425,472)	$ 7.40
Issued and unvested as of June 30, 2022	893,259	$ 4.35

The total fair value of restricted stock units vested during the six months ended June 30, 2022 and 2021 was $4 and $4, respectively.

Stock-Based Compensation

Stock-based compensation expense was allocated as follows:

	Three Months Ended June 30,		Six Months Ended June 30,	
	2022	2021	2022	2021
Research and development	$ 783	$ 1,909	$ 1,721	$ 4,024
General and administrative	2,451	2,782	4,890	5,302
Total stock-based compensation expense	$ 3,234	$ 4,691	$ 6,611	$ 9,326

As of June 30, 2022, total unrecognized compensation cost related to the unvested stock-based awards was $27,456, which is expected to be recognized over a weighted-average period of 2.60 years.

10. Net Loss Per Share

For purposes of the diluted net loss per share calculation, stock options and unvested restricted stock are considered to be common stock equivalents but have been excluded from the calculation of diluted net loss per share, as their effect would be anti-dilutive for all periods presented. Therefore, the weighted-average number of common shares outstanding used to calculate both basic and diluted net loss per share is the same.

The following potentially dilutive common stock equivalents, presented based on amounts outstanding at each period end, were excluded from the computation of diluted net loss per share for the periods indicated as they were anti-dilutive:

	Six Months Ended June 30,	
	2022	2021
Options to purchase common stock	8,913,316	8,412,822
Restricted stock units	893,259	772,511

(in thousands, except share and per share data)

11. Related Party Transactions

UHN

For the three months ended June 30, 2022 and 2021, the Company recognized $39 and $24, respectively, of research and development expense related to the license agreements with UHN. For the six months ended June 30, 2022 and 2021, the Company recognized $63 and $107, respectively, of research and development expense related to the license agreements with UHN. Refer to Note 3 "*License Agreements*" for additional information regarding the UHN license agreements.

Others

For the three months ended June 30, 2022 and 2021, the Company recorded expenses of $792 and $409, respectively, related to a sublease to rent lab space, provided by an entity affiliated with a member of the Company's board of directors. For the six months ended June 30, 2022 and 2021, the Company recorded expenses of $1,586 and $1,050, respectively, related to a sublease to rent lab space, provided by an entity affiliated with a member of the Company's board of directors.

12. Restructuring Activities

In January 2022, the Company announced the deprioritization of AVR-RD-01, its investigational gene therapy program for Fabry disease. This decision was made due to several factors, including new clinical data showing variable engraftment patterns from the five most recently dosed patients in the Company's Phase 2 clinical trial of AVR-RD-01 for the treatment of Fabry disease, which the Company refers to as the FAB-GT clinical trial. The emergence of such new data would have significantly extended the program's development timeline. That development, coupled with an increasingly challenging market and regulatory environment for Fabry disease, were among the primary factors leading to the Company's deprioritization of its Fabry program. As a result of the deprioritization, the Company has stopped enrollment of its Phase 2 FAB-GT clinical trial and has shifted focus to its other pipeline programs.

In connection with the deprioritization of AVR-RD-01 noted above, in January 2022, the Company approved changes to the Company's organization as well as a broader operational cost reduction plan. As part of this plan, the Company approved a reduction in the Company's workforce by approximately 23% across different areas and functions in the Company (the "Workforce Reduction").

Under the Workforce Reduction, the Company recognized total restructuring expenses for the three and six months ended June 30, 2022 of $0 and $1,369, respectively. No restructuring expenses were incurred for the three and six months ended June 30, 2021. These one-time employee termination benefits are related to affected employees, who were offered separation benefits, including severance payments. During the three and six months ended June 30, 2022 approximately $45 and $1,369 of these payments were made. There are no accrued remaining payments at June 30, 2022.

The outstanding restructuring liabilities are included in accrued expenses and other current liabilities on the consolidated balance sheets. The following table summarizes the charges related to the restructuring activities as of June 30, 2022:

	Employee Severance and Other Benefits
Liability included in accrued expenses and other current liabilities at January 1, 2022	$ —
Restructuring expenses	1,369
Cash payments	(1,369)
Liability included in accrued expenses and other current liabilities at June 30, 2022	$ —

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

You should read the following discussion and analysis of our financial condition and results of operations together with our consolidated financial statements and the related notes appearing elsewhere in this Quarterly Report on Form 10-Q and our audited consolidated financial statements and related notes for the year ended December 31, 2021 included in our Annual Report on Form 10-K for the year ended December 31, 2021. Some of the information contained in this discussion and analysis or set forth elsewhere in this Quarterly Report, including information with respect to our plans and strategy for our business, includes forward-looking statements that involve risks, uncertainties and assumptions. Factors that might cause future results to differ materially from those projected in the forward-looking statements include, but are not limited to, those set forth in our Annual Report on Form 10-K for the year ended December 31, 2021, as supplemented by our subsequent filings with the SEC.

Overview

We are a leading clinical-stage gene therapy company with a shared purpose to free people from a lifetime of genetic disease. Our company is focused on developing potentially curative HSC based gene therapies (which we sometimes refer to as *ex vivo* lentiviral-based gene therapies) to treat patients with rare diseases following a single dose treatment regimen. Our gene therapies employ hematopoietic stem cells that are harvested from the patient and then modified with a lentiviral vector to insert the equivalent of a functional copy of the gene that is mutated in the target disease. We believe that our approach, which is designed to transform stem cells from patients into therapeutic products, has the potential to provide curative benefit for a range of diseases. Our initial focus is on a group of rare genetic diseases referred to as lysosomal disorders, some of which today are primarily managed with enzyme replacement therapies, or ERTs. These lysosomal disorders have well-understood biologies, identified patient populations, established standards of care yet with significant unmet needs, and represent large market opportunities with approximately $3.4 billion in worldwide net sales in 2021.

Our pipeline is currently comprised of five HSC-based gene therapy programs: AVR-RD-04 for the treatment of cystinosis; AVR-RD-02 for the treatment of Gaucher disease, including a program for the treatment of Gaucher disease type 1 and a program (formerly AVR-RD-06) for the treatment of Gaucher disease type 3; AVR-RD-05 for the treatment of Hunter syndrome; and AVR-RD-03 for the treatment of Pompe disease. AVR-RD-04

AVR-RD-04 is currently being studied for the treatment of cystinosis by our collaborators at the University of California, San Diego, or UCSD, in a Phase 1/2 collaborator-sponsored clinical trial. Enrollment of this clinical trial is complete with a total of six patients enrolled, and five patients have been dosed. In May 2022, we reported updated interim data from the Phase 1/2 clinical trial of AVR-RD-04 at the 25th Annual Meeting of American Society for Gene and Cell Therapy ("ASGCT") in Washington D.C. Pending the outcome of planned Food and Drug Administration ("FDA") interactions this year, we expect to initiate a Company-sponsored trial in 2023 with potential sites anticipated in the United States, Europe and the United Kingdom. Our current plan involves a two-part strategy, including both a pre-renal transplant population and a post-renal transplant population.

AVR-RD-02 is currently being studied for the treatment of Gaucher disease type 1 in a Company-sponsored Phase 1/2 clinical trial, which we refer to as the Guard1 clinical trial. Four patients have been dosed to date in the Guard1 clinical trial, and we are actively recruiting additional potential patients for our currently active sites. We plan to provide updated interim clinical trial data in the fourth quarter of 2022.

AVR-RD-02 also includes a preclinical program for the treatment of Gaucher disease type 3, and we expect to engage with regulatory authorities this year to discuss a potential Phase 2/3 clinical trial to be initiated in 2023.

AVR-RD-05 is our preclinical program for the treatment of Hunter syndrome. Our collaborators at The University of Manchester have submitted a clinical trial application related to the study of Hunter Syndrome in the United Kingdom, and if authorized we expect that a Phase 1/2 collaborator-sponsored clinical trial will be initiated in 2023.

AVR-RD-03 is our preclinical program for the treatment of Pompe disease, and we are planning to engage with regulatory authorities this year to discuss a potential path to the clinic. While we are continuing to advance AVR-RD-03, we are prioritizing our cystinosis and Gaucher disease clinical programs. As a result, we no longer expect to initiate a clinical trial for AVR-RD-03 in 2023.

Since our inception in 2015, we have devoted substantially all of our resources to organizing and staffing our company, business planning, raising capital, acquiring or discovering product candidates and securing related intellectual property rights, conducting discovery, research and development activities for our programs and planning for potential commercialization. To date, we have not generated any product revenue and have financed our operations primarily through the private placement of our securities and through public offerings of our common stock. Through June 30, 2022, we had received gross cash proceeds of $87.5 million from sales of our preferred stock; gross cash proceeds, before deducting underwriting discounts and commissions and expenses, of $428.1 million from

sales of our common stock through our initial public offering and follow-on offerings; and gross cash proceeds, before deducting commissions and expenses, of $23.5 million from sales of our common stock through our "at-the-market," or ATM, facility.

Additionally, we have incurred significant operating losses. Our ability to generate product revenue sufficient to achieve profitability will depend heavily on the successful development and eventual commercialization of one or more of our current or future product candidates and programs. Our net losses were $57.9 million and $58.3 million for the six months ended June 30, 2022 and 2021, respectively. As of June 30, 2022, we had an accumulated deficit of $441.4 million. We expect to continue to incur significant expenses for at least the next several years as we advance our current and future product candidates from discovery through preclinical development and clinical trials and seek regulatory approval of our product candidates. We currently have a total of five investigational gene therapy programs in our pipeline, two of which are currently in clinical development. Further development of these programs will require us to expend significant resources to advance these candidates. In addition, if we obtain marketing approval for any of our product candidates, we expect to incur significant commercialization expenses related to product manufacturing, marketing, sales and distribution. We may also incur expenses in connection with the in-licensing or acquisition of additional product candidates.

We will need substantial additional funding to support our continuing operations and pursue our growth strategy. Until such time as we can generate significant revenue from product sales, if ever, we expect to finance our operations with proceeds from outside sources, with a majority of such proceeds to be derived from sales of equity, including the net proceeds from our follow-on offerings and sales of common stock under our ATM facility, as well as proceeds from our Loan and Security Agreement, or the Term Loan Agreement, with the lenders party thereto from time to time, or the Lenders, and Silicon Valley Bank, as administrative agent and collateral agent for the Lenders, or the Agent. We may also pursue additional funding from outside sources, including our expansion of, or our entry into, new borrowing arrangements; research and development incentive payments from governmental entities ; and our entry into potential future collaboration agreements for one or more of our programs. We may be unable to raise additional funds or enter into such other agreements or arrangements when needed on favorable terms, or at all. If we fail to raise capital or enter into such agreements as, and when, needed, we may have to significantly delay, scale back or discontinue the development and commercialization of one or more of our product candidates or delay our pursuit of potential in-licenses or acquisitions.

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

As of June 30, 2022, we had cash and cash equivalents of $132.4 million. We believe that our existing cash and cash equivalents as of June 30, 2022, will enable us to fund our operating expenses and capital expenditure requirements into the first quarter of 2024. We have based this estimate on assumptions that may prove to be wrong, and we could exhaust our available capital resources sooner than we expect. See "—Liquidity and Capital Resources." To finance our operations beyond that point, we will need to raise additional capital, which cannot be assured.

Other Updates

On July 8, 2022, we moved our corporate headquarters to 100 Technology Square, 6th Floor, Cambridge, MA 02139. We had previously subleased space in this location for laboratory facilities, and in January 2022, we amended our sublease agreement to, among other things, expand the square footage to include office space. The office space at One Kendall Square, Building 300, Suite 201, Cambridge, MA 02139 is still in use until the end of our lease in January 2023.

On July 13, 2022, we announced that the FDA has granted orphan drug designation for AVR-RD-05 for the treatment of mucopolysaccharidosis type II, or Hunter syndrome.

Components of Our Consolidated Results of Operations

Operating Expenses

Research and Development Expenses

Research and development expenses consist primarily of costs incurred in connection with the discovery and development of our product candidates. We expense research and development costs as incurred. These expenses consist of costs incurred in connection with the development of our product candidates, including:

- license maintenance fees and milestone fees incurred in connection with various license agreements;
- expenses incurred under agreements with contract research organizations, or CROs, contract manufacturing organizations, or CMOs, as well as investigative sites and consultants that conduct our clinical trials, preclinical studies and other scientific development services;

- manufacturing scale-up expenses and the cost of acquiring and manufacturing preclinical and clinical trial materials and commercial materials, including manufacturing validation batches;
- costs of purchasing lab supplies and non-capital equipment used in our preclinical activities;
- employee-related expenses, including salaries, related benefits, travel and stock-based compensation expense for employees engaged in research and development functions;
- costs related to compliance with regulatory requirements; and
- allocated facilities costs, depreciation and other expenses, which include rent and utilities.

We recognize external development costs based on an evaluation of the progress to completion of specific tasks using information provided to us by our service providers.

Our direct research and development expenses are tracked on a program-by-program basis for our product candidates and consist primarily of external costs, such as fees paid to outside consultants, CROs, CMOs, and central laboratories in connection with our preclinical development, process development, manufacturing and clinical development activities. Our direct research and development expenses by program also include fees incurred under license agreements. We do not allocate employee costs or facility expenses, including depreciation or other indirect costs, to specific programs because these costs are deployed across multiple programs and, as such, are not separately classified. We use internal resources primarily to oversee the research and discovery as well as for managing our preclinical development, process development, manufacturing and clinical development activities. These employees work across multiple programs and, therefore, we do not track their costs by program.

The table below summarizes our research and development expenses related to our product candidates (in thousands):

	Three Months Ended June 30,		Six Months Ended June 30,	
	2022	2021	2022	2021
Fabry	$ 1,779	$ 3,743	$ 3,895	$ 5,787
Gaucher	1,623	2,713	2,913	4,478
Pompe	997	362	598	708
Cystinosis	2,417	470	3,709	1,027
Hunter	444	537	1,943	352
Other research activities	32	21	25	117
Unallocated research and development expenses	11,585	14,698	25,047	28,555
Total research and development expenses	$ 18,877	$ 22,544	$ 38,130	$ 41,024

Research and development activities are central to our business model. Product candidates in later stages of clinical development generally have higher development costs than those in earlier stages of clinical development, primarily due to the increased size and duration of later-stage clinical trials. As a result, we expect that our research and development expenses will increase substantially over the next several years, particularly as we increase personnel costs, including stock-based compensation, contractor costs and facilities costs, as we continue to advance the development of our product candidates. We also expect to incur additional expenses related to milestone and royalty payments payable to third parties with whom we have entered into license agreements to acquire the rights to our product candidates.

The successful development and commercialization of our product candidates is highly uncertain. At this time, we cannot reasonably estimate or know the nature, timing and costs of the efforts that will be necessary to complete the preclinical and clinical development of any of our product candidates or when, if ever, material net cash inflows may commence from any of our product candidates. This uncertainty is due to the numerous risks and uncertainties associated with product development and commercialization, including the uncertainty of:

- the scope, progress, outcome and costs of our preclinical development activities, clinical trials and other research and development activities;
- establishing an appropriate safety profile with IND-enabling studies;
- successful patient enrollment in, and the design, initiation and completion of, clinical trials;
- the timing, receipt and terms of any marketing approvals from applicable regulatory authorities;
- establishing commercial manufacturing capabilities or making arrangements with third-party manufacturers;

- development and timely delivery of commercial-grade drug formulations that can be used in our clinical trials and for commercial launch;
- obtaining, maintaining, defending and enforcing patent claims and other intellectual property rights;
- significant and changing government regulation;
- launching commercial sales of our product candidates, if and when approved, whether alone or in collaboration with others;
- maintaining a continued acceptable safety profile of the product candidates following approval; and
- the risks disclosed in the section entitled "Risk Factors" of this Quarterly Report on Form 10-Q.

We may never succeed in achieving regulatory approval for any of our product candidates. We may obtain unexpected results from our clinical trials. We may elect to discontinue, delay or modify clinical trials of some product candidates or focus on others. Any changes in the outcome of any of these variables with respect to the development of our product candidates in preclinical and clinical development could mean a significant change in the costs and timing associated with the development of these product candidates. For example, if the FDA or another regulatory authority were to delay our planned start of clinical trials or require us to conduct clinical trials or other testing beyond those that we currently expect, or if we experience significant delays in enrollment in any of our planned clinical trials for any reason, we could be required to expend significant additional financial resources and time on the completion of clinical development of that product candidate. Identifying potential product candidates and conducting preclinical testing and clinical trials is a time-consuming, expensive and uncertain process that takes years to complete, and we may never generate the necessary data or results required to obtain marketing approval and achieve product sales. In addition, our product candidates, if approved, may not achieve commercial success.

General and Administrative Expenses

General and administrative expenses consist primarily of salaries, related benefits, travel and stock-based compensation expense for personnel in executive, finance and administrative functions. General and administrative expenses also include professional fees for legal, consulting, accounting and audit services.

We anticipate that our general and administrative expenses will increase in the future as we increase our headcount to support our continued research activities and development of our product candidates. We also anticipate that we will continue to incur increased accounting, audit, legal, regulatory, compliance, director and officer insurance costs as well as investor and public relations expenses associated with being a public company. We anticipate the additional costs for these services will substantially increase our general and administrative expenses. Additionally, if and when we believe a regulatory approval of a product candidate appears likely, we anticipate an increase in payroll and expense as a result of our preparation for commercial operations, especially as it relates to the sales and marketing of our product candidate.

Other (Expense) Income, Net

Other (expense) income, net primarily consists of interest income earned on our cash and cash equivalents and changes in foreign currency, and interest expense related to our Term Loan Agreement.

Consolidated Results of Operations

Comparison of the three months ended June 30, 2022 and 2021

The following table summarizes our consolidated results of operations (in thousands):

	Three Months Ended June 30,		
	2022	2021	Change
Operating expenses:			
Research and development	$ 18,877	$ 22,544	$ (3,667)
General and administrative	8,897	8,831	66
Total operating expenses	27,774	31,375	(3,601)
Loss from operations	(27,774)	(31,375)	3,601
Other (expense) income:			
Interest income	(285)	9	(294)
Other expense	5	(21)	26
Total other (expense) income, net	(280)	(12)	(268)
Net loss	$ (28,054)	$ (31,387)	$ 3,333

Research and Development Expenses

Research and development expenses decreased by approximately $3.7 million to $18.9 million for the three months ended June 30, 2022, from $22.5 million for the three months ended June 30, 2021. This decrease was driven by decreases of $1.5 million in manufacturing costs, $1.1 million in non-cash stock-based compensation, $0.7 million in preclinical costs, and $0.3 million in personnel-related costs.

General and Administrative Expenses

General and administrative expenses were $8.9 million for the three months ended June 30, 2022, compared to $8.8 million for the three months ended June 30, 2021. This increase of $0.1 million was attributable to an increase of $1.0 million in personnel-related costs, partially offset by a $0.6 million decrease in professional fees and a $0.3 million decrease in non-cash stock-based compensation.

Other (Expense) Income, Net

Other (expense), net, was $(0.3) million for the three months ended June 30, 2022, compared to less than $(0.1) million for the three months ended June 30, 2021. The change is primarily due to interest expense related to our Term Loan Agreement, which we entered into in the fourth quarter of 2021.

Comparison of the six months ended June 30, 2022 and 2021

The following table summarizes our consolidated results of operations (in thousands):

	Six Months Ended June 30,		
	2022	2021	Change
Operating expenses:			
Research and development	$ 38,130	$ 41,024	$ (2,894)
General and administrative	19,062	17,235	1,827
Total operating expenses	57,192	58,259	(1,067)
Loss from operations	(57,192)	(58,259)	1,067
Other (expense) income:			
Interest income	(655)	19	(674)
Other expenses	(40)	(46)	6
Total other (expense) income, net	(695)	(27)	(668)
Net loss	$ (57,887)	$ (58,286)	$ 399

Research and Development Expenses

Research and development expenses decreased by approximately $2.9 million to $38.1 million for the six months ended June 30, 2022, from $41.0 million for the six months ended June 30, 2021. This decrease was driven by a $2.3 million decrease in non-cash stock-based compensation, a $1.0 million decrease in manufacturing costs, a $1.0 million decrease in preclinical costs, a $0.2 million decrease in personnel-related costs, and was partially offset by an increase of $1.8 million in clinical trial consulting expenses.

General and Administrative Expenses

General and administrative expenses were $19.1 million for the six months ended June 30, 2022, compared to $17.2 million for the six months ended June 30, 2021. This increase of $1.8 million was attributable to an increase of $1.6 in personnel-related costs, and a $0.1 million increase in other expenses, primarily related to facilities costs, professional fees and legal fees.

Other (Expense) Income, Net

Other (expense), net, was $(0.7) million for the six months ended June 30, 2022, compared to $0.0 million for the six months ended June 30, 2021. The change is primarily due to interest expense related to our Term Loan Agreement, which we entered into in the fourth quarter of 2021.

Liquidity and Capital Resources

Since our inception, we have not generated any revenue and have incurred significant operating losses and negative cash flows from our operations. We have funded our operations to date primarily with proceeds from the sale of preferred stock and our common stock through our IPO, and we have raised additional capital through subsequent follow-on offerings and our ATM facility. Through June 30, 2022, we had received gross cash proceeds of $87.5 million from sales of our preferred stock; gross cash proceeds, before deducting underwriting discounts and commissions and expenses, of $428.1 million from sales of our common stock through our initial public offering and follow-on offerings; gross cash proceeds, before deducting commissions and expenses, of $23.5 million from sales of our common stock under our ATM facility; and we had drawn $15.0 million in term loans under our Term Loan Agreement.

On July 1, 2019, we filed a shelf registration statement on Form S-3 with the SEC, or the July 2019 Shelf, which covers the offering, issuance and sale by us of up to an aggregate of $200.0 million of our common stock, preferred stock, debt securities, warrants and/or units. We simultaneously entered into a Sales Agreement with Cowen and Company, LLC, as sales agent, to provide for the offering, issuance and sale by us of up to $50.0 million of our common stock from time to time in ATM offerings under the July 2019 Shelf. The July 2019 Shelf was declared effective by the SEC on July 10, 2019, and expired on July 1, 2022.

On December 20, 2019, we filed a shelf registration statement on Form S-3 with the SEC, or the December 2019 Shelf, which covers the offering, issuance and sale by us of up to an aggregate of $250.0 million of our common stock, preferred stock, debt securities, warrants and/or units. The December 2019 Shelf was declared effective by the SEC on January 14, 2020.

In July 2019, we closed an underwritten public offering, or the July 2019 Follow-On Offering, under the July 2019 Shelf of 7,475,000 shares of our common stock at a public offering price of $18.50 per share, which included 975,000 shares of our common stock resulting from the full exercise of the underwriters' option to purchase additional shares at the public offering price. The net proceeds to us from this offering, after deducting underwriting discounts and commissions and other offering expenses payable by us, were $129.5 million.

In February 2020, we closed an underwritten public offering, or the February 2020 Follow-On Offering, under the December 2019 Shelf of 4,350,000 shares of our common stock at a public offering price of $23.00 per share. The net proceeds to us from this offering, after deducting underwriting discounts and commissions and other offering expenses payable by us, were $93.6 million.

In June 2020, we sold an aggregate of 384,140 shares of common stock under the ATM facility for net proceeds, after deducting commissions and other offering expenses payable by us, of $8.1 million.

In November 2020, we closed an underwritten public offering, or the November 2020 Follow-On Offering, of 5,000,000 shares of our common stock at a public offering price of $15.00 per share. The net proceeds to us from the November 2020 Follow-On Offering, after deducting underwriting discounts and commissions and other offering expenses payable by us, were $70.2 million.

In May 2021, we sold an aggregate of 1,829,268 shares of common stock under the ATM facility for net proceeds, after deducting commissions and other offering expenses payable by us, of $14.5 million. As of June 30, 2022, approximately $26.5 million of common stock remained available for future issuance under the ATM facility.

On November 2, 2021, or the Closing Date, we entered into the Term Loan Agreement. The Term Loan Agreement provided for (i) on the Closing Date, $30.0 million aggregate principal amount of term loans available through October 31, 2023; (ii) an additional $20.0 million in term loan facilities available through October 31, 2023 upon the achievement of certain regulatory or clinical milestones prior to the time of draw, or the Milestone Funding; and (iii) an additional discretionary $15.0 million term loan facility available upon our request and approval by the Agent and the Lenders, or, collectively, the Term Loans. We drew $15.0 million in term loans on the Closing Date. As a result of the deprioritization of our Fabry disease program, we are no longer able to draw the $20.0 million of Milestone Funding per the terms of the Term Loan Agreement. The loan repayment schedule provides for interest only payments until November 1, 2024, followed by consecutive monthly payments of principal and interest. All unpaid principal and accrued and unpaid interest with respect to each term loan is due and payable in full on October 1, 2026.

As of June 30, 2022, we had cash and cash equivalents of $132.4 million. Cash in excess of immediate requirements is invested primarily with a view to liquidity and capital preservation. We believe that our existing cash and cash equivalents as of June 30, 2022 will enable us to fund our operating expenses and capital expenditure requirements into the first quarter of 2024.

Cash Flows

The following table summarizes our cash flows for each of the periods presented (in thousands):

	Six Months Ended June 30,	
	2022	2021
Net cash used in operating activities	$ (57,120)	$ (47,304)
Net cash used in investing activities	(181)	(1,344)
Net cash provided by financing activities	143	15,404
Net (decrease) in cash and cash equivalents	$ (57,158)	$ (33,244)

Operating Activities

During the six months ended June 30, 2022, operating activities used $57.1 million of cash, cash equivalents and restricted cash, resulting from our net loss of $57.9 million and cash used by changes in our operating assets and liabilities of $6.7 million which was partially offset by non-cash charges of $7.4 million. The net changes in our operating assets and liabilities were primarily due to a decrease in accounts payable of $3.5 million, a decrease in accrued expenses and other liabilities of $3.1 million, and an increase in prepaids and other current assets of $0.1 million. The non-cash charges primarily included $6.6 million of stock-based compensation expense and $0.8 million of depreciation and amortization expense.

During the six months ended June 30, 2021, operating activities used $47.3 million of cash, cash equivalents and restricted cash, resulting from our net loss of $58.3 million offset by cash provided by changes in our operating assets and liabilities of $1.2 million and non-cash charges of $9.8 million. The net changes in our operating assets and liabilities were primarily due to an increase in accrued expenses and other liabilities of $1.0 million and a $0.5 million decrease in prepaids and other current assets, partially offset by a decrease in accounts payable. The non-cash charges primarily included $9.3 million of stock-based compensation expense and $0.6 million of depreciation and amortization expense.

Investing Activities

Net cash used in investing activities was $0.2 million for the six months ended June 30, 2022 compared to $1.3 million for the six months ended June 30, 2021. The decrease in cash used in investing activities was primarily due to a decrease in purchases of property and equipment.

Financing Activities

Net cash provided by financing activities was $0.1 million for the six months ended June 30, 2022 compared to $15.4 million for the six months ended June 30, 2021. The decrease in cash provided by financing activities was primarily due to the proceeds of $14.6 million from issuance of common shares under ATM facility, net of offering costs paid and $0.9 million from proceeds from the exercise of stock options during the six months ended June 30, 2021 which was partially offset by $0.1 million in proceeds from the issuance of shares under our 2018 Employee Stock Purchase Plan during the six months ended June 30, 2022.

Funding Requirements

We expect our expenses to increase substantially in connection with our ongoing activities, particularly as we advance the preclinical activities and clinical trials of our product candidates. Our expenses will also increase as we:

- continue our development of our product candidates, including continuing enrollment and dosing of patients in our ongoing clinical trials;
- initiate additional clinical trials and preclinical studies for our current and future product candidates;
- seek to identify and develop or in-license or acquire additional product candidates and technologies;
- seek to industrialize our HSC therapy approach into a robust, scalable and, if approved, commercially viable process;
- seek marketing approvals for our product candidates that successfully complete clinical trials, if any;
- establish a sales, marketing and distribution infrastructure to commercialize any product candidates for which we may obtain marketing approval;
- hire and retain additional personnel, such as clinical, medical, manufacturing, quality, commercial and scientific personnel;
- expand our infrastructure, office space and facilities to accommodate our employee base, including adding equipment and physical infrastructure to support our research and development; and
- continue to incur additional public company-related costs.

We believe that our $132.4 million of existing cash and cash equivalents as of June 30, 2022, will enable us to fund our operating expenses and capital expenditure requirements into the first quarter of 2024. We have based these estimates on assumptions that may prove to be wrong, and we could utilize our available capital resources sooner than we expect. If we receive regulatory approval for any of our product candidates, we expect to incur significant commercialization expenses related to product manufacturing, sales, marketing and distribution, depending on where we choose to commercialize.

Until such time, if ever, that we can generate product revenue sufficient to achieve profitability, we expect to finance our cash needs through a combination of equity offerings, debt financings, collaboration agreements, government and other third-party funding, strategic alliances, licensing arrangements or marketing and distribution arrangements. Debt financing and preferred equity financing, if available, may involve agreements that include covenants limiting or restricting our ability to take specific actions, such as incurring additional debt, making capital expenditures or declaring dividends. If we raise additional funds through government and other third-party funding, collaboration agreements, strategic alliances, licensing arrangements or marketing and distribution arrangements, we may have to relinquish valuable rights to our technologies, future revenue streams, research programs or product candidates or grant licenses on terms that may not be favorable to us. If we are unable to raise additional funds through equity or debt financings when needed, we may be required to delay, limit, reduce or terminate our product development or future commercialization efforts or grant rights to develop and market products or product candidates that we would otherwise prefer to develop and market ourselves.

Contractual Obligations and Commitments

The disclosure of our contractual obligations and commitments is set forth under the heading “Management’s Discussion and Analysis of Financial Condition and Results of Operations—Contractual Obligations and Commitments” in our Annual Report on Form 10-K for the fiscal year ended December 31, 2021, filed with the SEC on March 17, 2022.

Critical Accounting Policies and Significant Judgments and Estimates

Our consolidated financial statements are prepared in accordance with generally accepted accounting principles in the United States. The preparation of our consolidated financial statements and related disclosures requires us to make estimates and judgments that affect the reported amounts of assets, liabilities, revenue, costs and expenses, and the disclosure of contingent assets and liabilities in our financial statements. We base our estimates on historical experience, known trends and events and various other factors that we believe are reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. We evaluate our estimates and assumptions on an ongoing basis. Our actual results may differ from these estimates under different assumptions or conditions. During the six months ended June 30, 2022, there were no material changes to our critical accounting policies. Our critical accounting policies are described under the heading “Management’s Discussion and Analysis of Financial Condition and Results of Operations— Critical Accounting Policies and Significant Judgments and Estimates” in our Annual Report on Form 10-K for the fiscal year ended December 31, 2021, which was filed with the SEC on March 17, 2022, and the notes to the consolidated financial statements included in Item 1, “*Condensed Consolidated Unaudited Financial Statements*,” of this Quarterly Report on Form 10-Q.

Emerging Growth Company Status

We are an "emerging growth company," as defined in the Jumpstart Our Business Startups Act of 2012, or the JOBS Act, and we may take advantage of certain exemptions from various reporting requirements applicable to other public companies, which are not emerging growth companies. We may take advantage of these exemptions until we are no longer an emerging growth company. Section 107 of the JOBS Act provides that an emerging growth company can take advantage of the extended transition period afforded by the JOBS Act for the implementation of new or revised accounting standards. We have elected to use the extended transition period for complying with new or revised accounting standards and, as a result of this election, our financial statements may not be comparable to companies that comply with public company effective dates. We may take advantage of these exemptions up until the last day of the fiscal year following the fifth anniversary of our IPO or such earlier time that we are no longer an emerging growth company. We would cease to be an emerging growth company if we have more than $1.07 billion in annual revenue, we have more than $700.0 million in market value of our stock held by non-affiliates (and we have been a public company for at least 12 months and have filed one annual report on Form 10-K) or we issue more than $1.0 billion of non-convertible debt securities over a three-year period.

Recently Issued Accounting Pronouncements

A description of recently issued accounting pronouncements that may potentially impact our financial position and results of operations is disclosed in Note 2, *"Summary of Significant Accounting Policies"* to our consolidated financial statements appearing at the beginning of this Quarterly Report on Form 10-Q.

Item 3. Quantitative and Qualitative Disclosures about Market Risk.

Interest Rate Risk

As of June 30, 2022, we had cash and cash equivalents of $132.4 million, which consisted of primarily money market funds. Our primary exposure to market risk is interest rate sensitivity, which is affected by changes in the general level of U.S. interest rates, particularly because our cash equivalents are in held in short-term money market funds. Due to short-term duration of our investment portfolio and the low risk profile of our investments, an immediate 100 basis point change in interest rates would not have a material effect on the fair market value of our portfolio.

Foreign Currency Exchange Risk

We are exposed to foreign exchange rate risk. Our headquarters are located in the United States, where the majority of our general and administrative expenses and research and development costs are incurred in U.S. dollars. A portion of our research and development costs are incurred by our subsidiaries in Australia and Canada, whose functional currencies are the U.S. dollar but engage in transactions in Australian dollars and Canadian dollars, respectively. During each of the six months ended June 30, 2022 and 2021, we recognized foreign currency transaction losses of $40 thousand and $46 thousand, respectively. These losses primarily related to unrealized and realized foreign currency gains and losses as a result of transactions entered into by our Australian and Canadian subsidiaries in currencies other than the U.S. dollar. These foreign currency transaction gains and losses were recorded in other expense, net in our consolidated statements of operations. We believe that a 10% change in the exchange rate between the U.S. dollar, Australian dollar, Great British Pound, and Canadian dollar would not have a material impact on our financial position or results of operations.

As we continue to grow our business, our results of operations and cash flows will be subject to fluctuations due to changes in foreign currency exchange rates, which could adversely impact our results of operations. To date, we have not entered into any foreign currency hedging contracts to mitigate our exposure to foreign currency exchange risk.

Item 4. Controls and Procedures.

Evaluation of Disclosure Controls and Procedures

Our management, with the participation of our Chief Executive Officer and our Chief Financial Officer (our principal executive officer and principal financial officer, respectively), evaluated the effectiveness of our disclosure controls and procedures as of June 30, 2022. The term "disclosure controls and procedures," as defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act, means controls and other procedures of a company that are designed to ensure that information required to be disclosed by a company in the reports that it files or submits under the Exchange Act is recorded, processed, summarized and reported, within the time periods specified in the SEC's rules and forms. Disclosure controls and procedures include, without limitation, controls and procedures designed to ensure that information required to be disclosed by a company in the reports that it files or submits under the Exchange Act is accumulated and communicated to the company's management, including its principal executive and principal financial officers, as appropriate to allow timely decisions regarding required disclosure. Management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving their objectives and management necessarily applies its judgment in evaluating the cost-benefit relationship of possible controls and procedures. While we continue to evaluate our disclosure controls and procedures, including new procedures and processes relating to our internal control over financial reporting, based on the evaluation of our disclosure controls and procedures as of June 30, 2022, our Chief Executive Officer and Chief Financial Officer concluded that our disclosure controls and procedures were effective at the reasonable assurance level as of June 30, 2022.

Changes in Internal Control over Financial Reporting

No change in our internal control over financial reporting (as defined in Rules 13a-15(f) and 15d-15(f) under the Exchange Act) occurred during the three months ended June 30, 2022 that has materially affected, or is reasonably likely to materially affect, our internal control over financial reporting.

PART II—OTHER INFORMATION

Item 1. Legal Proceedings.

From time to time, we may become subject to various legal proceedings and claims that arise in the ordinary course of our business activities. Although the results of litigation and claims cannot be predicted with certainty, as of June 30, 2022, we are not presently subject to any pending or threatened litigation that we believe, if determined adversely to us, would individually or in the aggregate be reasonably expected to have a material adverse effect on our business. Regardless of the outcome, litigation can have an adverse impact on us because of defense and settlement costs, diversion of management resources and other factors.

Item 1A. Risk Factors.

Investing in our common stock involves a high degree of risk. You should carefully consider the following risks and uncertainties, together with all other information in this Quarterly Report on Form 10-Q, including our consolidated financial statements and related notes and "Management's Discussion and Analysis of Financial Condition and Results of Operations," as well as our other filings with the Securities and Exchange Commission, or the SEC, before investing in our common stock. Any of the risk factors we describe below could adversely affect our business, financial condition or results of operations. The market price of our common stock could decline if one or more of these risks or uncertainties were to occur, which may cause you to lose all or part of the money you paid to buy our common stock. Additional risks that are currently unknown to us or that we currently believe to be immaterial may also impair our business. Certain statements below are forward-looking statements. See "Forward-Looking Information" in this Quarterly Report on Form 10-Q.

Risks related to our business, financial position and need for additional capital

We have incurred net losses since inception. We expect to incur net losses for the foreseeable future and may never achieve or maintain profitability.

Since inception, we have incurred net losses. We incurred net losses of $119.1 million and $119.7 million for the years ended December 31, 2021 and 2020, respectively, and $57.9 million for the six months ended June 30, 2022. We historically financed our operations primarily through private placements of our preferred stock and, more recently, our initial public offering and follow-on public offerings of our common stock, as well as sales of our common stock under our ATM facility. In addition, in November 2021 we entered into the Term Loan Agreement. We have devoted substantially all of our efforts to research and development, including clinical and preclinical development of our product candidates, as well as assembling our team. We expect that it will be several years, if ever, before we have commercialized any product candidates. We expect to continue to incur significant expenses and increasing operating losses for the foreseeable future. We anticipate that our expenses will increase substantially if, and as, we:

- continue our development of our product candidates, including continuing enrollment in our ongoing clinical trials, particularly if and as we commence and continue clinical-stage activities for our product candidates;
- initiate additional clinical trials and preclinical studies for our current and future product candidates;
- experience delays or interruptions in preclinical studies, clinical trials, or our supply chain due to the ongoing COVID-19 pandemic;
- seek to identify and develop or in-license additional product candidates;
- seek marketing approvals for our product candidates that successfully complete clinical trials, if any;
- establish a sales, marketing and distribution infrastructure to commercialize any product candidates for which we may obtain marketing approval;
- continue our implementation of our plato platform as we seek to industrialize our HSC gene therapy approach into a robust, scalable and, if approved, commercially viable process;
- hire and retain additional personnel, such as clinical, quality control, regulatory and scientific personnel;
- expand our office space, infrastructure and facilities as needed to accommodate our employee base, including adding equipment and physical infrastructure to support our research and development; and
- continue to incur additional public company-related costs.

To become and remain profitable, we must develop and eventually commercialize product candidates with significant market potential. This will require us to be successful in a range of challenging activities, and our expenses will increase substantially as we seek to complete preclinical and clinical trials of our product candidates, and manufacture, market and sell these or any future product

candidates for which we may obtain marketing approval, if any, and satisfy any post-marketing requirements. We may never succeed in any or all of these activities and, even if we do, we may never generate revenues that are significant or large enough to achieve profitability. If we do achieve profitability, we may not be able to sustain or increase profitability on a quarterly or annual basis. Our failure to become and remain profitable would decrease the value of our Company and could impair our ability to raise capital, maintain our research and development efforts, expand our business or continue our operations. A decline in the value of our Company also could cause you to lose all or part of your investment.

We have never generated revenue from product sales and do not expect to do so for the next several years, if ever.

Our ability to generate revenue from product sales and achieve profitability depends on our ability, alone or with collaborative partners, to successfully complete the development of, and obtain the regulatory approvals necessary to commercialize, our product candidates. We do not anticipate generating revenues from product sales for the next several years, if ever. Our ability to generate future revenues from product sales depends heavily on our, or our collaborators', success in:

- completing research and preclinical and clinical development of our product candidates;
- seeking and obtaining regulatory and marketing approvals for product candidates for which we complete clinical trials;
- launching and commercializing product candidates for which we obtain regulatory and marketing approval by establishing a sales force, marketing and distribution infrastructure or, alternatively, collaborating with a commercialization partner;
- qualifying for adequate coverage and reimbursement by government and third-party payors for our product candidates;
- establishing and maintaining supply and manufacturing processes and relationships with third parties that can provide adequate, in both amount and quality, products and services to support clinical development and the commercial market demand for our product candidates, if approved;
- obtaining market acceptance of our product candidates, if approved, as a viable treatment option;
- addressing any competing technological and market developments;
- negotiating favorable terms in any collaboration, licensing or other arrangements into which we may enter and performing our obligations under such arrangements; and
- attracting, hiring and retaining qualified personnel.

Even if one or more of the product candidates that we develop is approved for commercial sale, we anticipate incurring significant costs associated with commercializing any approved product candidate. Our expenses could increase beyond expectations if we are required by the FDA or other foreign regulatory authorities to perform clinical and other studies in addition to those that we currently anticipate. Even if we are able to generate revenues from the sale of any approved products, we may not become profitable and may need to obtain additional funding to continue operations.

We will need additional funding, which may not be available on acceptable terms, or at all. Failure to obtain this necessary capital when needed may force us to delay, limit or terminate our product development efforts or other operations.

As of June 30, 2022, we had cash and cash equivalents of $132.4 million. We believe that our existing cash and cash equivalents as of June 30, 2022, will enable us to fund our operating expenses and capital expenditure requirements into the first quarter of 2024. This forecast of cash resources is forward-looking information that involves risks and uncertainties, and the actual amount of our expenses could vary materially and adversely as a result of a number of factors. We have based our estimates on assumptions that may prove to be wrong, and our expenses could prove to be significantly higher than we currently anticipate.

We expect our expenses to increase in connection with our ongoing activities, particularly as we continue the research and development of, initiate further clinical trials of and seek marketing approval for, our product candidates and continue to enhance and optimize our vector technology and manufacturing processes. Furthermore, we currently have a total of five gene therapy programs in our pipeline, two of which are in clinical development. Further development of these programs will require us to expend significant resources to advance these candidates. In addition, if we obtain marketing approval for any of our product candidates, we expect to incur significant expenses related to product sales, medical affairs, marketing, manufacturing and distribution. Furthermore, we expect to continue to incur additional costs associated with operating as a public company. Accordingly, we will need to obtain substantial additional funding in connection with our continuing operations. If we are unable to raise capital when needed or on reasonable terms, we would be forced to delay, reduce or eliminate certain of our research and development programs. Our future capital requirements will depend on many factors, including:

- the scope, progress, results and costs of drug discovery, laboratory testing, preclinical development and clinical trials for our current and future product candidates, including the extent of any impacts from the ongoing COVID-19 pandemic on these activities;
- the costs, timing and outcome of regulatory review of our product candidates;
- the costs of future activities, including product sales, medical affairs, marketing, manufacturing and distribution, for any of our product candidates for which we receive marketing approval;
- the costs associated with our manufacturing process development and evaluation of third-party manufacturers;
- revenue, if any, received from commercial sale of our products, should any of our product candidates receive marketing approval;
- the costs of preparing, filing and prosecuting patent applications, maintaining and enforcing our intellectual property rights and defending intellectual property-related claims;
- the terms of our current and any future license agreements and collaborations; and
- the extent to which we acquire or in-license other product candidates, technologies and intellectual property.

Identifying potential product candidates and conducting preclinical testing and clinical trials is a time-consuming, expensive and uncertain process that takes years to complete, and we may never generate the necessary data or results required to obtain marketing approval and achieve product sales. In addition, our product candidates, if approved, may not achieve commercial success. Our product revenues, if any, will be derived from or based on sales of products that may not be commercially available for many years, if at all. Accordingly, we will need to continue to rely on additional financing to achieve our business objectives. Adequate additional financing may not be available to us on acceptable terms, or at all.

Our Term Loan Agreement contains restrictions that potentially limit our flexibility in operating our business, and we may be required to make a prepayment or repay our outstanding indebtedness earlier than we expect. In addition, as a result of the deprioritization of our Fabry program, we can no longer draw $20.0 million of term loans that were contingent upon the achievement of certain milestones related to our development of AVR-RD-01 for Fabry disease.

On November 2, 2021, we entered into the Term Loan Agreement. The Term Loan Agreement provided for term loans of up to $65.0 million in the aggregate available in three tranches, but due to the deprioritization of our Fabry program we can no longer draw $20.0 million of term loans that were contingent upon the achievement of certain milestones related to our development of AVR-RD-01 for Fabry disease. As a result, the amount that remains available to us for future drawdown, subject to satisfaction of the conditions in the Term Loan Agreement, is $30.0 million, $15.0 million of which requires the consent of the Agent and Lenders. The Term Loan Agreement contains various covenants that limit our ability to engage in specified types of transactions. These covenants limit our ability to, among other things:

- incur or assume certain debt;
- merge or consolidate or acquire all or substantially all of the capital stock or property of another entity;
- change the nature of our business;
- change our organizational structure or type;
- license, transfer, or dispose of certain assets;
- grant certain types of liens on our assets;
- make certain investments;
- pay cash dividends; and
- enter into material transactions with affiliates.

A breach of any of these covenants could result in an event of default under the Term Loan Agreement. An event of default will also occur if, among other things, a material adverse change in our business, operations, or condition occurs, which could potentially include a material impairment of the prospect of our repayment of any portion of the amounts we owe under the Term Loan Agreement. In the case of a continuing event of default under the Term Loan Agreement, the lenders could elect to declare all amounts outstanding to be immediately due and payable, proceed against the collateral in which we granted the Lenders a security interest under the Term Loan Agreement, or otherwise exercise the rights of a secured creditor. Amounts outstanding under the Term Loan Agreement are secured by all of our existing and future assets, excluding intellectual property, which is subject to a negative pledge arrangement.

At closing, we drew $15.0 million of the $30.0 million available to us as part of the first tranche. As executed, the Term Loan Agreement also provided the ability to access up to an additional $35.0 million, of which $20.0 million could be drawn in two additional tranches subject to the achievement of certain regulatory and clinical milestones, or the Milestone Funding, and of which $15.0 million could be drawn in an additional tranche with the approval of the Agent and the Lenders. However, as a result of the deprioritization of our Fabry disease program, we are no longer able to draw the $20.0 million of Milestone Funding per the terms of the Term Loan Agreement. Moreover, if the Agent and Lenders do not consent, we would not be able to draw down the final $15.0 million tranche of financing. If we are unable to access the final $15.0 million tranche, there can be no assurance that we will be able to obtain alternative financing to replace such tranche on commercially reasonable terms or at all, which could adversely impact our business.

We may not have enough available cash to repay or refinance our indebtedness at the time any such repayment is required. In such an event, we may be required to delay, limit, reduce, or terminate our preclinical and clinical product development or grant others rights to develop and market product candidates that we would otherwise prefer to develop and market ourselves. Our business, financial condition, and results of operations could be materially adversely affected as a result.

Raising additional capital may cause dilution to our existing stockholders, restrict our operations or cause us to relinquish valuable rights.

We may seek additional capital through a combination of public and private equity offerings, debt financings, strategic partnerships and alliances and licensing arrangements. To the extent that we raise additional capital through the sale of equity, convertible debt securities or other equity-based derivative securities, your ownership interest will be diluted and the terms may include liquidation or other preferences that adversely affect your rights as a stockholder. Any additional indebtedness we incur would result in increased fixed payment obligations and could involve restrictive covenants, such as limitations on our ability to incur additional debt, limitations on our ability to acquire or license intellectual property rights and other operating restrictions that could adversely impact our ability to conduct our business. Furthermore, the issuance of additional securities, whether equity or debt, by us, or the possibility of such issuance, may cause the market price of our common stock to decline and existing stockholders may not agree with our financing plans or the terms of such financings. If we raise additional funds through strategic partnerships and alliances and licensing arrangements with third parties, we may have to relinquish valuable rights to our technologies, or our product candidates, or grant licenses on terms unfavorable to us. Adequate additional financing may not be available to us on acceptable terms, or at all.

Our limited operating history may make it difficult for you to evaluate the success of our business to date and to assess our future viability.

We are a clinical-stage company founded in November 2015. Our operations to date have been limited to corporate organization, recruiting key personnel, business planning, raising capital, acquiring rights to our technology, identifying potential product candidates, undertaking preclinical studies and planning and supporting clinical trials of certain of our product candidates and establishing research and development and manufacturing capabilities. We have not yet demonstrated the ability to complete clinical trials of our product candidates, obtain marketing approvals, manufacture products on a commercial scale or conduct sales and marketing activities necessary for successful commercialization. Consequently, any predictions you make about our future success or viability may not be as accurate as they could be if we had a longer operating history. In addition, as an early-stage company, we may encounter unforeseen expenses, difficulties, complications, delays and other known and unknown factors.

Risks related to the discovery and development of our product candidates

Business interruptions resulting from the coronavirus disease ("COVID-19") pandemic or "similar public health crises have caused and may continue to cause a disruption of the development of our product candidates and adversely impact our business.

Public health crises such as pandemics or similar outbreaks could adversely impact our business. The ongoing COVID-19 pandemic has continued to disrupt normal business operations both in and outside of affected areas and has had significant negative impacts on businesses and financial markets worldwide. We continue to monitor our operations and follow applicable government recommendations and the majority of our employees, other than our laboratory staff, have adopted a "hybrid" work schedule which is intended to limit the number of people in our office at any particular time. Notwithstanding these measures, the evolving COVID-19 pandemic, including potential outbreaks of new variants, could affect the health and availability of our workforce as well as those of the third parties on which we rely. If members of our management and other key personnel are unable to perform their duties or have limited availability due to COVID-19, we may not be able to execute on our business strategy and/or our operations may be negatively impacted. We may experience limitations in employee resources, including because of sickness of employees or their families or the desire of employees to avoid contact with individuals or large groups of people.

In addition, clinical trial activities, including patient enrollment and data collection, are dependent upon global clinical trial sites which have been and continue to be adversely affected by the ongoing COVID-19 pandemic. For example, as the global healthcare community responded to the fluctuations in COVID-19 cases and hospitalizations, many hospitals, including our clinical sites, temporarily paused elective procedures, which included dosing of new patients with our investigational gene therapies. While dosing of new patients began to resume in the first half of 2021, our ability to continue clinical activities without further delay or interruption will depend on future developments that are highly uncertain and cannot be accurately predicted. Additionally, while ongoing data collection has continued for our patients that have been dosed, certain data collection was previously delayed and additional delays could result from COVID-19-related interruptions, particularly as new variants of the virus are identified and continue to spread. We are currently conducting and planning to conduct clinical trials for our product candidates in geographies that have been affected by COVID-19.

Additional factors from the ongoing COVID-19 pandemic that have delayed and may continue to delay or otherwise adversely affect enrollment in or the progress of the clinical trials of our product candidates, as well as our business generally, include:

- the potential diversion of healthcare resources away from the conduct of clinical trials to focus on pandemic concerns, including the attention of physicians serving as our clinical trial investigators, hospitals serving as our clinical trial sites and hospital staff supporting the conduct of our clinical trials;
- limitations on travel that could interrupt key trial activities, such as clinical trial site initiations and monitoring, domestic and international travel by employees, contractors or patients to clinical trial sites, including any government-imposed travel restrictions or quarantines that may impact the ability or willingness of patients, employees or contractors to travel to our clinical trial sites or secure visas or entry permissions, any of which could delay or adversely impact the conduct or progress of our clinical trials;
- interruption in global shipping affecting the transport of clinical trial materials, such as patient samples, investigational drug product and conditioning drugs and other supplies used in our clinical trials;
- business disruptions caused by workplace, laboratory and office closures and an increased reliance on employees working from home, disruptions to or delays in ongoing laboratory experiments and operations, staffing shortages, travel limitations or mass transit disruptions, any of which could adversely impact our business operations or those of third party service providers, contractors, or suppliers on whom we rely, impair the productivity of our personnel, subject us to additional cybersecurity risks, create data accessibility problems, cause us to become more susceptible to communication disruptions, or delay necessary interactions with local regulators, ethics committees and other important agencies and contractors;
- business disruptions involving our third parties on whom we rely, including CROs and other collaborators for the conduct of our clinical trials or our third party suppliers or manufacturers, which could impact their ability to perform adequately or disrupt our supply chain; and
- changes in hospital or research institution policies or government regulations, which could delay or adversely impact our ability to conduct our clinical trials.

Since the beginning of the COVID-19 pandemic, several vaccines for COVID-19 have received Emergency Use Authorization by the FDA and a number of those later received marketing approval. Additional vaccines may be authorized or approved in the future. The resultant demand for vaccines and potential for manufacturing facilities and materials to be commandeered under the Defense Production Act of 1950, or equivalent foreign legislation, may make it more difficult to obtain materials or manufacturing slots for the products needed for our clinical trials, which could lead to delays in these trials.

These and other factors arising from the ongoing COVID-19 pandemic could worsen and further adversely impact our ability to conduct clinical trials and our business generally, and could have a material adverse impact on our operations and financial condition and results. The extent to which the ongoing COVID-19 pandemic impacts our operations or those of our third party partners will depend on future developments, which are highly uncertain and cannot be predicted with confidence, including the duration of the pandemic, the efficacy and safety of vaccines, including against emerging variants, the ability of third parties to manufacture and distribute vaccines and the public's willingness to receive such vaccines, and new information that may emerge concerning mutations of the coronavirus that causes COVID-19, among others.

Our HSC-based gene therapy product candidates are based on a novel technology, which makes it difficult to predict the time and cost of product candidate development and of subsequently obtaining regulatory approval.

We have concentrated our research and development efforts on our HSC-based gene therapy approach, and our future success depends on our successful development of viable gene therapy product candidates. There can be no assurance that we will not experience problems or delays in developing new product candidates and that such problems or delays will not cause unanticipated costs, or that any such development problems can be solved. For example, timely enrollment in our clinical trials is dependent upon global clinical trial sites which have been and may continue to be adversely affected by the ongoing COVID-19 pandemic, especially if a resurgence of cases occurs. In addition, the implementation of our plato platform and upgrades, including our current conditioning regimen or any conditioning regimen we implement in the future, may result in delays or setbacks in our research and development activities, and we may not realize the intended benefits of these efforts. In addition, we may also experience delays in developing a sustainable, reproducible and scalable manufacturing process or transferring that process to commercial partners, which may prevent us from completing our clinical studies or commercializing our products on a timely or profitable basis, if at all. For example, as of August 1, 2022, we have only dosed ten patients using our plato platform in our clinical trials, which includes six patients in our FAB-GT clinical trial for which we have halted enrollment. Our implementation of the LV2 lentiviral vector or of our cell processing to an industrialized, automated closed system using disposable supplies may not be successful or may experience unforeseen delays, which may cause shortages or delays in the supply of our products available for clinical trials and future commercial sales, if any, or impair our research and development efforts, including those in our ongoing and future clinical trials. In addition, there is no assurance that products using our proprietary LV2 lentiviral vector or manufactured using this automated system will ultimately achieve the same favorable preliminary results observed to date. Furthermore, the FDA generally prefers that clinical trials be double-blinded and potentially include sham controls. Such a trial design could be challenging to implement due to the nature of the treatment regimen of HSC gene therapy.

In addition, the clinical trial requirements of the FDA and other foreign regulatory authorities and the criteria these regulators use to determine the safety and efficacy of a product candidate vary substantially according to the type, complexity, novelty and intended use and market of such product candidates. The regulatory approval process for novel product candidates such as ours can be more expensive and take longer than for other, better known or more extensively studied product candidates. To date, only a limited number of gene therapies have received marketing authorization from the FDA or foreign regulatory authorities. It is difficult to determine how long it will take or how much it will cost to obtain regulatory approvals for our product candidates in the United States, Canada, Europe, Japan or other major markets or how long it will take to commercialize our product candidates, if any are approved. Approvals by foreign regulatory authorities may not be indicative of what the FDA may require for approval, and vice versa.

Gene therapy clinical trials conducted at institutions that receive funding for recombinant DNA research from the United States National Institutes of Health, or NIH, also are subject to the NIH Guidelines, under which supervision of human gene transfer trials includes evaluation and assessment by an institutional biosafety committee, or IBC, a local institutional committee that reviews and oversees research utilizing recombinant or synthetic nucleic acid molecules at that institution. Before a clinical trial can begin at any institution, that institution's review board, or IRB, and its IBC assesses the safety of the research and identifies any potential risk to public health or the environment. While the NIH guidelines are not mandatory unless the research in question is being conducted at or sponsored by institutions receiving NIH funding of recombinant or synthetic nucleic acid molecule research, many companies and other institutions not otherwise subject to the NIH Guidelines voluntarily follow them. Although the FDA decides whether individual gene therapy protocols may proceed, the review process and determinations of other reviewing bodies can impede or delay the initiation of a clinical trial, even if the FDA has reviewed the trial and approved its initiation. In addition, adverse developments in clinical trials of gene therapy products conducted by others may cause the FDA or other oversight bodies to change the requirements for approval of any of our product candidates. Similarly, foreign regulatory authorities may issue new guidelines concerning the development and marketing authorization for gene therapy medicinal products and require that we comply with these new guidelines.

The FDA, NIH and the European Medicines Agency, or EMA, have each expressed interest in further regulating biotechnology, including gene therapy and genetic testing. For example, the EMA advocates a risk-based approach to the development of a gene therapy product. Agencies at both the federal and state level in the United States, as well as the U.S. congressional committees and other governments or governing agencies, have also expressed interest in further regulating the biotechnology industry. Such action may delay or prevent commercialization of some or all of our product candidates.

These regulatory review committees and advisory groups and any new guidelines they promulgate may lengthen the regulatory review process, require us to perform additional studies, increase our development costs, lead to changes in regulatory positions and interpretations, delay or prevent approval and commercialization of these product candidates or lead to significant post-approval limitations or restrictions. As we advance our product candidates, we will be required to consult with these regulatory and advisory groups, and comply with applicable guidelines. If we fail to do so, we may be required to delay or discontinue development of certain of our product candidates. These additional processes may result in a review and approval process that is longer than we otherwise would have expected. Delay or failure to obtain, or unexpected costs in obtaining, the regulatory approval necessary to bring a

potential product to market could decrease our ability to generate sufficient product revenue, and our business, financial condition, results of operations and prospects would be materially and adversely affected.

The FDA continues to develop its approach to assessing gene and cell therapy products. For example, the agency has released a series of draft and final guidance documents relating to, among other topics, various aspects of gene therapy product development, review, and approval, including aspects relating to clinical and manufacturing issues related to gene therapy products. In January 2020, the FDA released a final guidance with recommendations for long-term follow-up studies of patients following human gene therapy administration due to the increased risk of undesirable and unpredictable outcomes with gene therapies that may present as delayed adverse events. We cannot be certain whether such guidance, or other guidance that the FDA may issue, will be relevant to or have an adverse impact on our gene therapy candidates or the duration or expense of any applicable regulatory development and review processes.

Our product candidates and the process for administering our product candidates may cause undesirable side effects or have other properties that could delay or prevent their regulatory approval, limit their commercial potential or result in significant negative consequences following any potential marketing approval.

During the conduct of clinical trials, patients may experience changes in their health, including illnesses, injuries, discomforts or a fatal outcome. It is possible that as we test our product candidates in larger, longer and more extensive clinical programs, or as use of our product candidates becomes more widespread if they receive regulatory approval, illnesses, injuries, discomforts and other adverse events that were observed in earlier clinical trials, as well as conditions that did not occur or went undetected in previous clinical trials, will be reported by patients. Additionally, any early access to the Company's investigational therapies, such as through expanded or Right to Try access, may lead to discovery of undesirable side effects that could have adverse effects on the development programs for current and future product candidates. Gene therapies are also subject to the potential risk that occurrence of adverse events will be delayed following administration of the gene therapy due to persistent biological activity of the genetic material or other components of the vectors used to carry the genetic material. Many times, side effects are only detectable after investigational products are tested in larger scale, pivotal clinical trials or, in some cases, after they are made available to patients on a commercial scale after approval. FDA guidance advises that patients treated with gene therapies undergo long-term follow-up observation for potential adverse events for as long as 15 years. If additional clinical or long-term follow-up experience indicates that any of our product candidates have side effects or cause serious or life-threatening side effects, the development of the product candidate may fail or be delayed, or, if the product candidate has received regulatory approval, such approval may be revoked or limited.

Gene therapy is still a relatively new approach to disease treatment and adverse side effects could develop. A safety concern for gene therapies using lentiviral vectors has been the possibility of insertional oncogenesis, leading to malignant transformation of transduced cells and cellular outgrowth. As more patients are dosed with lentiviral gene therapies, it is expected that very rare cases of insertional oncogenesis may occur. For example, several patients with cerebral adrenoleukodystrophy treated in a third-party lentiviral gene therapy clinical trial have been diagnosed with treatment-related myelodysplastic syndrome to date. In addition, persistent clonal dominance due to vector integration has been observed in third-party lentiviral gene therapy clinical trials. While our lentiviral gene therapy approach is designed to avoid insertional oncogenesis, there can be no assurance that patients will not experience such adverse side effects, including death. In addition, although in the future we may potentially implement molecular cytogenetic screening, there can be no assurance that we will successfully implement such screening procedures in a timely manner or at all, or that, if implemented, they will enhance the safety profile of our gene therapy product candidates. If any of our gene therapy product candidates demonstrates adverse side effects at unacceptable rates or degrees of severity, we may decide or be required to halt or delay clinical development of such product candidates.

In addition to side effects caused by our product candidates, the conditioning, administration process or related procedures, which we evaluate from time to time as part of our process improvement and optimization efforts, also can cause adverse side effects. A gene therapy patient is generally administered one or more myeloablative drugs to remove stem cells from the bone marrow to create sufficient space in the bone marrow for the modified gene-corrected stem cells to engraft and produce their progeny. This procedure causes side effects and, among other potential risks, can transiently compromise the patient's immune system, known as neutropenia, and reduce blood clotting, known as thrombocytopenia.

In 2019 we began transitioning, in connection with our Company-sponsored clinical trials, towards a new conditioning regimen for our product candidates utilizing busulfan as the myeloablative conditioning agent instead of the melphalan that we previously used. The use of this conditioning regimen is designed to utilize a precision dosing program called Target Concentration Intervention, or TCI, to achieve a balance between the removal of a sufficient amount of bone marrow cells from a patient against potential risks such as toxicity or graft failure. In addition, we are evaluating the potential future use of alternative conditioning agents in lieu of the current busulfan TCI conditioning regimen. For example, we have entered into collaboration agreements with Jasper Therapeutics and Magenta Therapeutics and are currently evaluating the potential use of their respective monoclonal antibody conditioning agents. We are also evaluating the potential use of additional agents to tailor the conditioning regimen for certain disease indications. However,

there can be no assurances these alternative conditioning regimens will be implemented or would be successful if implemented. Our conditioning regimens may not be successful or may nevertheless result in adverse side effects. For example, in each of our ongoing clinical trials several adverse events, including suppression of neutrophils and platelet counts following the conditioning process, have been observed. While such adverse events in connection with conditioning are expected, if in the future any such adverse events caused by the conditioning process or related procedures continue at unacceptable rates or degrees of severity, the FDA or other foreign regulatory authorities could order us to cease development of, or deny approval of, our product candidates for any or all targeted indications. There have been cases of therapy-related myelodysplastic syndrome, a type of blood disorder that is a potential precursor to acute myeloid leukemia, in patients with preexisting cancer where busulfan treatment was posited to be a contributing factor to this secondary malignancy. Although in the future we may potentially implement molecular cytogenetic screening as an additional risk reduction measure, there can be no guarantees that these procedures will be implemented in a timely manner or would be successful if implemented. Even if we are able to demonstrate that adverse events are not product-related, such occurrences could adversely affect patient recruitment or the ability of enrolled patients to complete the clinical trial, and lead to a decline in our stock price.

Additionally, if any of our product candidates receives marketing approval, the FDA could require us to adopt a Risk Evaluation and Mitigation Strategy, or REMS, to ensure that the benefits outweigh its risks, which may include, among other things, a medication guide outlining the risks of the product for distribution to patients, a communication plan to health care practitioners, and restrictions on how or where the product can be distributed, dispensed or used. Furthermore, if we or others later identify undesirable side effects caused by our product candidates, several potentially significant negative consequences could result, including:

- regulatory authorities may suspend or withdraw approvals of such product candidate;
- regulatory authorities may require additional or boxed warnings on the label;
- we may be required to change the way a product candidate is distributed, dispensed, or administered or conduct additional clinical trials;
- we could be sued and held liable for harm caused to patients; and
- our reputation may suffer.

Any of these events could prevent us from achieving or maintaining market acceptance of our product candidates, lead to a decline in our stock price, and significantly harm our business, prospects, financial condition and results of operations.

We have never completed a pivotal or registrational clinical trial, and may be unable to do so for any product candidates we may develop.

We are at an early stage of development for all of our product candidates. As of August 1, 2022, only 23 patients have been dosed in our clinical trials, which includes 14 patients from our Fabry program that we deprioritized in January 2022. Our ongoing clinical trials, as well as potentially additional pivotal clinical trials (also referred to as registrational trials), must be completed in order to obtain FDA or other regulatory approval to market these product candidates. We have limited experience in preparing, submitting and prosecuting regulatory filings, and have not previously submitted a biologics license application, or BLA, for any product candidate. Carrying out later-stage clinical trials is a complicated and lengthy process, and we do not expect that all data from patients participating in the clinical trials will be relevant or meaningful.

In addition, across our Company-sponsored clinical trials we have dosed only three patients in the United States, and our interactions with the FDA have generally been limited. We cannot be certain how many additional clinical trials of AVR-RD-04, AVR-RD-02 or any other product candidates will be required or how such trials should be designed. In order to commence a clinical trial in the United States, we are required to seek FDA acceptance of an IND for each of our product candidates. We cannot be sure any IND we submit to the FDA, or any similar clinical trial application we submit in other countries, will be accepted. While we have received clearance from the FDA to commence clinical testing in the United States for AVR-RD-02 and AVR-RD-04, and the sponsor of the collaborator-led clinical trial for AVR-RD-04 has received the same, there can be no assurance that we will be able to submit and secure similar clearances for any of our other product candidates. We may also be required to conduct additional preclinical testing prior to filing an IND for any of our product candidates, and the results of any such testing may not be positive. Consequently, we may be unable to successfully and efficiently execute and complete necessary clinical trials in a way that leads to a BLA submission and approval of any of our product candidates. We may require more time and incur greater costs than our competitors and may not succeed in obtaining regulatory approvals of product candidates that we develop. Failure to commence or complete, or delays in, our planned clinical trials, could prevent us from or delay us in commercializing any of our product candidates.

The ongoing Phase 1/2 clinical trial of AVR-RD-04 is being conducted by our collaborators at the University of California, San Diego. In addition, the planned Phase 1/2 clinical trial of AVR-RD-05 will be a collaborator-sponsored trial conducted by our

collaborators at The University of Manchester. We do not control the design or administration of collaborator-sponsored trials, nor the submission or approval of any IND or foreign equivalent required to conduct these trials, and the collaborator-sponsored trials could, depending on the actions of such third parties, jeopardize the validity of the clinical data generated, identify significant concerns with respect to our product candidates that could impact our findings or clinical trials, and adversely affect our ability to obtain marketing approval from the FDA or other applicable regulatory authorities. To the extent the results of these or other investigator-sponsored trials are inconsistent with, or different from, the results of our planned Company-sponsored trials or raise concerns regarding our product candidates, the FDA or a foreign regulatory authority may question the results of the Company-sponsored trial, or subject such results to greater scrutiny than it otherwise would. In these circumstances, the FDA or such foreign regulatory authorities may require us to obtain and submit additional clinical data, which could delay clinical development or marketing approval of our product candidates. In addition, while collaborator-sponsored trials could be useful to inform our own clinical development efforts, there is no guarantee that we will be able to use the data from these trials to form the basis for regulatory approval of our product candidates.

Success in preclinical studies or early clinical trials may not be indicative of results obtained in later trials.

Results from preclinical studies or early clinical trials are not necessarily predictive of future clinical trial results and are not necessarily indicative of final results. There can be no assurance that prior results, such as signals of safety, activity or durability of effect, observed from preclinical studies or clinical trials will be replicated or will continue in ongoing or future studies or trials. Furthermore, preliminary results may not be indicative of the final results of a trial after all data have been collected and analyzed. For example, in January 2022 we announced the deprioritization of our Fabry program due to several factors, including new clinical data showing variable engraftment patterns from the five most recently dosed Phase 2 FAB-GT patients. Although previously reported data from 13 patients treated across our clinical-stage programs had shown durable engraftment out 9 to 54 months, the new data from the five most recently dosed Phase 2 FAB-GT patients were discordant with these other data and showed variable engraftment. Data from three of the five patients showed both a reduction to near baseline levels in alpha-galactosidase A enzyme activity in leukocytes and plasma, and a reduction in vector copy number in whole blood, potentially suggesting resistance to persistent engraftment of the genetically modified cells observed at three to nine months post infusion of AVR-RD-01. Based on our internal assessment, we believe, due to the large degree of heterogeneity in Fabry disease, that in some cases there may be intrinsic resistance to engraftment related to the unique underlying pathophysiology of untreated Fabry disease, potentially caused by the persistently stressed vascular endothelium. However, while this belief is based on a thorough review and analysis conducted by the Company, it remains a hypothesis and there can be no assurances that similar engraftment or other issues will not occur in clinical trials of our other product candidates, which are all based on our technology and the same *ex vivo* lentiviral approach utilized for AVR-RD-01. For example, although we believe the variable engraftment data were caused by factors intrinsic to certain Fabry disease patients and we do not anticipate readthrough to other clinical trials, if the variable engraftment data were actually caused, directly or indirectly, by any other factors, including any aspect of our plato platform or the conditioning process, we could see similar issues in other clinical trials.

There is a high failure rate for gene therapy and biologic product candidates proceeding through clinical trials. Many companies in the pharmaceutical and biotechnology industries have suffered significant setbacks in late-stage clinical trials even after achieving promising results in preclinical testing and earlier-stage clinical trials. Data obtained from preclinical and clinical activities are subject to varying interpretations, which may delay, limit or prevent regulatory approval. In addition, the design of a pivotal clinical trial can determine whether its results will support approval of a product and flaws in the design of a clinical trial may not become apparent until the clinical trial is well advanced. Our Company has limited experience in designing and conducting clinical trials and we may be unable to design and execute a clinical trial to support regulatory approval.

We also may experience regulatory delays or rejections as a result of many factors, including due to changes in regulatory policy or the approval of competitive therapies during the period of our product candidate development. Any of our current or future product candidates may fail to show the desired safety and efficacy in clinical development despite positive results in preclinical studies. Any such failure would cause us to abandon the product candidate.

Additionally, the clinical trials performed to date have been open-label studies and have been conducted at a limited number of clinical sites on a limited number of patients. An “open-label” clinical trial is one where both the patient and investigator know whether the patient is receiving the investigational product candidate or either an existing approved drug or placebo. Most typically, open-label clinical trials test only the investigational product candidate and sometimes may do so at different dose levels. Open-label clinical trials are subject to various limitations that may exaggerate any therapeutic effect as patients in open-label clinical trials are aware when they are receiving treatment. Open-label clinical trials may be subject to a “patient bias” where patients perceive their symptoms to have improved merely due to their awareness of receiving an experimental treatment. Moreover, patients selected for early clinical studies often include the most severe sufferers and their symptoms may have been bound to improve notwithstanding the new treatment. In addition, open-label clinical trials may be subject to an “investigator bias” where those assessing and reviewing the physiological outcomes of the clinical trials are aware that patients have received treatment and may interpret the information more favorably given this knowledge. Because our clinical trials are ongoing, the data that we report are preliminary and subject to change. As is typical in open-label studies in which interim reports are provided, the safety and efficacy data are regularly reviewed and

validated. As a result, certain data may change over time, including reductions or increases in the number of reported safety events, until the database is locked at the end of the study.

We may find it difficult to enroll patients in our clinical trials, which could delay or prevent us from proceeding with clinical trials of our product candidates.

The timing and success of our patient enrollment and clinical trial activities depend on our ability to recruit patients to participate as well as the completion of required follow-up periods. Patients may be unwilling to participate in our gene therapy clinical trials because of negative publicity from adverse events related to the biotechnology or gene therapy fields, competitive clinical trials for similar patient populations, clinical trials in product candidates employing our vectors, the existence of current treatments or for other reasons. In addition, the indications that we are currently targeting and may in the future target are rare diseases, which may limit the pool of patients that may be enrolled in our ongoing or planned clinical trials. The timeline for recruiting patients, conducting studies and obtaining regulatory approval of our product candidates may be delayed, including as a result of the ongoing COVID-19 pandemic, which could result in increased costs, delays in advancing our product candidates, delays in testing the effectiveness of our product candidates or termination of the clinical trials altogether. For example, as a result of the COVID-19 pandemic, patient enrollment and dosing was temporarily paused in our ongoing clinical trials and certain data collection has been delayed. While patient enrollment and dosing activities have resumed, there could be additional pauses in the future as a result of the ongoing COVID-19 pandemic or other factors.

We may not be able to identify, recruit and enroll a sufficient number of patients, or those with required or desired characteristics, to complete our clinical trials in a timely manner or at all. Although we currently expect to have enrolled by the end of 2022 up to a total of eight patients in our Company-sponsored clinical trial of AVR-RD-02 for Gaucher disease type 1, which we refer to as the Guard1 clinical trial, there can be no assurances we will achieve that goal or any of our other patient enrollment goals. For example, in 2019 we encountered delays in the enrollment of patients in the Guard1 clinical trial due to patient pre-screening failures that impacted the commencement of enrollment. Additionally, as a result of the COVID-19 pandemic, in 2020 we encountered protracted timelines with our Guard1 investigational site startup activities, which also impacted patient enrollment.

Patient enrollment and trial completion is affected by factors including the:

- ability to enroll patients and conduct studies as a result of the ongoing COVID-19 pandemic;
- size of the patient population and process for identifying patients;
- design of the trial protocol;
- eligibility and exclusion criteria;
- perceived risks and benefits of the product candidate under study;
- perceived risks and benefits of gene therapy-based approaches to treatment of diseases, including any required pretreatment conditioning regimens;
- availability of competing therapies and clinical trials;
- severity of the disease under investigation;
- availability of genetic testing for potential patients;
- proximity and availability of clinical trial sites for prospective patients;
- ability to obtain and maintain subject consent;
- risk that enrolled patients will drop out before completion of the trial;
- patient referral practices of physicians; and
- ability to monitor patients adequately during and after treatment.

We have expanded our patient enrollment activities to include patients who reside in a country other than the country where the applicable clinical site is located, and who are required to travel for some or all of the clinical testing and procedures required for patients in the applicable clinical trial. We have encountered and in the future may continue to encounter logistical and regulatory challenges that could delay or prevent any such international patients from successfully enrolling and completing clinical trial procedures, including delays in processing or obtaining patient travel visas or denials of entry at borders, potential travel disruptions, or de-prioritization or unavailability of resources at clinical sites for non-resident international clinical trial participants, any of which could delay our progress and completion of planned clinical trials and which would have an adverse effect on our business. In

addition, once these international patients return to their home country they may need to travel back to the country where the applicable clinical site is located. If these patients are unwilling or unable to return to the clinical site for testing and procedures, progress and completion of the clinical trial could be delayed or prevented.

Our current product candidates are being developed to treat rare conditions. We plan to seek initial marketing approvals in the United States, Europe and certain other major markets, including Japan. We may not be able to initiate or continue clinical trials if we cannot enroll a sufficient number of eligible patients to participate in the clinical trials required by FDA or other foreign regulatory authorities. Our ability to successfully initiate, enroll and complete a clinical trial in any foreign country is subject to numerous risks unique to conducting business in foreign countries, including:

- difficulty in establishing or managing relationships with contract research organizations, or CROs, clinical study sites and physicians;
- different standards for the conduct of clinical trials;
- the absence in some countries of established groups with sufficient regulatory expertise for review of gene therapy protocols;
- our inability to locate qualified local consultants, physicians and partners; and
- the potential burden of complying with a variety of foreign laws, medical standards and regulatory requirements, including the regulation of pharmaceutical and biotechnology products and treatment.

If we have difficulty enrolling a sufficient number of patients to conduct our clinical trials as planned, we may need to delay, limit or terminate ongoing or planned clinical trials, any of which would have an adverse effect on our business, financial condition, results of operations and prospects.

We may encounter substantial delays in our clinical trials or we may fail to demonstrate safety and efficacy to the satisfaction of applicable regulatory authorities.

Before obtaining marketing approval from regulatory authorities for the sale of our product candidates, we must conduct extensive clinical studies to demonstrate the safety and efficacy of the product candidates in humans. Clinical testing is expensive, time-consuming and uncertain as to outcome. We cannot guarantee that any clinical studies will be conducted as planned or completed on schedule, if at all. A failure of one or more clinical studies can occur at any stage of testing. Events that may prevent successful or timely completion of clinical development include:

- delays as a result of the ongoing COVID-19 pandemic;
- delays in reaching a consensus with regulatory agencies on study design;
- delays in reaching agreement on acceptable terms with prospective CROs and clinical study sites;
- delays in obtaining required Institutional Review Board, or IRB, approval at each clinical study site;
- delays in recruiting suitable patients to participate in our clinical studies;
- imposition of a clinical hold by regulatory agencies, after an inspection of our clinical study operations or study sites;
- failure by our CROs, other third parties or us to adhere to clinical study requirements;
- failure to perform in accordance with the FDA's good clinical practices, or GCP, or applicable regulatory guidelines in other countries;
- delays in the testing, validation, manufacturing and delivery of our product candidates to the clinical sites;
- delays in having patients complete participation in a study or return for post-treatment follow-up;
- clinical study sites or patients dropping out of a study;
- the occurrence of serious adverse events associated with the product candidate that are viewed to outweigh its potential benefits; or
- changes in regulatory requirements and guidance that require amending or submitting new clinical protocols.

Any inability to successfully complete preclinical and clinical development could result in additional costs to us or impair our ability to generate revenues. In addition, if we make changes to our product candidates, we may need to conduct additional studies to

bridge our modified product candidates to earlier versions, which could delay our clinical development plan or marketing approval for our product candidates. For example, we have transitioned our lentiviral vectors to an LV2 version in connection with our plato platform implementation. In addition, the transition from LV1 to LV2 has required (and is anticipated to continue to require) submission of relevant data to the applicable regulatory authorities in connection with certain of our regulatory filings, including our INDs and clinical trial applications, to demonstrate analytic comparability between LV1 and LV2. Our CTA (including amendments) and IND for our Guard1 clinical study of AVR-RD-02 for Gaucher disease in Canada and the United States, for which Health Canada has issued no objection letters and the FDA has cleared, respectively, included data utilizing LV2 and our automated manufacturing platform. While these applications included data relating to our LV2 lentiviral vector and our automated manufacturing process, which are elements of our plato platform, we expect that the FDA, Health Canada or other regulatory authorities will require us to undertake additional actions in connection with our transition to our plato platform, including submission of additional comparability studies in connection with future regulatory filings, which may result in delays, suspension or termination of ongoing or future clinical trials, or our inability to conduct our trials according to the plans or the timelines that we have envisioned. For example, the Phase 1/2 collaborator-sponsored clinical study of AVR-RD-04 for cystinosis in the United States, which has been cleared by the FDA, does not include our LV2 lentiviral vector or our automated manufacturing platform. Additionally, the study drug for the planned collaborator-sponsored clinical study of AVR-RD-05 for Hunter syndrome will not be manufactured using our plato platform, and neither the automated, closed manufacturing system nor LV2 will be used in connection with this clinical trial. Moreover, we are currently evaluating the implementation of an additional, new conditioning regimen that utilizes conditioning agents other than busulfan. We anticipate that we will be required to submit comparability data in future regulatory filings relating to our transition to LV2, the automated manufacturing platform and any new conditioning regiment that we implement. Any such filings may result in delay, suspension or termination of ongoing or future clinical trials pending our submission, and the applicable regulatory agency's review, of such updates. Clinical trial delays could also shorten any periods during which we may have the exclusive right to commercialize our product candidates, if approved, or allow our competitors to bring products to market before we do, which could impair our ability to successfully commercialize our product candidates and may harm our business and results of operations.

If the results of our clinical studies are inconclusive or if there are safety concerns or adverse events associated with our product candidates, we may:

- be delayed in obtaining marketing approval for our product candidates, if at all;
- obtain approval for indications or patient populations that are not as broad as intended or desired;
- obtain approval with labeling or a REMS that includes significant use or distribution restrictions or safety warnings;
- be subject to changes with the way the product is administered;
- be required to perform additional clinical studies to support approval or be subject to additional post-marketing testing requirements;
- have regulatory authorities withdraw their approval of the product or impose restrictions on its distribution in the form of a REMS;
- be subject to the addition of labeling statements, such as warnings or contraindications;
- be sued; or
- experience damage to our reputation.

Any of these events could prevent us from achieving or maintaining market acceptance of our product candidates and impair our ability to commercialize our products.

Even if we complete the necessary preclinical and clinical studies, we cannot predict when or if we will obtain regulatory approval to commercialize a product candidate and the approval may be for a narrower indication than we seek.

We cannot commercialize a product until the appropriate regulatory authorities have reviewed and approved the product candidate. Even if our product candidates demonstrate safety and efficacy in clinical studies, the regulatory agencies may not complete their review processes in a timely manner, or we may not be able to obtain regulatory approval. Additional delays may result if an FDA Advisory Committee or other regulatory authority recommends non-approval or restrictions on approval. In addition, we may experience delays or rejections based upon additional government regulation from future legislation or administrative action, or changes in regulatory agency policy during the period of product development, clinical studies and the review process. Regulatory agencies also may approve a treatment candidate for fewer or more limited indications than requested or may grant approval subject to the performance of post-marketing studies. In addition, regulatory agencies may not approve the labeling claims that are necessary or desirable for the successful commercialization of our product candidates. If we are unable to obtain necessary regulatory approvals, our business, prospects, financial condition and results of operations may suffer.

Only one of our ongoing clinical trials utilizes our commercial-scale plato platform.

While we have submitted and intend to continue to submit comparability studies to the FDA and other regulatory agencies, as needed, with respect to our implementation of our commercial-scale plato platform, there can be no assurance that the FDA or other regulatory agencies will not in the future require us to conduct additional preclinical studies or clinical trials that could result in delays and additional costs in our development or commercialization programs for our product candidates, which could adversely affect our business. We intend to continue implementing our commercial-scale plato platform, including heightened vector efficiency, our closed, automated manufacturing system and utilization of a customized conditioning regimen, in connection with each of our investigational product candidates. We have developed the plato platform to form the backbone of our commercial programs, with the intent of replacing our original academic platform with improved solutions for delivering our gene therapy candidates to patients in multiple disease indications. We believe improvements from our plato platform may lead to better patient outcomes with our gene therapy candidates. In order to implement this transition, we have been and will be required to conduct additional studies to bridge our modified product candidates to earlier versions, which could delay our clinical development plans or marketing approvals, if any. Clinical trial delays could also shorten any periods during which we may have the exclusive right to commercialize our product candidates, if approved, or allow our competitors to bring products to market before we do, which could impair our ability to successfully commercialize our product candidates and may harm our business and results of operations.

We face significant competition in our industry and there can be no assurance that our product candidates, if approved, will achieve acceptance in the market over existing established therapies. In addition, our competitors may develop therapies that are more advanced or effective than ours, which may adversely affect our ability to successfully market or commercialize any of our product candidates.

We operate in a highly competitive segment of the biopharmaceutical market. We face competition from many different sources, including larger pharmaceutical, specialty pharmaceutical and biotechnology companies, as well as from academic institutions, government agencies and private and public research institutions. Our product candidates, if successfully developed and approved, will compete with established therapies, some of which are being marketed by large and international companies. In addition, we expect to compete with new treatments that are under development or may be advanced into the clinic by our competitors. There are a variety of product candidates, including gene therapies, in development for the indications that we are targeting.

We anticipate competing with the largest pharmaceutical companies in the world. For example, for Gaucher disease, Sanofi Genzyme, Pfizer, and Takeda market existing enzyme replacement therapies, or ERTs, that represent the standard of care for Gaucher patients. For Gaucher disease we also expect to compete with oral therapies marketed by Actelion and Sanofi. Sanofi also markets an enzyme replacement therapy for Pompe disease, and Takeda markets an enzyme replacement therapy for Hunter syndrome. Denali Therapeutics has an ERT in late-stage clinical development for Hunter syndrome. Cystinosis is currently treated by therapies marketed by Horizon Orphan, Mylan, Chiesi, Recordati, Orphan Europe and Leadiant Biosciences. In addition, we may compete with other gene therapy companies in our industry such as Freeline Therapeutics, Generation Bio, Prevail Therapeutics or Graphite Bio. Freeline Therapeutics, for example, is developing an adeno-associated virus (**"**AAV") based gene therapy for Gaucher disease type 1. Moreover, a number of gene therapy companies have announced preclinical or clinical non-viral AAV based gene therapy programs that, if successful in obtaining regulatory approval, could compete with our gene therapies.

Many of our competitors have significantly greater financial, product candidate development, manufacturing and marketing resources than we do. Large pharmaceutical and biotechnology companies have extensive experience in clinical testing and obtaining regulatory approval for their products, and mergers and acquisitions within these industries may result in even more resources being concentrated among a smaller number of larger competitors. Established pharmaceutical companies may also invest heavily to accelerate discovery and development of novel therapeutics or to in-license novel therapeutics that could make the product candidates that we develop obsolete. Competition may increase further as a result of advances in the commercial applicability of technologies and greater availability of capital for investment in these industries. Our business would be materially and adversely affected if competitors develop and commercialize products that are safer, more effective, have fewer or less severe side effects, have broader market acceptance, are more convenient or are less expensive than any product candidate that we may develop.

Even if we obtain regulatory approval of our product candidates, the availability and price of our competitors' products could limit the demand and the price we are able to charge for our product candidates. We may not be able to implement our business plan if the acceptance of our product candidates is inhibited by price competition or the reluctance of physicians to switch from existing methods of treatment to our product candidates, or if physicians switch to other new drug or biologic products or choose to reserve our product candidates for use in limited circumstances.

While we intend to seek designations for our product candidates with the FDA and comparable foreign regulatory authorities that are intended to confer benefits such as a faster development process or an accelerated regulatory pathway, there can be no assurance that we will successfully obtain such designations. In addition, even if one or more of our product candidates are granted such designations, we may not be able to realize the intended benefits of such designations.

The FDA and comparable foreign regulatory authorities offer certain designations for product candidates that are designed to encourage the research and development of product candidates that are intended to address conditions with significant unmet medical need. These designations may confer benefits such as additional interaction with regulatory authorities, a potentially accelerated regulatory pathway and priority review. However, there can be no assurance that we will successfully obtain such designations for any of our product candidates. In addition, while such designations could expedite the development or approval process, they generally do not change the standards for approval. Even if we obtain such designations for one or more of our product candidates, there can be no assurance that we will realize their intended benefits.

We may seek a Breakthrough Therapy Designation for some of our product candidates. A breakthrough therapy is defined as a therapy that is intended, alone or in combination with one or more other therapies, to treat a serious or life-threatening disease or condition, and preliminary clinical evidence indicates that the therapy may demonstrate substantial improvement over existing therapies on one or more clinically significant endpoints, such as substantial treatment effects observed early in clinical development. For therapies that have been designated as breakthrough therapies, interaction and communication between the FDA and the sponsor of the trial can help to identify the most efficient path for clinical development while minimizing the number of patients placed in ineffective control regimens. Therapies designated as breakthrough therapies by the FDA are also eligible for accelerated approval. Designation as a breakthrough therapy is within the discretion of the FDA. Accordingly, even if we believe one of our product candidates meets the criteria for designation as a breakthrough therapy, the FDA may disagree and instead determine not to make such designation. In any event, the receipt of a Breakthrough Therapy Designation for a product candidate may not result in a faster development process, review or approval compared to therapies considered for approval under conventional FDA procedures and does not assure ultimate approval by the FDA. In addition, even if one or more of our product candidates qualify as breakthrough therapies, the FDA may later decide that such product candidates no longer meet the conditions for qualification.

In addition, we may seek Fast Track Designation for some of our product candidates. If a therapy is intended for the treatment of a serious or life-threatening condition and the therapy demonstrates the potential to address unmet medical needs for this condition, the therapy sponsor may apply for Fast Track Designation. In July 2021 we received Fast Track Designation from the FDA for AVR-RD-04 for the treatment of cystinosis to improve renal function. However, the FDA has broad discretion whether or not to grant this designation, so even if we believe another product candidate is eligible for this designation, there can be no assurance that the FDA would decide to grant it. Even if we do receive Fast Track Designation, we may not experience a faster development process, review or approval compared to conventional FDA procedures, and receiving a Fast Track Designation does not provide assurance of ultimate FDA approval. In addition, the FDA may withdraw Fast Track Designation if it believes that the designation is no longer supported by data from our clinical development program.

In addition, we may seek a regenerative medicine advanced therapy, or RMAT, designation for some of our product candidates. An RMAT is defined as cell therapies, therapeutic tissue engineering products, human cell and tissue products, and combination products using any such therapies or products. Gene therapies, including genetically modified cells that lead to a durable modification of cells or tissues may meet the definition of a regenerative medicine therapy. The RMAT program is intended to facilitate efficient development and expedite review of RMATs, which are intended to treat, modify, reverse, or cure a serious or life-threatening disease or condition. A new drug application or a BLA for an RMAT may be eligible for priority review or accelerated approval through (1) surrogate or intermediate endpoints reasonably likely to predict long-term clinical benefit or (2) reliance upon data obtained from a meaningful number of sites. Benefits of such designation also include early interactions with FDA to discuss any potential surrogate or intermediate endpoint to be used to support accelerated approval. A regenerative medicine therapy that is granted accelerated approval and is subject to post-approval requirements may fulfill such requirements through the submission of clinical evidence, clinical studies, patient registries, or other sources of real-world evidence, such as electronic health records; the collection of larger confirmatory data sets; or post-approval monitoring of all patients treated with such therapy prior to its approval. RMAT designation is within the discretion of the FDA. Accordingly, even if we believe one of our product candidates meets the criteria for designation as a regenerative medicine advanced therapy, the FDA may disagree and instead determine not to make such designation. In any event, the receipt of RMAT designation for a product candidate may not result in a faster development process, review or approval compared to drugs considered for approval under conventional FDA procedures and does not assure ultimate approval by the FDA. In addition, even if one or more of our product candidates qualify for RMAT designation, the FDA may later decide that the biological products no longer meet the conditions for qualification.

We may be unable to obtain orphan drug designation for our product candidates and, even if we obtain such designation, we may not be able to realize the benefits of such designation, including potential marketing exclusivity of our product candidates, if approved.

Regulatory authorities in some jurisdictions, including the United States and other major markets, may designate drugs intended to treat conditions or diseases affecting relatively small patient populations as orphan drugs. Under the Orphan Drug Act of 1983, the FDA may designate a product candidate as an orphan drug if it is intended to treat a rare disease or condition, which is generally defined as having a patient population of fewer than 200,000 individuals in the United States, or a patient population greater than 200,000 in the United States where there is no reasonable expectation that the cost of developing the drug will be recovered from sales in the United States. In the European Union, EMA's Committee for Orphan Medicinal Products grants orphan drug designation to promote the development of products that are intended for the diagnosis, prevention or treatment of a life-threatening or chronically debilitating condition affecting not more than 5 in 10,000 persons in the European Union. Additionally, orphan designation is granted for products intended for the diagnosis, prevention or treatment of a life-threatening, seriously debilitating or serious and chronic condition and when, without incentives, it is unlikely that sales of the drug in the European Union would be sufficient to justify the necessary investment in developing the drug or biologic product.

In October 2019 and March 2020, the FDA granted our requests for orphan drug designation for AVR-RD-02 for the treatment of Gaucher disease and AVR-RD-04 for the treatment of cystinosis, respectively. Additionally, in July 2022, we announced that the FDA granted our request for orphan drug designation for AVR-RD-05 for the treatment of Hunter syndrome. In September 2020 and March 2021 we announced that the European Commission granted our request for orphan drug designation for AVR-RD-02 for the treatment of Gaucher disease and AVR-RD-04 for the treatment of cystinosis, respectively. However, if we request orphan drug designation (or the foreign equivalent) for any other product candidates, there can be no assurances that the FDA or foreign regulatory authorities will grant any of our product candidates such designation. Additionally, the designation of any of our product candidates as an orphan product does not mean that any regulatory agency will accelerate regulatory review of, or ultimately approve, that product candidate, nor does it limit the ability of any regulatory agency to grant orphan drug designation to product candidates of other companies that treat the same indications as our product candidates prior to our product candidates receiving exclusive marketing approval.

Generally, if a product candidate with an orphan drug designation receives the first marketing approval for the indication for which it has such designation, the product is entitled to a period of marketing exclusivity, which precludes the FDA or applicable foreign regulatory authorities from approving another marketing application for a product that constitutes the same drug treating the same indication for that marketing exclusivity period, except in limited circumstances. If another sponsor receives such approval before we do (regardless of our orphan drug designation), we will be precluded from receiving marketing approval for our product for the applicable exclusivity period. The applicable period is seven years in the United States and 10 years in the European Union. The exclusivity period in the European Union can be reduced to nine years if a product no longer meets the criteria for orphan drug designation or if the product is sufficiently profitable so that market exclusivity is no longer justified. Orphan drug exclusivity may be revoked if any regulatory agency determines that the request for designation was materially defective or if the manufacturer is unable to assure sufficient quantity of the product to meet the needs of patients with the rare disease or condition.

Even if we obtain orphan drug exclusivity for a product candidate, that exclusivity may not effectively protect the product candidate from competition because different drugs can be approved for the same condition in the United States. Even after an orphan drug is approved, the FDA may subsequently approve another drug for the same condition if the FDA concludes that the latter drug is not the same drug or is clinically superior in that it is shown to be safer, more effective or makes a major contribution to patient care. In the European Union, marketing authorization may be granted to a similar medicinal product for the same orphan indication if:

- the second applicant can establish in its application that its medicinal product, although similar to the orphan medicinal product already authorized, is safer, more effective or otherwise clinically superior;
- the holder of the marketing authorization for the original orphan medicinal product consents to a second orphan medicinal product application; or
- the holder of the marketing authorization for the original orphan medicinal product cannot supply sufficient quantities of orphan medicinal product.

We have received rare pediatric disease designation for AVR-RD-05 for the treatment of Hunter syndrome. However, a marketing application for AVR-RD-05, if approved, may not meet the eligibility criteria for a Priority Review Voucher, or PRV, or the rare pediatric disease designation program may sunset before FDA is able consider us for a voucher.

We have received rare pediatric disease designation for AVR-RD-05 for the treatment of Hunter syndrome. Designation of a drug or biologic as a product for a rare pediatric disease does not guarantee that a BLA for such drug or biologic will meet the eligibility criteria for a rare pediatric disease PRV at the time the application is approved. Under the FDCA, we will need to request a

rare pediatric disease PRV in our original BLA for AVR-RD-05. The FDA may determine that a BLA for AVR-RD-05, if approved, does not meet the eligibility criteria for a PRV, including for the following reasons:

- Hunter syndrome no longer meets the definition of a rare pediatric disease;
- the BLA contains an active ingredient that has been previously approved in a BLA;
- the BLA is not deemed eligible for priority review;
- the BLA does not rely on clinical data derived from studies examining a pediatric population and dosages of the drug intended for that population (that is, if the BLA does not contain sufficient clinical data to allow for adequate labeling for use by the full range of affected pediatric patients); or
- the BLA is approved for a different adult indication than the rare pediatric disease for which AVR-RD-05 is designated.

The authority for the FDA to award rare pediatric disease PRVs for drugs that have received rare pediatric disease designation prior to September 30, 2024 currently expires on September 30, 2026. If the BLA for AVR-RD-05 is not approved prior to September 30, 2026 for any reason, regardless of whether it meets the criteria for a rare pediatric disease PRV, it will not be eligible for a PRV. However, it is also possible the authority for FDA to award rare pediatric disease PRVs will be further extended through federal lawmaking.

Even if we obtain regulatory approval for a product candidate, our products will remain subject to regulatory oversight.

Even if we obtain any regulatory approval for our product candidates, they will be subject to ongoing regulatory requirements for manufacturing, labeling, packaging, storage, advertising, promotion, sampling, record-keeping and submission of safety and other post-market information. Any regulatory approvals that we receive for our product candidates also may be subject to a REMS, limitations on the approved indicated uses for which the product may be marketed or to the conditions of approval, or contain requirements for potentially costly post-marketing testing, including Phase 4 clinical trials, and surveillance to monitor the quality, safety and efficacy of the product. For example, the holder of an approved BLA is obligated to monitor and report adverse events and any failure of a product to meet the specifications in the BLA. FDA guidance advises that patients treated with gene therapies undergo long-term follow-up observation for potential adverse events for as long as 15 years. The holder of an approved BLA also must submit new or supplemental applications and obtain FDA approval for certain changes to the approved product, product labeling or manufacturing process. Advertising and promotional materials must comply with FDA rules and are subject to FDA review, in addition to other potentially applicable federal and state laws.

In addition, product manufacturers and their facilities are subject to payment of user fees and continual review and periodic inspections by the FDA and other regulatory authorities for compliance with current good manufacturing practices, or cGMP, requirements and adherence to commitments made in the BLA or foreign marketing application. Manufacturers and manufacturers' facilities are required to comply with extensive FDA, and comparable foreign regulatory authority, requirements including ensuring that quality control and manufacturing procedures conform to cGMP regulations and applicable product tracking and tracing requirements. If we, or a regulatory authority, discover previously unknown problems with a product, such as adverse events of unanticipated severity or frequency, or problems with the facility where the product is manufactured or disagrees with the promotion, marketing or labeling of that product, a regulatory authority may impose restrictions relative to that product, the manufacturing facility or us, including requiring recall or withdrawal of the product from the market or suspension of manufacturing.

If we fail to comply with applicable regulatory requirements following approval of any of our product candidates, a regulatory authority may:

- issue a warning letter asserting that we are in violation of the law;
- seek an injunction or impose administrative, civil or criminal penalties or monetary fines;
- suspend or withdraw regulatory approval;
- suspend any ongoing clinical trials;
- refuse to approve a pending BLA or comparable foreign marketing application (or any supplements thereto) submitted by us or our strategic partners;
- restrict the marketing or manufacturing of the product;
- seize or detain the product or otherwise require the withdrawal of the product from the market;
- refuse to permit the import or export of products; or

- refuse to allow us to enter into supply contracts, including government contracts.

Any government investigation of alleged violations of law could require us to expend significant time and resources in response and could generate negative publicity. The occurrence of any event or penalty described above may inhibit our ability to commercialize our product candidates and adversely affect our business, financial condition, results of operations and prospects.

In addition, the FDA's policies, and those of equivalent foreign regulatory agencies, may change and additional government regulations may be enacted that could prevent, limit or delay regulatory approval of our product candidates. We cannot predict the likelihood, nature or extent of government regulation that may arise from future legislation or administrative action, either in the United States or abroad. If we are slow or unable to adapt to changes in existing requirements or the adoption of new requirements or policies, or if we are not able to maintain regulatory compliance, we may lose any marketing approval that we may have obtained and we may not achieve or sustain profitability, which would materially and adversely affect our business, financial condition, results of operations and prospects.

Our focus on developing our current product candidates may not yield any commercially viable products, and our failure to successfully identify and develop additional product candidates could impair our ability to grow.

As part of our growth strategy, we intend to identify, develop and market additional product candidates beyond our existing product candidates. We may spend several years completing our development of any particular current or future product candidates, and failure can occur at any stage. The product candidates to which we allocate our resources may not end up being successful. Because we have limited resources, we may forego or delay pursuit of opportunities with certain programs or product candidates or for indications that later prove to have greater commercial potential than our product candidates. Our spending on current and future research and development programs may not yield any commercially viable product candidates. If we do not accurately evaluate the commercial potential for a particular product candidate, we may relinquish valuable rights to that product candidate through strategic collaborations, licensing or other arrangements in cases in which it would have been more advantageous for us to retain sole development and commercialization rights to such product candidate. If any of these events occur, we may be forced to abandon our development efforts with respect to a particular product candidate or fail to develop a potentially successful product candidate.

Because our internal research capabilities are limited, we may be dependent upon biotechnology companies, academic scientists and other researchers to sell or license product candidates, approved products or the underlying technology to us. The success of this strategy depends partly upon our ability to identify, select, discover and acquire promising product candidates and products.

In addition, certain of our current or future product candidates may not demonstrate in patients any or all of the pharmacological benefits we believe they may possess or compare favorably to existing, approved therapies, such as ERT. We have not yet succeeded and may never succeed in demonstrating efficacy and safety of our product candidates or any future product candidates in clinical trials or in obtaining marketing approval thereafter. Accordingly, our focus on treating these diseases may not result in the development of commercially viable products.

If we are unsuccessful in our development efforts, we may not be able to advance the development of our product candidates, commercialize products, raise capital, expand our business or continue our operations.

Risks related to manufacturing

Gene therapies are novel, complex and difficult to manufacture. We could experience production problems that result in delays in our development or commercialization programs or otherwise adversely affect our business.

The manufacturing process we use to produce our product candidates is complex, novel and has not been validated for commercial use. Several factors could cause production interruptions, including equipment malfunctions, facility contamination, raw material shortages or contamination, natural disasters, disruption in utility services, human error or disruptions in the operations of our suppliers.

Our product candidates require processing steps that are more complex than those required for most chemical pharmaceuticals. Moreover, unlike chemical pharmaceuticals, the physical and chemical properties of a biologic such as ours generally cannot be fully characterized. As a result, assays of the finished product may not be sufficient to ensure that the product will perform in the intended manner. Accordingly, we and our manufacturing suppliers employ multiple steps to control the manufacturing process with the goal of ensuring that the product candidate is made strictly and consistently in compliance with the applicable process and specifications. Problems with the manufacturing process, including even minor deviations from the intended process, could result in product defects or manufacturing failures that result in lot failures, product recalls, product liability claims or insufficient inventory. We may

encounter problems achieving adequate quantities and quality of clinical-grade materials that meet FDA or other applicable regulatory standards or specifications with consistent and acceptable production yields and costs.

In addition, the FDA and other foreign regulatory authorities may require us to submit samples of any lot of any approved product together with the protocols showing the results of applicable tests at any time. Under some circumstances, the FDA or other foreign regulatory authorities may require that we not distribute a lot until the agency authorizes its release. Even slight deviations in the manufacturing process, including those affecting quality attributes and stability, may result in unacceptable changes in the product that could result in lot failures or product recalls. There is no assurance we will not experience lot failures in the future. Lot failures or product recalls could cause us to delay clinical trials, or, if approved, commercial product launches, which could be costly to us and otherwise harm our business, financial condition, results of operations and prospects.

Risks related to our reliance on third parties

We expect to rely on third parties to conduct some or all aspects of our vector production, product manufacturing, protocol development, research and preclinical and clinical testing, and these third parties may not perform satisfactorily.

We do not expect to independently conduct all aspects of our vector production, product manufacturing, protocol development, research and preclinical and clinical testing. We currently rely, and expect to continue to rely, on third parties with respect to these items. Any of these third parties may terminate their engagements with us or renegotiate the terms of our agreements at any time. If we need to enter into alternative arrangements, it could delay our product development activities. Our reliance on these third parties for research and development activities will reduce our control over these activities but will not relieve us of our responsibility to ensure compliance with all required regulations and study protocols. For example, for product candidates that we develop and commercialize on our own, we will remain responsible for ensuring that each of our preclinical and clinical studies are conducted in accordance with the study plan, protocols and regulatory requirements.

Even with relevant experience and expertise, our third-party manufacturers may encounter difficulties in production, such as initial production, managing the transition from early to late-stage clinical and commercial manufacturing, and ensuring that the product meets required specifications. These difficulties may include delays, failure or inability achieving production yields, establishing and maintaining stage-appropriate cGMP quality procedures, operator error, shortages of qualified personnel, and compliance with federal, state and foreign regulations. We cannot make any assurances that these difficulties will not occur in the future, or that we will be able to resolve or address them in a timely manner or at all as problems arise.

If our contract counterparties do not successfully carry out their contractual duties, meet expected deadlines or conduct our studies in accordance with regulatory requirements or our stated study plans and protocols, we will not be able to complete, or may be delayed in completing, the preclinical and clinical studies required to support approval of our product candidates or the FDA or other regulatory agencies may refuse to accept our clinical or preclinical data. For example, in 2019 we encountered delays in the enrollment of patients in the Company-sponsored Guard1 clinical trial of AVR-RD-02 for Gaucher disease. While a number of interested patients had been identified for the Guard1 clinical trial, we encountered patient pre-screening failures that impacted the commencement of enrollment in these studies. Additionally, as a result of the COVID-19 pandemic, in 2020 we encountered protracted timelines with our investigational site startup activities for our Guard1 clinical trial, which also impacted patient enrollment. In 2020, a kidney biopsy was conducted on the third patient in the FAB-GT clinical trial of AVR-RD-01, but due to human error in processing the biopsy sample at the external laboratory vendor, the kidney Gb3 inclusions could not be evaluated and anticipated data was not available.

Reliance on third-party manufacturers entails risks to which we would not be subject if we manufactured the product candidates ourselves, including:

- the inability to negotiate manufacturing agreements with third parties under commercially reasonable terms;
- reduced control as a result of using third-party manufacturers for all aspects of manufacturing activities;
- termination or nonrenewal of manufacturing agreements with third parties in a manner or at a time that is costly or damaging to us; and
- disruptions to the operations of our third-party manufacturers or suppliers caused by conditions unrelated to our business or operations, including the impact of the ongoing COVID-19 pandemic or the bankruptcy of the manufacturer or supplier.

Any of these events could lead to delays of our preclinical and clinical studies or failure to obtain regulatory approval, or impact our ability to successfully commercialize future products. Some of these events could be the basis for FDA action, including injunction, recall, seizure or total or partial suspension of production.

We currently rely, and expect to continue to rely, on sole source suppliers for our automated, closed cell processing system; vector supply; plasmid supply; cell culture media supply; and drug product manufacturing. In addition, we are dependent on a limited number of suppliers for some of our other components and materials used in our product candidates.

We have moved our cell processing to an automated, closed system with a sole source supplier. In addition, we currently rely, and expect to continue to rely, on sole source suppliers for vector supply, plasmid supply and cell culture media, as well as drug product manufacturing for our Company-sponsored clinical trials. Our sole source suppliers may be unwilling or unable to supply product to us reliably, continuously or at the levels we anticipate or are required by our clinical trial activities. Although we have entered into written supply agreements with our sole source suppliers, such suppliers could still delay, suspend, or terminate supply of product to us for a number of reasons, including manufacturing or quality issues, payment disputes with us, intellectual property disputes with third parties, bankruptcy or insolvency, earthquakes or other natural disasters or other occurrences.

In addition, we currently depend on a limited number of suppliers for some of the other components necessary for our product candidates. We cannot be sure that any of our suppliers will remain in business, or that they will not be purchased by one of our competitors or another company that is not interested in continuing to produce these materials for our intended purpose. Our use of a sole source or limited number of suppliers of raw materials, components and finished goods exposes us to several risks, including disruptions in supply, price increases, late deliveries and an inability to meet customer demand. There are, in general, relatively few alternative sources of supply for these components and equipment. Any of our vendors may be unable or unwilling to meet our future demands for our clinical trials or commercial sale. Establishing additional or replacement suppliers for these components and materials could take a substantial amount of time and it may be difficult to establish replacement suppliers who meet regulatory requirements. Any disruption in supply from any supplier or manufacturing location could lead to supply delays or interruptions which would damage our business, financial condition, results of operations and prospects.

If we are required to switch to a replacement supplier or manufacture materials ourselves, the manufacture and delivery of our product candidates could be interrupted for an extended period, adversely affecting our business. Establishing additional or replacement suppliers may not be accomplished quickly, and we may not be able to enter agreements with replacement suppliers on reasonable terms, if at all. In either scenario, our clinical trials supply could be delayed significantly as we establish alternative supply sources. In some cases, the technical skills required to manufacture our products or product candidates may be unique or proprietary to the original CMO and we may have difficulty, or there may be contractual restrictions prohibiting us from, transferring such skills to a back-up or alternate supplier, or we may be unable to transfer such skills at all. If we are able to find a replacement supplier, the replacement supplier would need to be qualified and may require additional regulatory authority approval, which could result in further delay. For example, the FDA could require additional supplemental bridging data if we rely upon a new supplier. We may be unsuccessful in demonstrating the comparability of clinical supplies which could require the conduct of additional clinical trials. While we seek to maintain adequate inventory of the components and materials used in our product candidates, any interruption or delay in the supply of components or materials, or our inability to obtain components or materials from alternate sources at acceptable prices in a timely manner, could impair our ability to conduct our clinical trials and, if our product candidates are approved, to meet the demand of our customers and cause them to cancel orders.

In addition, as part of the FDA's approval of our product candidates, the FDA must review and approve the individual components of our production process, which includes the manufacturing processes and facilities of our suppliers. Our current suppliers have not undergone this process, nor have they had any components included in any product approved by the FDA.

Our reliance on suppliers subjects us to a number of risks that could harm our reputation, business, and financial condition, including, among other things:

- delays in production, supply, shipment or delivery as a result of the ongoing COVID-19 pandemic or trade sanctions, embargoes, and heightened export requirements resulting from the war in Ukraine;
- the interruption of supply resulting from modifications to or discontinuation of a supplier's operations;
- delays in product shipments resulting from uncorrected defects, reliability issues, or a supplier's variation in a component;
- a lack of long-term supply arrangements for key components with our suppliers;
- the inability to obtain adequate supply in a timely manner, or to obtain adequate supply on commercially reasonable terms;
- difficulty and cost associated with locating and qualifying alternative suppliers for our components in a timely manner;
- production delays related to the evaluation and testing of products from alternative suppliers, and corresponding regulatory qualifications;
- a delay in delivery due to our suppliers prioritizing other customer orders over ours;
- damage to our reputation caused by defective components produced by our suppliers;

- increased cost of our warranty program due to product repair or replacement based upon defects in components produced by our suppliers; and
- fluctuation in delivery by our suppliers due to changes in demand from us or their other customers.

If any of these risks materialize, costs could significantly increase and our ability to conduct our clinical trials and, if our product candidates are approved, to meet demand for our products could be impacted.

We and our contract manufacturers are subject to significant regulation with respect to manufacturing our products. The manufacturing facilities on which we rely may not continue to meet regulatory requirements and have limited capacity.

We currently rely on sole source suppliers of our automated, closed cell processing system; vector supply; plasmid supply; cell culture media; as well as drug product manufacturing for our Company-sponsored clinical trials. In addition, we currently depend on a limited number of suppliers for some of the other components necessary for our product candidates. Each of our suppliers may require licenses to manufacture such components if such processes are not owned by the supplier or in the public domain and we may be unable to transfer or sublicense the intellectual property rights we may have with respect to such activities.

All entities involved in the preparation of therapeutics for clinical studies or commercial sale, including our existing contract manufacturers for our product candidates, are subject to extensive regulation. Components of a finished therapeutic product approved for commercial sale or used in clinical studies must be manufactured in accordance with cGMP. These regulations govern manufacturing processes and procedures (including record keeping) and the implementation and operation of quality systems to control and assure the quality of investigational products and products approved for sale. Poor control of production processes can lead to the introduction of adventitious agents or other contaminants, or to inadvertent changes in the properties or stability of our product candidates that may not be detectable in final product testing. We or our contract manufacturers must supply all necessary documentation in support of a BLA on a timely basis and must adhere to the FDA's good laboratory practices, or GLP, and cGMP regulations enforced by the FDA through its facilities inspection program. Some of our contract manufacturers have not produced a commercially-approved product and have never been inspected by the FDA before. Our facilities and quality systems and the facilities and quality systems of some or all of our third-party contractors must pass a pre-approval inspection for compliance with the applicable regulations as a condition of regulatory approval of our product candidates or any of our other potential products. In addition, the regulatory authorities may, at any time, audit or inspect a manufacturing facility involved with the preparation of our product candidates or our other potential products or the associated quality systems for compliance with the regulations applicable to the activities being conducted. If these facilities do not pass a pre-approval plant inspection, or if the FDA is unable to conduct such an inspection due to the ongoing COVID-19 pandemic, the FDA may issue a complete response letter or defer action on our applications, and approval of the products may be delayed or may not be granted.

The regulatory authorities also may, at any time following approval of a product for sale, audit our manufacturing facilities or those of our third-party contractors. If any such inspection or audit identifies a failure to comply with applicable regulations or if a violation of our product specifications or applicable regulations occurs independent of such an inspection or audit, we or the relevant regulatory authority may require remedial measures that may be costly and/or time-consuming for us or a third party to implement and that may include the temporary or permanent suspension of a clinical study or commercial sales or the temporary or permanent closure of a facility. Any such remedial measures imposed upon us or third parties with whom we contract could materially harm our business.

If we or any of our third-party manufacturers fail to maintain regulatory compliance, the FDA can impose regulatory sanctions including, among other things, refusal to approve a pending application for a new drug product or biologic product, or revocation of a pre-existing approval. As a result, our business, financial condition and results of operations may be materially harmed.

These factors could cause the delay of clinical studies, regulatory submissions, required approvals or commercialization of our product candidates, cause us to incur higher costs and prevent us from commercializing our products successfully. Furthermore, if our suppliers fail to meet contractual requirements, and we are unable to secure one or more replacement suppliers capable of production at a substantially equivalent cost, our preclinical and clinical studies may be delayed.

Our reliance on third parties requires us to share our trade secrets, which increases the possibility that a competitor will discover them or that our trade secrets will be misappropriated or disclosed.

Because we rely on third parties to manufacture our vectors and our product candidates, and because we collaborate with various organizations and academic institutions on the advancement of our gene therapy approach, we must, at times, share trade secrets with them. We seek to protect our proprietary technology in part by entering into confidentiality agreements and, if applicable, material transfer agreements, collaborative research agreements, consulting agreements or other similar agreements with our

collaborators, advisors, employees and consultants prior to beginning research or disclosing proprietary information. These agreements typically limit the rights of the third parties to use or disclose our confidential information, such as trade secrets.

Despite the contractual provisions employed when working with third parties, the need to share trade secrets and other confidential information increases the risk that such trade secrets become known by our competitors, are inadvertently incorporated into the technology of others, or are disclosed or used in violation of these agreements. Given that our proprietary position is based, in part, on our know-how and trade secrets, a competitor's discovery of our trade secrets or other unauthorized use or disclosure would impair our competitive position and may have a material adverse effect on our business.

In addition, these agreements typically restrict the ability of our collaborators, advisors, employees and consultants to publish data potentially relating to our trade secrets. Our academic collaborators typically have rights to publish data, provided that we are notified in advance and may delay publication for a specified time in order to secure our intellectual property rights arising from the collaboration. In other cases, publication rights are controlled exclusively by us, although in some cases we may share these rights with other parties. Despite our efforts to protect our trade secrets, our competitors may discover our trade secrets, either through breach of these agreements, independent development or publication of information including our trade secrets in cases where we do not have proprietary or otherwise protected rights at the time of publication. A competitor's discovery of our trade secrets would impair our competitive position and have an adverse impact on our business.

Risks related to commercialization of our product candidates

If we are unable to establish sales, distribution and marketing capabilities or enter into agreements with third parties to market and sell our product candidates, we will be unable to generate any product revenue.

To successfully commercialize any of our current or future product candidates, if approved, we will need to develop our commercial capabilities, either on our own or with others. The establishment and development of our own commercial team or the establishment of a contract sales force to market any product candidate we may develop will be expensive and time-consuming and could delay any product launch. Moreover, we cannot be certain that we will be able to successfully develop this capability. We may enter into collaborations regarding any approved product candidates with other entities to utilize their established marketing and distribution capabilities, but we may be unable to enter into such agreements on favorable terms, if at all. If any future collaborators do not commit sufficient resources to commercialize our product candidates, or we are unable to develop the necessary capabilities on our own, we will be unable to generate sufficient product revenue to sustain our business. We compete with many companies that currently have extensive, experienced and well-funded sales, distribution and marketing operations to recruit, hire, train and retain marketing and sales personnel. We also face competition in our search for third parties to assist us with the sales and marketing efforts of our product candidates, if approved. Without an internal team or the support of a third-party to perform marketing and sales functions, we may be unable to compete successfully against these more established companies.

If the market opportunities for our product candidates are smaller than we believe they are, our product revenues may be adversely affected and our business may suffer.

We focus our research and product development on treatments for serious lysosomal disorders. Our understanding of both the number of people who have these diseases, as well as the subset of people with these diseases who have the potential to benefit from treatment with our product candidates, are based on estimates. These estimates may prove to be incorrect and new studies may reduce the estimated incidence or prevalence of these diseases. The number of patients in the United States and elsewhere may turn out to be lower than expected or may not be otherwise amenable to treatment with our products, patients may become increasingly difficult to identify and access, and any approval we receive from regulatory agencies may be for a narrower indication and smaller patient population than anticipated, all of which would adversely affect our business, financial condition, results of operations and prospects.

The commercial success of any current or future product candidate will depend upon the degree of market acceptance by physicians, patients, third-party payors and others in the medical community.

Even if we obtain any regulatory approval for our product candidates, the commercial success of our product candidates will depend in part on the medical community, patients, and third-party payors accepting gene therapy products in general, and our product candidates in particular, as effective, safe and cost-effective. Any product that we bring to the market may not gain market acceptance by physicians, patients, third-party payors and others in the medical community. The degree of market acceptance of these product candidates, if approved for commercial sale, will depend on a number of factors, including:

- the potential efficacy and potential advantages over alternative treatments, including any similar generic treatments;
- the efficacy and safety as demonstrated in pivotal clinical trials and published in peer-reviewed journals;

- the prevalence and severity of any adverse events or side effects, including any limitations or warnings contained in a product's approved labeling or that are later found to be associated with a product, including in findings from long-term follow-up studies;
- the prevalence and severity of any side effects resulting from the conditioning regimen for the administration of our product candidates;
- the ability to offer the products for sale at competitive prices;
- the clinical indications for which the products are approved by the FDA or comparable regulatory agencies;
- the relative convenience and ease of dosing and administration compared to alternative treatments;
- the willingness of the target patient population to try new therapies and of physicians to prescribe these therapies;
- the strength of marketing and distribution support and timing of market introduction of competitive products;
- restrictions on how the product is distributed;
- publicity concerning our products or competing products and treatments; and
- favorable third-party insurance coverage and sufficient reimbursement.

Sales of medical products also depend on the willingness of physicians to prescribe the treatment, which is likely to be based on a determination by these physicians that the products are safe, therapeutically effective and cost effective. In addition, the inclusion or exclusion of products from treatment guidelines established by various physician groups and the viewpoints of influential physicians can affect the willingness of other physicians to prescribe the treatment. We cannot predict whether physicians, physicians' organizations, hospitals, other healthcare providers, government agencies or private insurers will determine that our product is safe, therapeutically effective and cost effective as compared with competing treatments.

Even if a product candidate displays a favorable efficacy and safety profile in preclinical and clinical studies, market acceptance of the product, if approved for commercial sale, will not be known until after it is launched. Our efforts to educate the medical community and third-party payors on the benefits of our product candidates may require significant resources and may never be successful. Such efforts to educate the marketplace may require more resources than are required by the conventional technologies marketed by our competitors. If these products do not achieve an adequate level of acceptance, we may not generate significant product revenue and may not become profitable.

If we obtain approval to commercialize our product candidates outside of the United States, a variety of risks associated with international operations could materially adversely affect our business.

We are currently conducting clinical trials for our product candidates in the United States, Canada and Australia, and plan to expand to other geographies. If any of our product candidates are approved for commercialization, we may enter into agreements with third parties to market them on a worldwide basis or in more limited geographical regions. We expect that we will be subject to additional risks related to entering into international business relationships, including:

- different regulatory requirements for approval of drugs and biologics in foreign countries;
- reduced protection for intellectual property rights;
- unexpected changes in tariffs, trade barriers and regulatory requirements;
- economic weakness, including inflation, or political instability in particular foreign economies and markets;
- compliance with tax, employment, immigration and labor laws for employees living or traveling abroad;
- foreign currency fluctuations, which could result in increased operating expenses and reduced revenues, and other obligations incident to doing business in another country;
- workforce uncertainty in countries where labor unrest is more common than in the United States;
- production shortages resulting from any events affecting raw material supply or manufacturing capabilities abroad; and
- business interruptions resulting from geopolitical actions, including war and terrorism, or natural disasters including earthquakes, typhoons, floods and fires.

The insurance coverage and reimbursement status of newly-approved products are uncertain. Failure to obtain or maintain adequate coverage and reimbursement for any of our product candidates, if approved, could limit our ability to market those products and decrease our ability to generate revenue.

The regulations that govern marketing approvals, pricing and reimbursement for new drugs vary widely from country to country. In the United States, recently enacted legislation may significantly change the approval requirements in ways that could involve additional costs and cause delays in obtaining approvals. Some countries require approval of the sale price of a drug before it can be marketed. In many countries, the pricing review period begins after marketing or product licensing approval is granted. In some foreign markets, prescription pharmaceutical pricing remains subject to continuing governmental control even after initial approval is granted. As a result, we might obtain marketing approval for a product in a particular country, but then be subject to price regulations that delay our or their commercial launch of the product, possibly for lengthy time periods, and negatively impact the revenue we are able to generate from the sale of the product in that country. Adverse pricing limitations may hinder our ability to recoup our investment in one or more product candidates, even if any product candidates we may develop obtain marketing approval. See section entitled "*Business – Government Regulation – Coverage and Reimbursement*."

Our ability to successfully commercialize our product candidates or any other products that we or they may develop also will depend in part on the extent to which reimbursement for these products and related treatments will be available from government health administration authorities, private health insurers, and other organizations. Government authorities and other third-party payors, such as private health insurers and health maintenance organizations, decide which medications they will pay for and establish reimbursement levels. The availability and extent of reimbursement by governmental and private payors is essential for most patients to be able to afford treatments. Sales of our product candidates will depend substantially, both domestically and abroad, on the extent to which the costs of our product candidates will be paid by health maintenance, managed care, pharmacy benefit and similar healthcare management organizations, or reimbursed by government health administration authorities, private health coverage insurers and other third-party payors. We may not be able to provide data sufficient to gain acceptance with respect to coverage and reimbursement. If reimbursement is not available, or is available only at limited levels, we may not be able to successfully commercialize our product candidates, if approved. Even if coverage is provided, the approved reimbursement amount may not be high enough to allow us to establish or maintain pricing sufficient to realize a sufficient return on our investment.

There is significant uncertainty related to the insurance coverage and reimbursement of newly approved products. In the United States, the principal decisions about reimbursement for new medicines are typically made by CMS, an agency within the U.S. Department of Health and Human Services, or HHS, as CMS decides whether and to what extent a new medicine will be covered and reimbursed under Medicare. Private payors tend to follow CMS to a substantial degree. It is difficult to predict what CMS will decide with respect to reimbursement for fundamentally novel products such as ours, as there is no body of established practices and precedents for these new products. Patients who are provided medical treatment for their conditions generally rely on third-party payors to reimburse all or part of the costs associated with their treatment. Adequate coverage and reimbursement from governmental healthcare programs and commercial payors are critical to new product acceptance. Government authorities and other third-party payors, such as private health insurers and health maintenance organizations, decide which drugs and treatments they will cover and the amount of reimbursement.

A primary trend in the U.S. healthcare industry and elsewhere is cost containment. Government authorities and other third-party payors have attempted to control costs by limiting coverage and the amount of reimbursement for particular medications. Outside the United States, international operations are generally subject to extensive governmental price controls and other market regulations, and we believe the increasing emphasis on cost-containment initiatives in Europe and certain other major markets where we plan to commercialize may put pressure on the pricing and usage of our product candidates. In many countries, the prices of medical products are subject to varying price control mechanisms as part of national health systems, and pricing negotiations with governmental authorities can take considerable time after the receipt of marketing approval for a product. To obtain reimbursement or pricing approval in some countries, we may be required to conduct a clinical trial that compares the cost effectiveness of our product candidates to other available therapies. In general, the prices of medicines under such systems are substantially lower than in the United States. Other countries allow companies to fix their own prices for medicines, but monitor and control company profits. Additional foreign price controls or other changes in pricing regulation could restrict the amount that we are able to charge for our product candidates. Accordingly, in markets outside the United States, the reimbursement for our products may be reduced compared with the United States and may be insufficient to generate commercially reasonable revenues and profits.

Moreover, efforts by governmental and other third-party payors, in the United States and abroad, to cap or reduce healthcare costs may cause such organizations to limit both coverage and level of reimbursement for new products approved and, as a result, they may not cover or provide adequate payment for our product candidates. We expect to experience pricing pressures in connection with the sale of any of our product candidates, due to the trend toward managed healthcare, the increasing influence of health maintenance organizations and additional legislative changes. The downward pressure on healthcare costs in general, particularly prescription drugs

and surgical procedures and other treatments, has become very intense. As a result, increasingly high barriers are being erected to the entry of new products.

Due to the novel nature of our technology and the potential for our product candidates to offer therapeutic benefit in a single administration, we face uncertainty related to pricing and reimbursement for these product candidates.

Our target patient populations are relatively small, as a result of which the pricing and reimbursement of our product candidates, if approved, must be adequate to support commercial infrastructure. If we are unable to obtain adequate levels of reimbursement, our ability to successfully market and sell our product candidates will be adversely affected. The manner and level at which reimbursement is provided for services related to our product candidates (e.g., for administration of our product to patients) is also important. Inadequate reimbursement for such services may lead to physician resistance and adversely affect our ability to market or sell our product candidates, if approved.

Healthcare legislative reform measures and constraints on national budget social security systems may have a material adverse effect on our business and results of operations.

The United States and many foreign jurisdictions have enacted or proposed legislative and regulatory changes affecting the healthcare system that could prevent or delay marketing approval of our product candidates or any future product candidates, restrict or regulate post-approval activities and affect our ability to profitably sell any product for which we obtain marketing approval. In the United States, the pharmaceutical industry has been a particular focus of these efforts and has been significantly affected by major legislative initiatives. There have been, and likely will continue to be, legislative and regulatory proposals at the federal and state levels directed at broadening the availability of healthcare and containing or lowering the cost of healthcare. See Section entitled *"Business - Government Regulation – Healthcare Reform."* We cannot predict the initiatives that may be adopted in the future.

The continuing efforts of the government, insurance companies, managed care organizations and other payers of healthcare services to contain or reduce costs of healthcare may adversely affect:

- the demand for any of our product candidates, if approved;
- the ability to set a price that we believe is fair for any of our product candidates, if approved;
- our ability to generate revenues and achieve or maintain profitability;
- the level of taxes that we are required to pay; and
- the availability of capital.

Legislative and regulatory proposals have been made to expand post-approval requirements and restrict sales and promotional activities for pharmaceutical and biologic products. We cannot be sure whether additional legislative changes will be enacted, or whether FDA regulations, guidance or interpretations will be changed, or what the impact of such changes on the marketing approvals of our product candidates, if any, may be. In addition, increased scrutiny by Congress of the FDA's approval process may significantly delay or prevent marketing approval, as well as subject us to more stringent product labeling and post-marketing testing and other requirements.

Moreover, increasing efforts by governmental and third-party payors in the United States and abroad to cap or reduce healthcare costs may cause such organizations to limit both coverage and the level of reimbursement for newly approved products and, as a result, they may not cover or provide adequate payment for our product candidates. There has been increasing legislative and enforcement interest in the United States with respect to specialty drug pricing practices. Specifically, there have been several recent U.S. Congressional inquiries and proposed and enacted federal and state legislation designed to, among other things, bring more transparency to drug pricing, reduce the cost of prescription drugs under Medicare, review the relationship between pricing and manufacturer patient programs, and reform government program reimbursement methodologies for drugs.

We expect that the healthcare reform measures that have been adopted and may be adopted in the future, may result in more rigorous coverage criteria and in additional downward pressure on the price that we receive for any approved product and could seriously harm our future revenues. Any reduction in reimbursement from Medicare or other government programs may result in a similar reduction in payments from private payors. The implementation of cost containment measures or other healthcare reforms may prevent us from being able to generate revenue, attain profitability or commercialize our product candidates.

Inadequate funding for the FDA and other government agencies could hinder their ability to hire and retain key leadership and other personnel, prevent new products and services from being developed or commercialized in a timely manner or otherwise prevent those agencies from performing normal business functions on which the operation of our business may rely, which could negatively impact our business.

The ability of the FDA to review and approve new products can be affected by a variety of factors, including government budget and funding levels, ability to hire and retain key personnel and accept the payment of user fees, and statutory, regulatory, and policy changes. Average review times at the agency have fluctuated in recent years as a result. In addition, government funding of other agencies on which our operations may rely, including those that fund research and development activities, is subject to the political process, which is inherently fluid and unpredictable.

Disruptions at the FDA and other agencies may also slow the time necessary for new drugs to be reviewed and/or approved by necessary government agencies, which would adversely affect our business. For example, over the last several years the U.S. government has shut down several times and certain regulatory agencies, such as the FDA, have had to furlough critical FDA and other government employees and stop critical activities. Since March 2020 when foreign and domestic inspections of facilities were largely placed on hold, the FDA has been working to resume routine surveillance, bioresearch monitoring and pre-approval inspections on a prioritized basis. Since April 2021, the FDA has conducted limited inspections and employed remote interactive evaluations, using risk management methods, to meet user fee commitments and goal dates. Ongoing travel restrictions and other uncertainties continue to impact oversight operations both domestic and abroad and it is unclear when standard operational levels will resume. The FDA is continuing to complete mission-critical work, prioritize other higher-tiered inspectional needs (e.g., for-cause inspections), and carry out surveillance inspections using risk-based approaches for evaluating public health. Should the FDA determine that an inspection is necessary for approval and an inspection cannot be completed during the review cycle due to restrictions on travel, and the FDA does not determine a remote interactive evaluation to be adequate, the FDA has stated that it generally intends to issue, depending on the circumstances, a complete response letter or defer action on the application until an inspection can be completed. During the COVID-19 public health emergency, a number of companies announced receipt of complete response letters due to the FDA's inability to complete required inspections for their applications. Additionally, during the COVID-19 public health emergency, the FDA has stated it is continuing working to ensure timely reviews of applications for medical products in line with its user fee performance goals and conducting mission critical domestic and foreign inspections to ensure compliance of manufacturing facilities with FDA quality standards. However, the FDA may not be able to continue its current pace and approval timelines could be extended, including where a pre-approval inspection or an inspection of clinical sites is required and due to the ongoing COVID-19 pandemic and travel restrictions FDA is unable to complete such required inspections during the review period. Regulatory authorities outside the U.S. may adopt similar restrictions or other policy measures in response to the ongoing COVID-19 pandemic and may experience delays in their regulatory activities. If a prolonged government shutdown occurs, it could significantly impact the ability of the FDA to timely review and process our regulatory submissions, which could have a material adverse effect on our business. Further, future shutdowns of other government agencies, such as the SEC, may also impact our business through review of our public filings and our ability to access the public markets.

Any contamination in our manufacturing process, shortages of materials or failure of any of our key suppliers to deliver necessary components could result in interruption in the supply of our product candidates and delays in our clinical development or commercialization schedules.

Given the nature of biologics manufacturing, there is a risk of contamination in our manufacturing processes. Any contamination could materially adversely affect our ability to produce product candidates on schedule and could, therefore, harm our results of operations and cause reputational damage.

Some of the materials required in our manufacturing process are derived from biologic sources. Such materials are difficult to procure and may be subject to contamination or recall. A material shortage, contamination, recall or restriction on the use of biologically derived substances in the manufacture of our product candidates could adversely impact or disrupt the commercial manufacturing or the production of clinical material, which could materially and adversely affect our development timelines and our business, financial condition, results of operations and prospects.

Risks related to our business operations

Our gene therapy approach utilizes lentiviral vectors derived from viruses, which may be perceived as unsafe or may result in unforeseen adverse events. Negative public opinion and increased regulatory scrutiny of gene therapy and genetic research may damage public perception of our product candidates or adversely affect our ability to conduct our business or obtain regulatory approvals for our product candidates.

Gene therapy remains a novel technology, with only a limited number of gene therapy products approved to date. Public perception may be influenced by claims that gene therapy is unsafe, and gene therapy may not gain the acceptance of the public or the

medical community. In particular, our success will depend upon physicians specializing in the treatment of those diseases that our product candidates target prescribing treatments that involve the use of our product candidates in lieu of, or in addition to, existing treatments they are already familiar with and for which greater clinical data may be available. More restrictive government regulations or negative public opinion would have a negative effect on our business or financial condition and may delay or impair the development and commercialization of our product candidates or demand for any products we may develop. For example, earlier gene therapy trials led to several well-publicized adverse events, including cases of leukemia, myelodysplastic syndromes and deaths seen in other trials using other vectors. Adverse events in our clinical studies or discovered in long-term follow-up, even if not ultimately attributable to our product candidates (such as the many adverse events that typically arise from the conditioning process), or adverse events in other gene therapy trials, and the resulting publicity could result in a decline in our stock price, increased governmental regulation, unfavorable public perception, potential regulatory delays in the testing or approval of our potential product candidates, stricter labeling requirements for those product candidates that are approved and a decrease in demand for any such product candidates.

Our future success depends on our ability to retain key employees, consultants and advisors and to attract, retain and motivate qualified personnel.

We are highly dependent on principal members of our executive team and key employees, the loss of whose services may adversely impact the achievement of our objectives. While we have entered into employment agreements with each of our executive officers, any of them could leave our employment at any time, as all of our employees are "at will" employees. We do not maintain "key person" insurance policies on the lives of these individuals or the lives of any of our other employees. The loss of the services of one or more of our current executive or key employees might impede the achievement of our research, development and commercialization objectives. Recruiting and retaining other qualified employees, consultants and advisors for our business, including scientific and technical personnel, will also be critical to our success. We implemented a reduction in force in January 2022 in connection with the deprioritization of our Fabry disease program, and through the first half of 2022 we have continued to streamline employee headcount including senior management. Reductions in force, management changes and program reprioritizations can have an adverse impact on employee morale. While we believe our relations with our continuing employees to be good, there can be no assurance that we can avoid hiring and retention challenges for skilled personnel in the future. There is currently a shortage of skilled executives and other personnel in our industry, which is likely to continue. As a result, competition for skilled personnel, including in gene therapy research and vector manufacturing, is intense and the turnover rate can be high. We may not be able to attract and retain personnel on acceptable terms given the competition among numerous pharmaceutical and biotechnology companies for individuals with similar skill sets. In addition, our ability to recruit and retain qualified personnel could be impacted by other factors, such as remote or hybrid working arrangements, including those resulting from the ongoing COVID-19 pandemic, which could impact employees' productivity and morale, as well as any failure to succeed in preclinical or clinical trials. In addition, in recent months the market price of our common stock has experienced significant downward pressure, resulting in "underwater" or "out-of-the-money" stock options for many of our employees, thereby limiting the desired retentive effect that our equity incentive program was intended to achieve. The inability to recruit or the loss of the services of any executive, key employee, consultant or advisor may impede the progress of our research, development and commercialization objectives.

We may need to expand our operations and we may experience difficulties in managing this growth, which could disrupt our operations.

As we mature, we may need to rapidly expand our full-time employee base and hire more consultants and contractors. Our management may need to divert a disproportionate amount of its attention away from our day-to-day activities and devote a substantial amount of time to managing these growth activities. We may not be able to effectively manage the expansion of our operations, which may result in weaknesses in our infrastructure, operational mistakes, loss of business opportunities, loss of employees and reduced productivity among remaining employees. Our expected growth could require significant capital expenditures and may divert financial resources from other projects, such as the development of additional product candidates. If our management is unable to effectively manage our growth, our expenses may increase more than expected, our ability to generate and/or grow revenues could be reduced, and we may not be able to implement our business strategy. Our future financial performance and our ability to commercialize product candidates and compete effectively will depend, in part, on our ability to effectively manage any future growth.

If we are unable to manage expected growth in the scale and complexity of our operations, our performance may suffer.

If we are successful in executing our business strategy, we will need to expand our managerial, operational, financial and other systems and resources to manage our operations, continue our research and development activities and, in the longer term, build a commercial infrastructure to support commercialization of any of our product candidates that are approved for sale. Future growth would impose significant added responsibilities on members of management. It is likely that our management, finance, development personnel, systems and facilities currently in place may not be adequate to support this future growth. Our need to effectively manage

our operations, growth and product candidates requires that we continue to develop more robust business processes and improve our systems and procedures in each of these areas and to attract and retain sufficient numbers of talented employees. We may be unable to successfully implement these tasks on a larger scale and, accordingly, may not achieve our research, development and growth goals.

Our employees, principal investigators, consultants and commercial partners may engage in misconduct or other improper activities, including non-compliance with regulatory standards and requirements and insider trading.

We are exposed to the risk of fraud or other misconduct by our employees, principal investigators, consultants and commercial partners. Misconduct by these parties could include intentional failures to comply with the regulations of the FDA or of other foreign regulatory authorities, provide accurate information to the FDA and other foreign regulatory authorities, comply with healthcare fraud and abuse laws and regulations in the United States and abroad, report financial information or data accurately or disclose unauthorized activities to us. In particular, sales, marketing and business arrangements in the healthcare industry are subject to extensive laws and regulations intended to prevent fraud, misconduct, kickbacks, self-dealing and other abusive practices. These laws and regulations may restrict or prohibit a wide range of pricing, discounting, marketing and promotion, sales commission, customer incentive programs and other business arrangements. Such misconduct could also involve the improper use of information obtained in the course of clinical studies, which could result in regulatory sanctions and cause serious harm to our reputation. We have adopted a code of conduct applicable to all of our employees, but it is not always possible to identify and deter employee misconduct, and the precautions we take to detect and prevent this activity may not be effective in controlling unknown or unmanaged risks or losses or in protecting us from governmental investigations or other actions or lawsuits stemming from a failure to comply with these laws or regulations. If any such actions are instituted against us, and we are not successful in defending ourselves or asserting our rights, those actions could have a significant impact on our business, including the imposition of significant fines or other sanctions.

We are subject to certain U.S. and foreign anti-corruption, anti-money laundering, export control, sanctions, and other trade laws and regulations. We can face serious consequences for violations.

Among other matters, U.S. and foreign anti-corruption, anti-money laundering, export control, sanctions, and other trade laws and regulations, which are collectively referred to as Trade Laws, prohibit companies and their employees, agents, clinical research organizations, legal counsel, accountants, consultants, contractors, and other partners from authorizing, promising, offering, providing, soliciting, or receiving directly or indirectly, corrupt or improper payments or anything else of value to or from recipients in the public or private sector. Violations of Trade Laws can result in substantial criminal fines and civil penalties, imprisonment, the loss of trade privileges, debarment, tax reassessments, breach of contract and fraud litigation, reputational harm, and other consequences. We have direct or indirect interactions with officials and employees of government agencies or government-affiliated hospitals, universities, and other organizations. We also expect our non-U.S. activities to increase in time. We plan to engage third parties for clinical trials and/or to obtain necessary permits, licenses, patent registrations, and other regulatory approvals and we can be held liable for the corrupt or other illegal activities of our personnel, agents, or partners, even if we do not explicitly authorize or have prior knowledge of such activities. The failure to comply with laws governing international business practices may result in substantial civil and criminal penalties and suspension or debarment from government contracting. The SEC also may suspend or bar issuers from trading securities on U.S. exchanges for violations of the United States Foreign Corrupt Practices Act's accounting provisions.

We may be subject, directly or indirectly, to federal and state healthcare fraud and abuse laws, false claims laws health information privacy and security laws, and other health care laws and regulations. If we are unable to comply, or have not fully complied, with such laws, we could face substantial penalties.

If we obtain FDA approval for any of our product candidates and begin commercializing those products in the United States, our operations will be directly, or indirectly through our prescribers, customers and purchasers, subject to various federal and state fraud and abuse laws and regulations, including, without limitation, the federal Health Care Program Anti-Kickback Statute, the federal civil and criminal False Claims Act and Physician Payments Sunshine Act and regulations. These laws will impact, among other things, our proposed sales, marketing and educational programs. In addition, we may be subject to patient privacy laws by both the federal government and the states in which we conduct our business. See section entitled "*Business – Government Regulation – Other Healthcare Laws and Compliance Requirements*."

The scope and enforcement of each of these laws is uncertain and subject to rapid change in the current environment of healthcare reform. Federal and state enforcement bodies have recently increased their scrutiny of interactions between healthcare companies and healthcare providers, which has led to a number of investigations, prosecutions, convictions and settlements in the healthcare industry. Ensuring business arrangements comply with applicable healthcare laws, as well as responding to possible investigations by government authorities, can be time- and resource-consuming and can divert a company's attention from the business.

The failure to comply with any of these laws or regulatory requirements subjects entities to possible legal or regulatory action. Depending on the circumstances, failure to meet applicable regulatory requirements can result in significant civil, criminal and administrative penalties, damages, fines, disgorgement, individual imprisonment, exclusion from participation in federal and state funded healthcare programs (such as Medicare and Medicaid), contractual damages and the curtailment or restructuring of our operations, as well as additional reporting obligations and oversight if we become subject to a corporate integrity agreement or other agreement to resolve allegations of non-compliance with these laws. Any action for violation of these laws, even if successfully defended, could cause a pharmaceutical manufacturer to incur significant legal expenses and divert management's attention from the operation of the business. If any of the physicians or other healthcare providers or entities with whom we expect to do business is found not to be in compliance with applicable laws, that person or entity may be subject to criminal, civil or administrative sanctions, including exclusions from government funded healthcare programs. Prohibitions or restrictions on sales or withdrawal of future marketed products could materially affect business in an adverse way.

Efforts to ensure that our business arrangements will comply with applicable healthcare laws may involve substantial costs. It is possible that governmental and enforcement authorities will conclude that our business practices may not comply with current or future statutes, regulations or case law interpreting applicable fraud and abuse or other healthcare laws and regulations. If any such actions are instituted against us, and we are not successful in defending ourselves or asserting our rights, those actions could have a significant impact on our business, including the imposition of civil, criminal and administrative penalties, damages, disgorgement, monetary fines, possible exclusion from participation in Medicare, Medicaid and other federal healthcare programs, contractual damages, reputational harm, diminished profits and future earnings, and curtailment of our operations, any of which could adversely affect our ability to operate our business and our results of operations. In addition, the approval and commercialization of any of our candidates outside the United States will also likely subject us to foreign equivalents of the healthcare laws mentioned above, among other foreign laws.

Failure to comply with health and data protection laws and regulations could lead to government enforcement actions (which could include civil or criminal penalties), private litigation, and/or adverse publicity and could negatively affect our operating results and business.

We and any potential collaborators may be subject to federal, state, and foreign data protection laws and regulations (i.e., laws and regulations that address privacy and data security). In the United States, numerous federal and state laws and regulations, including federal health information privacy laws, state data breach notification laws, state health information privacy laws, and federal and state consumer protection laws (e.g., Section 5 of the Federal Trade Commission Act), that govern the collection, use, disclosure and protection of health-related and other personal information could apply to our operations or the operations of our collaborators. In addition, we may obtain health information from third parties (including research institutions from which we obtain clinical trial data) that are subject to privacy and security requirements under HIPAA, as amended by HITECH. Depending on the facts and circumstances, we could be subject to civil, criminal, and administrative penalties if we knowingly obtain, use, or disclose individually identifiable health information maintained by a HIPAA-covered entity in a manner that is not authorized or permitted by HIPAA.

Compliance with U.S. and international data protection laws and regulations could require us to take on more onerous obligations in our contracts, restrict our ability to collect, use and disclose data, or in some cases, impact our ability to operate in certain jurisdictions. Failure to comply with these laws and regulations could result in government enforcement actions (which could include civil, criminal and administrative penalties), private litigation, and/or adverse publicity and could negatively affect our operating results and business. Moreover, clinical trial patients, employees and other individuals about whom we or our potential collaborators obtain personal information, as well as the providers who share this information with us, may limit our ability to collect, use and disclose the information. Claims that we have violated individuals' privacy rights, failed to comply with data protection laws, or breached our contractual obligations, even if we are not found liable, could be expensive and time-consuming to defend and could result in adverse publicity that could harm our business.

European data collection is governed by restrictive regulations governing the use, processing and cross-border transfer of personal information.

We currently plan to conduct clinical trials in the European Union, or EU, and the United Kingdom, or UK, and as a result will be subject to additional privacy restrictions. The collection, use, disclosure, transfer or other processing of personal health data in the EU is governed by the provisions of the General Data Protection Regulation, or GDPR. The GDPR is wide-ranging in scope and imposes numerous requirements on companies that process personal data, including requirements relating to processing health and other sensitive data, providing information to individuals regarding data processing activities, obtaining consent from individuals to whom the data processing relates, responding to additional data subject requests, imposing notification of personal data breaches to the competent national data protection authorities, implementing safeguards in connection with the security and confidentiality of the personal data, accountability requirements and taking certain measures when engaging third-party processors. The GDPR informs our

obligations with respect to any clinical trials conducted in the European Economic Area, or EEA, by expanding the definition of personal data to include coded data and requiring changes to informed consent practices and more detailed notices for clinical trial subjects and investigators. In addition, the GDPR imposes strict rules on the transfer of personal data out of the European Union, including to the United States, and as a result increases scrutiny that such rules may apply to transfers of personal data from any clinical trial sites located in the EU and the UK to the United States. The GDPR also permits data protection authorities to require destruction of improperly gathered or used personal data and/or impose substantial fines for violations of the GDPR, which can be up to four percent of global revenues or 20 million Euros, whichever is greater, and confers a private right of action on data subjects and consumer associations to lodge complaints with supervisory authorities, seek judicial remedies, and obtain compensation for damages resulting from violations of the GDPR. In addition, the GDPR provides that European Union member states may make their own further laws and regulations limiting the processing of personal data, including genetic, biometric, or health data.

Given the breadth and depth of its obligations, complying with the GDPR's requirements is rigorous and time intensive and requires significant resources and assessment of our technologies, systems and practices, as well as those of any third-party collaborators, service providers, contractors, or consultants that process or transfer personal data collected in the European Union.

Further, the UK exited the EU effective January 31, 2020, subject to a transition period that ended December 31, 2020. Following the UK's withdrawal from the EU on January 31, 2020, pursuant to the transitional arrangements agreed to between the UK and EU, the GDPR continued to have effect under law in the UK, and continued to do so until December 31, 2020 as if the UK remained a member state of the EU for such purposes. Following December 31, 2020, and the expiry of those transitional arrangements, the data protection obligations of the GDPR continue to apply to UK-related processing of personal data in substantially unvaried form and fashion under the so-called "UK GDPR" (i.e., the GDPR as it continues to form part of UK law by virtue of section 3 of the European Union (Withdrawal) Act 2018, as amended (including by the various Data Protection, Privacy and Electronic Communications (Amendments etc.) (EU Exit) Regulations)). Although the UK is regarded as a third country under the EU's GDPR, the European Commission has now issued a decision recognizing the UK as providing adequate protection under the EU GDPR and, therefore, transfers of personal data originating in the EU to the UK remain unrestricted. Like the EU GDPR, the UK GDPR restricts personal data transfers outside the UK to countries not regarded by the UK as providing adequate protection. The UK government has confirmed that personal data transfers from the UK to the EEA remain free flowing.

To enable the transfer of personal data outside of the EEA or the UK, adequate safeguards must be implemented in compliance with European and UK data protection laws. On June 4, 2021, the EC issued new forms of standard contractual clauses for data transfers from controllers or processors in the EU/EEA (or otherwise subject to the GDPR) to controllers or processors established outside the EU/EEA (and not subject to the GDPR). The new standard contractual clauses replace the standard contractual clauses that were adopted previously under the EU Data Protection Directive. The UK is not subject to the EC's new standard contractual clauses but has published a draft version of a UK-specific transfer mechanism, which, once finalized, will enable transfers from the UK. We will be required to implement these new safeguards when conducting restricted data transfers under the EU and UK GDPR and doing so will require significant effort and cost.

Further, certain European data protection laws restrict transfers of personal data to countries outside Europe that do not ensure an adequate level of protection, like the United States (so-called "third countries"). These transfers are prohibited unless an appropriate safeguard specified by the European data protection laws is implemented, such as the Standard Contractual Clauses, or SCCs, approved by the European Commission, or a derogation applies. The Court of Justice of the European Union, or CJEU, in its decision in Case C-311/18 *(Data Protection Commissioner v Facebook Ireland and Maximillian Schrems*, or Schrems II,) deemed that the SCCs are valid. However, the CJEU ruled that transfers made pursuant to the SCCs and other alternative transfer mechanisms need to be assessed on a case-by-case basis taking into account the legal regime applicable in the destination country, in particular regarding applicable surveillance laws and relevant rights of individuals with respect to the transferred personal data, to ensure an "essentially equivalent" level of protection to that guaranteed in the EEA in the jurisdiction where the data importer is based. On June 4, 2021, the European Commission published new versions of the SCCs, or New SCCs, which seek to address the issues identified by the CJEU's Schrems II decision and provide further details regarding the transfer assessments of the importer third country's laws that the parties are required to conduct when implementing the New SCCs. On June 18, 2021, the European Data Protection Board, or EDPB, issued its final guidance following the CJEU's decision that imposes significant new diligence requirements on transferring data outside the EEA, including under an approved transfer mechanism. This guidance requires an "essential equivalency" assessment of the laws of the destination country transferred. If the "essentially equivalent" level of protection standard outlined by the CJEU's decision is not satisfied in the destination country, the exporting entity must then assess if supplementary technical, organizational and/or contractual measures can be put in place that, in combination with the chosen transfer mechanism, would address the deficiency in the laws and ensure that essentially equivalent protection can be given to the data. Complying with this guidance will be expensive and time consuming and may ultimately prevent us from transferring personal data outside the EEA, which would cause significant business disruption. At present, there are few, if any, viable alternatives to the SCCs. The risks associated with such exports of personal data from locations within Europe are particularly relevant to our business as our organization comprises several operating entities, some of which may be located, and/or sponsor clinical trials, in Europe. We have yet to adopt and implement comprehensive processes, systems and other relevant measures within our organization, and/or with our relevant collaborators, service providers, contractors or consultants, which are appropriate to address relevant requirements relating to international transfers of personal data from Europe, and to minimize the potential impacts and risks resulting from those requirements, across our organization.

Failure to implement valid mechanisms for personal data transfers from Europe may result in our facing increased exposure to regulatory actions, substantial fines and injunctions against processing personal data from Europe. Inability to export personal data may also: restrict our activities outside Europe; limit our ability to collaborate with partners as well as other service providers, contractors and other companies outside of Europe; and/or require us to increase our processing capabilities within Europe at significant expense or otherwise cause us to change the geographical location or segregation of our relevant systems and operations – any or all of which could adversely affect our operations or financial results. Additionally, other countries outside of Europe have enacted or are considering enacting similar cross-border data transfer restrictions and laws requiring local data residency, which could increase the cost and complexity of delivering our services and operating our business. The type of challenges we face in Europe will likely also arise in other jurisdictions that adopt laws similar in construction to the GDPR or regulatory frameworks of equivalent complexity.

We face potential product liability, and, if successful claims are brought against us, we may incur substantial liability and costs. If the use of our product candidates harms patients, or is perceived to harm patients even when such harm is unrelated to our product candidates, our regulatory approvals could be revoked or otherwise negatively impacted and we could be subject to costly and damaging product liability claims.

The use of our product candidates in clinical studies and the sale of any products for which we obtain marketing approval exposes us to the risk of product liability claims. Product liability claims might be brought against us by consumers, healthcare providers, pharmaceutical companies or others selling or otherwise coming into contact with our products. There is a risk that our product candidates may induce adverse events. If we cannot successfully defend against product liability claims, we could incur substantial liability and costs. In addition, regardless of merit or eventual outcome, product liability claims may result in:

- the impairment of our business reputation;
- the withdrawal of clinical study participants;
- costs due to related litigation;
- the distraction of management's attention from our primary business;
- substantial monetary awards to patients or other claimants;
- the inability to commercialize our product candidates; and
- decreased demand for our product candidates, if approved for commercial sale.

We carry master product liability insurance of $5.0 million per occurrence and $5.0 million in the aggregate in the United States. For studies conducted in certain countries outside the United States, we maintain local admitted policies with varying limits. We believe our product liability insurance coverage is sufficient in light of our current clinical programs; however, we may not be able to maintain insurance coverage at a reasonable cost or in sufficient amounts to protect us against losses due to liability. If and when we obtain marketing approval for product candidates, we intend to expand our insurance coverage to include the sale of commercial products; however, we may be unable to obtain product liability insurance on commercially reasonable terms or in adequate amounts. On occasion, large judgments have been awarded in class action lawsuits based on drugs or medical treatments that had unanticipated adverse effects. A successful product liability claim or series of claims brought against us could cause our stock price to decline and, if judgments exceed our insurance coverage, could adversely affect our results of operations and business.

Patients with the diseases targeted by certain of our product candidates are often already in severe and advanced stages of disease and have both known and unknown significant pre-existing and potentially life- threatening health risks. During the course of treatment, patients may suffer adverse events, including death, for reasons that may be related to our product candidates. Such events could subject us to costly litigation, require us to pay substantial amounts of money to injured patients, delay, negatively impact or end our opportunity to receive or maintain regulatory approval to market our products, or require us to suspend or abandon our commercialization efforts. Even in a circumstance in which we do not believe that an adverse event is related to our products, the investigation into the circumstance may be time-consuming or inconclusive. These investigations may interrupt our sales efforts, delay our regulatory approval process in other countries, or impact and limit the type of regulatory approvals our product candidates receive or maintain. As a result of these factors, a product liability claim, even if successfully defended, could have a material adverse effect on our business, financial condition or results of operations.

If we fail to comply with environmental, health and safety laws and regulations, we could become subject to fines or penalties or incur costs that could have a material adverse effect on the success of our business.

We are subject to numerous environmental, health and safety laws and regulations, including those governing laboratory procedures and the handling, use, storage, treatment and disposal of hazardous materials and wastes. Our operations involve the use of

hazardous and flammable materials, including chemicals and biological materials. Our operations also produce hazardous waste products. We generally contract with third parties for the disposal of these materials and wastes. We cannot eliminate the risk of contamination or injury from these materials. In the event of contamination or injury resulting from our use of hazardous materials, we could be held liable for any resulting damages, and any liability could exceed our resources. We also could incur significant costs associated with civil or criminal fines and penalties. Furthermore, environmental laws and regulations are complex, change frequently and have tended to become more stringent. We cannot predict the impact of such changes and cannot be certain of our future compliance. In addition, we may incur substantial costs in order to comply with current or future environmental, health and safety laws and regulations. These current or future laws and regulations may impair our research, development or production efforts. Failure to comply with these laws and regulations also may result in substantial fines, penalties or other sanctions.

Although we maintain workers' compensation insurance to cover us for costs and expenses we may incur due to injuries to our employees resulting from the use of hazardous materials or other work-related injuries, this insurance may not provide adequate coverage against potential liabilities. In addition, we may incur substantial costs in order to comply with current or future environmental, health and safety laws and regulations. These current or future laws and regulations may impair our research, development or production efforts. Failure to comply with these laws and regulations also may result in substantial fines, penalties or other sanctions or liabilities, which could materially adversely affect our business, financial condition, results of operations and prospects.

We might not be able to utilize a significant portion of our net operating loss carryforwards and research and development tax credit carryforwards.

As of December 31, 2021 and 2020, we had federal and state net operating loss carryforwards of $313.0 million and $214.0 million, respectively, and federal research and development tax credit carryforwards of approximately $6.2 million and $3.7 million, respectively. If not utilized, the net operating loss carryforwards and research and development credits will generally expire at various dates through 2038 (other than federal net operating loss carryforwards generated in taxable years beginning after December 31, 2017, which are not subject to expiration and generally may not be carried back to prior taxable years except that net operating losses generated in 2018, 2019 and 2020 may be carried back five taxable years). These net operating loss and tax credit carryforwards could expire unused and be unavailable to offset future income tax liabilities. In addition, under Section 382 of the Internal Revenue Code of 1986, as amended, or the Code, and corresponding provisions of state law, if a corporation undergoes an "ownership change," which is generally defined as a greater than 50 percentage point change, by value, in its equity ownership over a three-year period, the corporation's ability to use its pre-change net operating loss carryforwards and other pre-change tax attributes to offset its post-change income may be limited. We may have experienced ownership changes in the past. We may also experience ownership changes in the future as a result of subsequent shifts in our stock ownership, some of which may be outside of our control. If an ownership change occurred or occurs and our ability to use our historical net operating loss and tax credit carryforwards is materially limited, or if our research and development carryforwards are adjusted, it would harm our future operating results by effectively increasing our future tax obligations. For taxable years beginning after December 31, 2020, deductions for federal net operating losses arising in taxable years beginning after December 31, 2017 may only offset 80% of taxable income.

Risks related to our intellectual property

Third-party claims of intellectual property infringement may prevent or delay our development and commercialization efforts.

Our commercial success depends in part on avoiding infringement of the patents and proprietary rights of third parties. There is a substantial amount of litigation, both within and outside the United States, involving patent and other intellectual property rights in the biotechnology and pharmaceutical industries, including patent infringement lawsuits, interferences, oppositions and *inter partes* reexamination proceedings before the U.S. Patent and Trademark Office, or USPTO, and corresponding foreign patent offices. Numerous U.S. and foreign issued patents and pending patent applications, which are owned by third parties, exist in the fields in which we are pursuing development candidates. As the biotechnology and pharmaceutical industries expand and more patents are issued, the risk increases that our product candidates may be subject to claims of infringement of the patent rights of third parties.

Third parties may assert that we or our licensors are employing their proprietary technology without authorization. There may be third-party patents or patent applications with claims to materials, formulations, methods of manufacture or methods for treatment related to the use or manufacture of our product candidates. In particular, we are aware of issued patents in the United States that cover the lentiviral vectors used in the manufacture of our product candidates. While we believe that we have reasonable defenses against a claim of infringement, potentially including that certain of these patents are expected to expire prior to commercializing our product candidates, if approved, in the United States, there can be no assurance that we will prevail in any such action by the holder of these patents. In the event that the holder of these patents seeks to enforce its patent rights and our defenses against a claim of infringement are unsuccessful, we may not be able to commercialize our product candidates in the United States, if approved, without

first obtaining a license to some or all of these patents, which may not be available on commercially reasonable terms or at all. In addition, the defense of any claim of infringement, even if successful, is time-consuming, expensive and diverts the attention of our management from our ongoing business operations.

Because patent applications can take many years to issue, there may be currently pending patent applications which may later result in issued patents that our product candidates may infringe or be alleged to infringe. In addition, third parties may obtain patents in the future and claim that use of our or our licensors' technologies infringes upon these patents. If any third-party patents were held by a court of competent jurisdiction to cover the manufacturing process of any of our product candidates, any molecules formed during the manufacturing process or any final product itself, the holders of any such patents may be able to block our ability to commercialize such product candidate unless we obtained a license under the applicable patents, or until such patents expire.

Similarly, if any third-party patents were held by a court of competent jurisdiction to cover aspects of our formulations, processes for manufacture or methods of use, including combination therapy, the holders of any such patents may be able to block our ability to develop and commercialize the applicable product candidate unless we obtained a license or until such patent expires. In either case, such a license may not be available on commercially reasonable terms or at all.

Parties making claims against us may obtain injunctive or other equitable relief, which could effectively block our ability to further develop and commercialize one or more of our product candidates. Defense of these claims, regardless of their merit, would involve substantial litigation expense and would be a substantial diversion of employee resources from our business. In the event of a successful claim of infringement against us, we may have to pay substantial damages, including treble damages and attorneys' fees for willful infringement, pay royalties, redesign our infringing products or obtain one or more licenses from third parties, which may be impossible or require substantial time and monetary expenditure. Even in the absence of a finding of infringement, we may choose to obtain a license, if such a license is available. A successful claim of patent or other intellectual property infringement against us could materially adversely affect our business, results of operations and financial condition.

Our rights to develop and commercialize our product candidates are subject, in part, to the terms and conditions of licenses granted to us by others.

We depend upon the intellectual property rights granted to us under licenses from third parties that are important or necessary to the development of our technology and products, including technology related to our manufacturing process and our gene therapy product candidates. In particular, we have in-licensed certain intellectual property rights and know-how from the University Health Network (relevant to AVR-RD-01 and our Fabry program, which we deprioritized in January 2022) and affiliates of Lund University (relevant to AVR-RD-02 and our Gaucher type 1 and type 3 programs). In addition, we have in-licensed patents and patent applications from BioMarin Pharmaceutical Inc., or BioMarin (relevant to AVR-RD-03 and our Pompe program), GenStem Therapeutics, Inc., which was subsequently assigned to Papillon Therapeutics, Inc., or Papillon, (relevant to AVR-RD-04 and our cystinosis program) and The University of Manchester (relevant to AVR-RD-05 and our Hunter program), directed to compositions and methods related to the manufacture and use of AVR-RD-03, AVR-RD-04 and AVR-RD-05, respectively. Any termination of these licenses could result in the loss of significant rights and could harm or prevent our ability to commercialize our product candidates.

Each of our existing licenses are exclusive but are limited to particular fields, such as Fabry disease, cystinosis, Gaucher disease type 1, Hunter syndrome, or Pompe disease, and are subject to certain retained rights. Absent an amendment or additional agreement, we may not have the right to use intellectual property in-licensed for one of our programs for another program. In addition, licenses that we may enter into in the future may not provide exclusive rights to use such intellectual property and technology in all relevant fields of use and in all territories in which we may wish to develop or commercialize our technology and products in the future. As a result, we may not be able to prevent competitors from developing and commercializing competitive products in territories included in all of our licenses. Licenses to additional third-party technology that may be required for our development programs may not be available in the future or may not be available on commercially reasonable terms, or at all, which could have a material adverse effect on our business and financial condition.

In some circumstances, we may not have the right to control the preparation, filing and prosecution of patent applications, or to maintain the patents, covering technology that we license from third parties. For example, pursuant to each of our intellectual property licenses with Papillon, BioMarin, the rights holders associated with Lund University, and The University of Manchester, our licensors retain control of such activities. Therefore, we cannot be certain that these patents and applications will be prosecuted, maintained and enforced in a manner consistent with the best interests of our business. If our licensors fail to maintain such patents, or lose rights to those patents or patent applications, the rights we have licensed may be reduced or eliminated and our right to develop and commercialize any of our products that are the subject of such licensed rights could be adversely affected.

Our current license agreements impose, and we expect that future license agreements that we may enter into will impose, various obligations, including diligence and certain payment obligations. If we fail to satisfy our obligations, the licensor may have the right to terminate the agreement. Disputes may arise between us and any of our licensors regarding intellectual property subject to such agreements and other issues. Such disputes over intellectual property that we have licensed or the terms of our license agreements may prevent or impair our ability to maintain our current arrangements on acceptable terms, or at all, or may impair the value of the arrangement to us. Any such dispute could have a material adverse effect on our business. If we cannot maintain a necessary license agreement or if the agreement is terminated, we may be unable to successfully develop and commercialize the affected product candidates.

If we are unable to obtain and maintain patent protection for our product candidates, or if the scope of the patent protection obtained is not sufficiently broad, our competitors could develop and commercialize products similar or identical to ours, and our ability to successfully commercialize our product candidates may be adversely affected.

Our ability to compete effectively will depend, in part, on our ability to maintain the proprietary nature of our technology and manufacturing processes. We rely on manufacturing and other know-how, patents, trade secrets, trademarks, license agreements and contractual provisions to establish our intellectual property rights and protect our products. These legal means, however, afford only limited protection and may not adequately protect our rights. The failure to obtain, maintain, enforce or defend such intellectual property rights, for any reason, could allow third parties to make competing products or impact our ability to develop, manufacture and market our products, if approved, on a commercially viable basis, or at all, which could have a material adverse effect on our financial condition and results of operations.

In particular, we rely primarily on trade secrets, know-how and other unpatented technology, which are difficult to protect. Although we seek such protection in part by entering into confidentiality agreements with our vendors, employees, consultants and others who may have access to proprietary information, we cannot be certain that these agreements will not be breached, adequate remedies for any breach would be available or our trade secrets, know-how and other unpatented proprietary technology will not otherwise become known to or be independently developed by our competitors. If we are unsuccessful in protecting our intellectual property rights, sales of our products may suffer and our ability to generate revenue could be severely impacted.

Our licensors and we have sought, and we intend to continue to seek to protect our proprietary position by filing patent applications in the United States and, in at least some cases, one or more countries outside the United States related to current and future product candidates that are important to our business. However, we cannot predict whether the patent applications we and our licensors are currently pursuing will issue as patents, whether the claims of any issued patents will provide us with a competitive advantage, or whether we will be able to successfully pursue patent applications in the future related to our current or future product candidates. While we have in-licensed patents and patent applications relevant to AVR-RD-03, we currently have no owned or in-licensed patents or patent applications covering AVR-RD-01 or AVR-RD-02, and the patent applications that we in-licensed related to AVR-RD-04 and AVR-RD-05 are at a very early stage. Many of our product candidates are in-licensed from third parties. Accordingly, in some cases, the availability and scope of potential patent protection is limited based on prior decisions by our licensors or the inventors, such as decisions on when to file patent applications or whether to file patent applications at all.

We may not be able to protect our intellectual property rights throughout the world.

Filing, prosecuting and defending patents on product candidates in all countries throughout the world would be prohibitively expensive, and our intellectual property rights in some countries outside the United States could be less extensive than those in the United States. Although our license agreements grant us worldwide rights, and our currently in-licensed U.S. patent rights have certain corresponding foreign patents or patent applications, there can be no assurance that we will obtain or maintain such corresponding patents or patent applications with respect to any future license agreements. In addition, the laws of some foreign countries do not protect intellectual property rights to the same extent as federal and state laws in the United States even in jurisdictions where we and our licensors pursue patent protection. Consequently, we and our licensors may not be able to prevent third parties from practicing our inventions in all countries outside the United States, even in jurisdictions where we and our licensors pursue patent protection, or from selling or importing products made using our inventions in and into the United States or other jurisdictions. Competitors may use our technologies in jurisdictions where we and our licensors have not pursued and obtained patent protection to develop their own

products and, further, may export otherwise infringing products to territories where we have patent protection, but enforcement is not as strong as that in the United States. These products may compete with our product candidates and our patents or other intellectual property rights may not be effective or sufficient to prevent them from competing.

Many companies have encountered significant problems in protecting and defending intellectual property rights in foreign jurisdictions. The legal systems of certain countries, particularly certain developing countries, do not favor the enforcement of patents, trade secrets and other intellectual property protection, particularly those relating to biotechnology products, which could make it difficult for us to stop the infringement of our patents or marketing of competing products in violation of our proprietary rights generally. Proceedings to enforce our patent rights, even if obtained, in foreign jurisdictions could result in substantial costs and divert our efforts and attention from other aspects of our business, could put our patents at risk of being invalidated or interpreted narrowly and our patent applications at risk of not issuing and could provoke third parties to assert claims against us. We may not prevail in any lawsuits that we initiate and the damages or other remedies awarded, if any, may not be commercially meaningful. Accordingly, our efforts to enforce our intellectual property rights around the world may be inadequate to obtain a significant commercial advantage from the intellectual property that we develop or license.

Issued patents covering our product candidates could be found invalid or unenforceable if challenged in court. We may not be able to protect our trade secrets in court.

If one of our licensing partners or we initiate legal proceedings against a third-party to enforce a patent covering one of our product candidates, should such a patent issue, the defendant could counterclaim that the patent covering our product candidate is invalid or unenforceable. In patent litigation in the United States, defendant counterclaims alleging invalidity or unenforceability are commonplace. Grounds for a validity challenge could be an alleged failure to meet any of several statutory requirements, including lack of novelty, obviousness, written description or non-enablement. Grounds for an unenforceability assertion could be an allegation that someone connected with prosecution of the patent withheld information material to patentability from the USPTO, or made a misleading statement, during prosecution. Third parties also may raise similar claims before administrative bodies in the United States or abroad, even outside the context of litigation. Such mechanisms include re-examination, post grant review, *inter partes* review and equivalent proceedings in foreign jurisdictions. Such proceedings could result in the revocation or cancellation of or amendment to our patents in such a way that they no longer cover our product candidates. The outcome following legal assertions of invalidity and unenforceability is unpredictable. With respect to the validity question, for example, we cannot be certain that there is no invalidating prior art, of which the patent examiner and we or our licensing partners were unaware during prosecution. If a defendant were to prevail on a legal assertion of invalidity or unenforceability, we could lose at least part, and perhaps all, of the patent protection on one or more of our product candidates. Such a loss of patent protection could have a material adverse impact on our business.

In addition to the protection afforded by patents, we rely on trade secret protection and confidentiality agreements to protect proprietary know-how that is not patentable or that we elect not to patent, processes for which patents are difficult to enforce and any other elements of our product candidate discovery and development processes that involve proprietary know-how, information or technology that is not covered by patents. However, trade secrets can be difficult to protect and some courts inside and outside the United States are less willing or unwilling to protect trade secrets. We seek to protect our proprietary technology and processes, in part, by entering into confidentiality agreements with our employees, consultants, scientific advisors and contractors. We cannot guarantee that we have entered into such agreements with each party that may have or have had access to our trade secrets or proprietary technology and processes. We also seek to preserve the integrity and confidentiality of our data and trade secrets by maintaining physical security of our premises and physical and electronic security of our information technology systems. While we have confidence in these individuals, organizations and systems, agreements or security measures may be breached, and we may not have adequate remedies for any breach. In addition, our trade secrets may otherwise become known or be independently discovered by competitors.

We may be subject to claims asserting that our employees, consultants or advisors have wrongfully used or disclosed alleged trade secrets of their current or former employers or claims asserting ownership of what we regard as our own intellectual property.

Certain of our employees, consultants or advisors are currently, or were previously, employed at universities or other biotechnology or pharmaceutical companies, including our competitors or potential competitors. Although we try to ensure that our employees, consultants and advisors do not use the proprietary information or know-how of others in their work for us, we may be subject to claims that these individuals or we have used or disclosed intellectual property, including trade secrets or other proprietary information, of any such individual's current or former employer. Litigation may be necessary to defend against these claims. If we fail in defending any such claims, in addition to paying monetary damages, we may lose valuable intellectual property rights or personnel. Even if we are successful in defending against such claims, litigation could result in substantial costs and be a distraction to management. Our licensors may face similar risks, which could have an adverse impact on intellectual property that is licensed to us.

In addition, while it is our policy to require our employees and contractors who may be involved in the conception or development of intellectual property to execute agreements assigning such intellectual property to us, we may be unsuccessful in executing such an agreement with each party who, in fact, conceives or develops intellectual property that we regard as our own. The assignment of intellectual property rights may not be self-executing or the assignment agreements may be breached, and we may be forced to bring claims against third parties, or defend claims that they may bring against us, to determine the ownership of what we regard as our intellectual property.

We may be subject to claims challenging the inventorship or ownership of the patents and other intellectual property that we own or license.

We or our licensors may be subject to claims that former employees, collaborators or other third parties have an ownership interest in the patents and intellectual property that we own or license or that we may own or license in the future. While it is our policy to require our employees and contractors who may be involved in the development of intellectual property to execute agreements assigning such intellectual property to us, we may be unsuccessful in executing such an agreement with each party who in fact develops intellectual property that we regard as our own; our licensors may face similar obstacles. We could be subject to ownership disputes arising, for example, from conflicting obligations of consultants or others who are involved in developing our product candidates. Litigation may be necessary to defend against any claims challenging inventorship or ownership. If we or our licensors fail in defending any such claims, we may have to pay monetary damages and may lose valuable intellectual property rights, such as exclusive ownership of, or right to use, intellectual property, which could adversely impact our business, results of operations and financial condition.

Some intellectual property which we have in-licensed may have been discovered through government funded programs and thus may be subject to federal regulations such as "march-in" rights, certain reporting requirements, and a preference for U.S. industry. Compliance with such regulations may limit our exclusive rights, and limit our ability to contract with non-U.S. manufacturers.

Some of the intellectual property rights we have licensed, including rights licensed to us by Papillon, may have been generated through the use of U.S. government and California state funding and may therefore be subject to certain federal and state laws and regulations. For example, with respect to the AVR-RD-04 program for cystinosis, the NIH previously granted funding to UCSD for certain research in connection with the development of UCSD's gene therapy program for cystinosis, which we originally licensed from GenStem Therapeutics, Inc., who subsequently assigned the license to Papillon. As a result, the U.S. government may have certain rights to intellectual property embodied in our AVR-RD-04 program, or in other product candidates to the extent funded by the U.S. government pursuant to the Bayh-Dole Act of 1980, or Bayh-Dole Act. These U.S. government rights in certain inventions developed under a government-funded program include a non-exclusive, non-transferable, irrevocable worldwide license to use inventions for any governmental purpose. In addition, the U.S. government has the right to require us to grant exclusive, partially exclusive, or non-exclusive licenses to any of these inventions to a third party if it determines that: (i) adequate steps have not been taken to commercialize the invention; (ii) government action is necessary to meet public health or safety needs; or (iii) government action is necessary to meet requirements for public use under federal regulations (also referred to as "march-in rights"). The U.S. government also has the right to take title to these inventions if we, or the applicable licensor, fail to disclose the invention to the government and fail to file an application to register the intellectual property within specified time limits. Intellectual property generated under a government funded program is also subject to certain reporting requirements, compliance with which may require us or the applicable licensor to expend substantial resources. In addition, the U.S. government requires that any products embodying the subject invention or produced through the use of the subject invention be manufactured substantially in the United States. The manufacturing preference requirement can be waived if the owner of the intellectual property can show that reasonable but unsuccessful efforts have been made to grant licenses on similar terms to potential licensees that would be likely to manufacture substantially in the United States or that under the circumstances domestic manufacture is not commercially feasible. This preference for U.S. manufacturers may limit our ability to contract with non-U.S. product manufacturers for products covered by such intellectual property. To the extent any of our current or future intellectual property is generated through the use of U.S. government funding, the provisions of the Bayh-Dole Act may similarly apply. Any exercise by the government of certain of its rights could harm our competitive position, business, financial condition, results of operations and prospects. With respect to state funding, specifically funding via the California Institute of Regenerative Medicine, or CIRM, which has granted funds to UCSD for the study of AVR-RD-04 for cystinosis, the grantee has certain obligations and the state or CIRM has certain rights. For example, the grantee has an obligation to share intellectual property, including research results, generated by CIRM-funded research, for research use in California.

Changes in U.S. patent law could diminish the value of patents in general, thereby impairing our ability to protect our product candidates.

Changes in either the patent laws or the interpretation of the patent laws in the United States could increase the uncertainties and costs surrounding the prosecution of patent applications and the enforcement or defense of issued patents. On September 16, 2011, the Leahy-Smith America Invents Act, or the Leahy-Smith Act, was signed into law. The Leahy-Smith Act includes several significant changes to U.S. patent law. These include provisions that affect the way patent applications are prosecuted and also may affect patent litigation. These also include provisions that switched the United States from a "first-to-invent" system to a "first-to-file" system, allow third-party submission of prior art to the USPTO during patent prosecution and set forth additional procedures to attack the validity of a patent by the USPTO administered post grant proceedings. Under a first-to-file system, assuming the other requirements for patentability are met, the first inventor to file a patent application generally will be entitled to the patent on an invention regardless of whether another inventor had made the invention earlier. The USPTO developed new regulations and procedures to govern administration of the Leahy-Smith Act, and many of the substantive changes to patent law associated with the Leahy-Smith Act, and in particular, the first to file provisions, only became effective on March 16, 2013. Accordingly, it is not clear what, if any, impact the Leahy-Smith Act will have on the operation of our business. However, the Leahy-Smith Act and its implementation could increase the uncertainties and costs surrounding the prosecution of our patent applications and the enforcement or defense of our issued patents, all of which could have a material adverse effect on our business, financial condition, results of operations and prospects.

The patent positions of companies engaged in the development and commercialization of biologics and pharmaceuticals are particularly uncertain. Two cases involving diagnostic method claims and "gene patents" were decided this year by the Supreme Court of the United States, or Supreme Court. On March 20, 2012, the Supreme Court issued a decision in Mayo Collaborative Services v. Prometheus Laboratories, Inc., or Prometheus, a case involving patent claims directed to a process of measuring a metabolic product in a patient to optimize a drug dosage for the patient. According to the Supreme Court, the addition of well-understood, routine or conventional activity such as "administering" or "determining" steps was not enough to transform an otherwise patent-ineligible natural phenomenon into patent-eligible subject matter. On July 3, 2012, the USPTO issued a guidance memo to patent examiners indicating that process claims directed to a law of nature, a natural phenomenon or a naturally occurring relation or correlation that do not include additional elements or steps that integrate the natural principle into the claimed invention such that the natural principle is practically applied and the claim amounts to significantly more than the natural principle itself should be rejected as directed to not patent-eligible subject matter. On June 13, 2013, the Supreme Court issued its decision in Association for Molecular Pathology v. Myriad Genetics, Inc., or Myriad, a case involving patent claims held by Myriad Genetics, Inc. relating to the breast cancer susceptibility genes BRCA1 and BRCA2. Myriad held that an isolated segment of naturally occurring DNA, such as the DNA constituting the BRCA1 and BRCA2 genes, is not patent-eligible subject matter, but that complementary DNA, which is an artificial construct that may be created from RNA transcripts of genes, may be patent-eligible. On March 4, 2014, the USPTO issued a guidance memorandum to patent examiners entitled 2014 Procedure For Subject Matter Eligibility Analysis Of Claims Reciting Or Involving Laws Of Nature/Natural Principles, Natural Phenomena, And/Or Natural Products. These guidelines instruct USPTO examiners on the ramifications of the Prometheus and Myriad rulings and apply the Myriad ruling to natural products and principles including all naturally occurring nucleic acids.

Certain claims of our licensed patents and patent applications contain, and any future patents we may obtain may contain, claims that relate to specific recombinant DNA sequences that are naturally occurring at least in part and, therefore, could be the subject of future challenges made by third parties. In addition, the 2014 USPTO guidance could impact our ability to pursue similar patent claims in patent applications we may prosecute in the future.

We cannot assure you that our efforts to seek patent protection for our product candidates will not be negatively impacted by the decisions described above, rulings in other cases or changes in guidance or procedures issued by the USPTO. We cannot fully predict what impact the Supreme Court's decisions in Prometheus and Myriad may have on the ability of life science companies to obtain or enforce patents relating to their products in the future. These decisions, the guidance issued by the USPTO and rulings in other cases or changes in USPTO guidance or procedures could have a material adverse effect on our existing patent rights and our ability to protect and enforce our intellectual property in the future.

Moreover, although the Supreme Court has held in Myriad that isolated segments of naturally occurring DNA are not patent-eligible subject matter, certain third parties could allege that activities that we may undertake infringe other gene-related patent claims, and we may deem it necessary to defend ourselves against these claims by asserting non-infringement and/or invalidity positions, or paying to obtain a license to these claims. In any of the foregoing or in other situations involving third-party intellectual property rights, if we are unsuccessful in defending against claims of patent infringement, we could be forced to pay damages or be subjected to an injunction that would prevent us from utilizing the patented subject matter. Such outcomes could harm our business, financial condition, results of operations or prospects.

If we do not obtain patent term extension and data exclusivity for our product candidates, our business may be materially harmed.

Depending upon the timing, duration and specifics of any FDA marketing approval of our product candidates, one or more U.S. patents that we license or may own or license in the future, if any, may be eligible for limited patent term extension under the Drug Price Competition and Patent Term Restoration Act of 1984, or Hatch-Waxman Amendments. The Hatch-Waxman Amendments permit a patent extension term of up to five years as compensation for patent term lost during the FDA regulatory review process. A patent term extension cannot extend the remaining term of a patent beyond a total of 14 years from the date of product approval, only one patent may be extended and only those claims covering the approved drug, a method for using it or a method for manufacturing it may be extended. A patent may only be extended once and only based on a single approved product. However, we may not be granted an extension because of, for example, failing to exercise due diligence during the testing phase or regulatory review process, failing to apply within applicable deadlines, failing to apply prior to expiration of relevant patents or otherwise failing to satisfy applicable requirements. Moreover, the applicable time period or the scope of patent protection afforded could be less than we request. If we are unable to obtain patent term extension or the term of any such extension is less than we request, our competitors may obtain approval of competing products following our patent expiration, and our revenue could be reduced, possibly materially. In addition, we do not control the efforts of our licensors to obtain a patent term extension, and there can be no assurance that they will pursue or obtain such extensions to the patents that we license from them.

If our trademarks and trade names are not adequately protected, then we may not be able to build name recognition in our markets of interest and our business may be adversely affected.

We have registered the marks "AVROBIO" and "plato" with the USPTO and in certain other countries, but we do not have trademarks or trademark applications with the USPTO for the marks "AVRO" or the AVROBIO logo. In the future, even if we apply for registration of these marks, there can be no assurance that such registration will be approved. Once registered, our trademarks or trade names may be challenged, infringed, circumvented or declared generic or determined to be infringing on other marks. We may not be able to protect our rights to these trademarks and trade names, which we need to build name recognition among potential partners or customers in our markets of interest. At times, competitors may adopt trade names or trademarks similar to ours, thereby impeding our ability to build brand identity and possibly leading to market confusion. In addition, there could be potential trade name or trademark infringement claims brought by owners of other registered trademarks or trademarks that incorporate variations of our registered or unregistered trademarks or trade names. Over the long term, if we are unable to establish name recognition based on our trademarks and trade names, then we may not be able to compete effectively and our business may be adversely affected. Our efforts to enforce or protect our proprietary rights related to trademarks, trade secrets, domain names, copyrights or other intellectual property may be ineffective and could result in substantial costs and diversion of resources and could adversely impact our financial condition or results of operations.

Intellectual property rights and regulatory exclusivity rights do not necessarily address all potential threats.

The degree of future protection afforded by our intellectual property rights is uncertain because intellectual property rights have limitations, and may not adequately protect our business or permit us to maintain our competitive advantage. For example:

- others may be able to make gene therapy products that are similar to our product candidates but that are not covered by the claims of the patents that we license or may own or license in the future;
- we, our license partners or current or future collaborators, might not have been the first to make the inventions covered by the issued patents or pending patent applications that we license or may own or license in the future;
- we, our license partners or current or future collaborators, might not have been the first to file patent applications covering certain of our or their inventions;
- others may independently develop similar or alternative technologies or duplicate any of our technologies without infringing our owned or licensed intellectual property rights;
- it is possible that our pending licensed patent applications or those that we may own or license in the future will not lead to issued patents;
- issued patents that we hold rights to or may hold rights to in the future may be held invalid or unenforceable, including as a result of legal challenges by our competitors;
- one or more of our product candidates may never be protected by patents;

- our competitors might conduct research and development activities in countries where we do not have patent rights and then use the information learned from such activities to develop competitive products for sale in our major commercial markets;
- we may not develop additional proprietary technologies that are patentable;
- the patents of others may have an adverse effect on our business; and
- we may choose not to file a patent application for certain trade secrets or know-how, and a third party may subsequently file a patent application or obtain a patent covering such intellectual property.

Should any of these events occur, they could significantly harm our business, financial condition, results of operations and prospects.

Risks related to ownership of our common stock

The market price of our common stock may be highly volatile, and you may not be able to resell your shares at or above the price at which you purchased our shares.

Our stock price is likely to be volatile. Since our initial public offering, or IPO, in June 2018, through August 1, 2022, the trading price of our common stock has ranged from $53.70 to $0.74. The stock market in general, and the market for biopharmaceutical companies in particular, has experienced extreme volatility that has often been unrelated to the operating performance of particular companies. As a result of this volatility, you may not be able to sell your common stock at or above the price at which you purchased shares. The market price for our common stock may be influenced by many factors, including:

- the ongoing COVID-19 pandemic;
- adverse results or delays in ongoing or planned preclinical studies or clinical trials;
- reports of adverse events in other gene therapy products or clinical studies of such products;
- an inability to obtain additional funding;
- failure by us to comply with the terms of our Term Loan Agreement;
- failure by us to successfully develop and commercialize our product candidates;
- failure by us to maintain our existing strategic collaborations or enter into new collaborations;
- failure by us or our licensors and strategic partners to prosecute, maintain or enforce our intellectual property rights;
- changes in laws or regulations applicable to future products;
- an inability to obtain adequate product supply for our product candidates or the inability to do so at acceptable prices;
- adverse regulatory decisions;
- the introduction of new products, services or technologies by our competitors;
- failure by us to meet or exceed financial projections we may provide to the public;
- failure by us to meet or exceed the financial projections of the investment community;
- the perception of the pharmaceutical industry by the public, legislatures, regulators and the investment community;
- announcements of significant acquisitions, strategic partnerships, joint ventures or capital commitments by us, our strategic partners or our competitors;
- disputes or other developments relating to proprietary rights, including patents, litigation matters and our ability to obtain patent protection for our technologies;
- additions or departures of key scientific or management personnel;
- significant lawsuits, including patent or stockholder litigation;
- changes in the market valuations of similar companies;
- sales of our common stock by us or our stockholders in the future; and
- the trading volume of our common stock.

In addition, companies trading in the stock market in general, and The Nasdaq Global Select Market in particular, have experienced extreme price and volume fluctuations that have often been unrelated or disproportionate to the operating performance of these companies. Broad market and industry factors may negatively affect the market price of our common stock, regardless of our actual operating performance.

We could be subject to securities class action litigation.

In the past, securities class action litigation has often been brought against a company following a decline in the market price of its securities. This risk is especially relevant for us because pharmaceutical companies have experienced significant stock price volatility in recent years. If we face such litigation, it could result in substantial costs and a diversion of management's attention and resources, which could harm our business.

An active trading market for our common stock may not be sustained.

Prior to our IPO in June 2018, there had been no public market for our common stock. Although our common stock is listed on The Nasdaq Global Select Market, an active trading market for our shares may never be sustained. If an active market for our common stock is not sustained, it may be difficult for you to sell shares you purchased without depressing the market price for the shares, or at all.

An inactive trading market may also impair our ability to raise capital to continue to fund operations by selling additional shares and may impair our ability to acquire other companies or technologies by using our shares as consideration.

If securities or industry analysts do not publish research or publish inaccurate or unfavorable research about our business, our share price and trading volume could decline.

The trading market for our common stock will likely depend in part on the research and reports that securities or industry analysts publish about us or our business. We do not have any control over these analysts. Although we have obtained research coverage from certain analysts, there can be no assurance that analysts will continue to cover us or provide favorable coverage. If one or more analysts downgrade our stock or change their opinion of our stock, our share price would likely decline. In addition, if one or more analysts cease coverage of our company or fail to regularly publish reports on us, we could lose visibility in the financial markets, which could cause our share price or trading volume to decline.

Concentration of ownership of our common stock among our existing executive officers, directors and principal stockholders may prevent new investors from influencing significant corporate decisions.

Based on shares outstanding as of August 1, 2022, our executive officers, directors, five percent stockholders and their affiliates beneficially owned approximately 27% of our voting stock. As a result, if these stockholders were to act together, they would be able to significantly influence all matters submitted to our stockholders for approval, as well as our management and affairs. For example, these stockholders, acting together, may be able to influence elections of directors, amendments of our organizational documents, or approval of any merger, sale of assets, or other major corporate transaction. This may prevent or discourage unsolicited acquisition proposals or offers for our common stock that you may believe are in your best interest as one of our stockholders. Some of these persons or entities may have interests different than yours. For example, because many of these stockholders purchased their shares at prices substantially below the current trading price of our stock and have held their shares for a longer period, they may be more interested in selling our Company to an acquirer than other investors or they may want us to pursue strategies that deviate from the interests of other stockholders.

We are an "emerging growth company," and the reduced disclosure requirements applicable to emerging growth companies may make our common stock less attractive to investors.

We are an "emerging growth company," or EGC, as defined in the JOBS Act. We will remain an EGC until the earliest of: (i) the last day of the fiscal year in which we have total annual gross revenues of $1.07 billion or more; (ii) the last day of the fiscal year following the fifth anniversary of the date of the completion of our IPO; (iii) the date on which we have issued more than $1.0 billion in nonconvertible debt during the previous three years; or (iv) the date on which we are deemed to be a large accelerated filer under the rules of the SEC, which means the first day of the year following the first year in which the market value of our common stock that is held by non-affiliates exceeds $700 million as of June 30 in any given year. For so long as we remain an EGC, we are permitted and intend to rely on exemptions from certain disclosure requirements that are applicable to other public companies that are not emerging growth companies. These exemptions include:

- not being required to comply with the auditor attestation requirements of Section 404 of the Sarbanes-Oxley Act, or Section 404;
- not being required to comply with any requirement that may be adopted by the Public Company Accounting Oversight Board regarding mandatory audit firm rotation or a supplement to the auditor's report providing additional information about the audit and the financial statements;
- being permitted to provide only two years of audited financial statements, in addition to any required unaudited interim financial statements, with correspondingly reduced "Management's discussion and analysis of financial condition and results of operations" disclosure;
- reduced disclosure obligations regarding executive compensation; and
- an exemption from the requirement to seek nonbinding advisory votes on executive compensation or golden parachute arrangements.

We may choose to take advantage of some, but not all, of the available exemptions. We have taken advantage of reduced reporting burdens in this Quarterly Report on Form 10-Q. In particular, we have not included in this Quarterly Report, or our Annual Report or 2022 Proxy Statement, all of the executive compensation information that would be required if we were not an EGC. We cannot predict whether investors will find our common stock less attractive if we rely on certain or all of these exemptions. If some investors find our common stock less attractive as a result, there may be a less active trading market for our common stock and our stock price may be more volatile.

In addition, the JOBS Act provides that an EGC may take advantage of an extended transition period for complying with new or revised accounting standards. This allows an EGC to delay the adoption of certain accounting standards until those standards would otherwise apply to private companies. We have elected to avail ourselves of this exemption from new or revised accounting standards and, therefore, we will not be subject to the same new or revised accounting standards as other public companies that are not emerging growth companies.

Even after we no longer qualify as an emerging growth company, we may still qualify as a "smaller reporting company" if the market value of our common stock held by non-affiliates is below $250 million (or $700 million if our annual revenue is less than $100 million) as of June 30 in any given year, which would allow us to take advantage of many of the same exemptions from disclosure requirements.

We expect to continue to incur increased costs as a result of operating as a public company, and our management is required to devote substantial time to new compliance initiatives.

As a public company, and particularly after we are no longer an EGC, we will incur significant legal, accounting and other expenses that we did not incur as a private company. In addition, the Sarbanes-Oxley Act of 2002 and rules subsequently implemented by the SEC and Nasdaq have imposed various requirements on public companies, including establishment and maintenance of effective disclosure and financial controls and corporate governance practices. Our management and other personnel will continue to devote a substantial amount of time to these compliance initiatives. Moreover, these rules and regulations have increased our legal and financial compliance costs and will continue to make some activities more time-consuming and costly. For example, we expect that these rules and regulations may make it more difficult and increasingly more expensive for us to obtain and maintain director and officer liability insurance.

Pursuant to Section 404, we are required to furnish a report by our management on our internal control over financial reporting, and, once we are no longer an EGC or a "smaller reporting company," we will be required to furnish an attestation report on internal control over financial reporting issued by our independent registered public accounting firm. To achieve compliance with Section 404, we continue to be engaged in a process to document and evaluate our internal control over financial reporting, which is both costly and challenging. In this regard, we will need to continue to dedicate internal resources, potentially continue to engage outside consultants and adopt a detailed work plan to assess and document the adequacy of internal control over financial reporting, continue steps to improve control processes as appropriate, validate through testing that controls are functioning as documented and implement a continuous reporting and improvement process for internal control over financial reporting. Despite our efforts, there is a risk that we will not be able to conclude that our internal control over financial reporting is effective as required by Section 404. This could result in an adverse reaction in the financial markets due to a loss of confidence in the reliability of our financial statements.

If we fail to maintain an effective system of internal control over financial reporting, we may not be able to accurately report our financial results or prevent fraud. As a result, stockholders could lose confidence in our financial and other public reporting, which would harm our business and the trading price of our common stock.

Effective internal control over financial reporting is necessary for us to provide reliable financial reports and, together with adequate disclosure controls and procedures, are designed to prevent fraud. Any failure to implement required new or improved controls, or difficulties encountered in their implementation could cause us to fail to meet our reporting obligations. In addition, any testing by us conducted in connection with Section 404, or any subsequent testing by our independent registered public accounting firm, may reveal deficiencies in our internal control over financial reporting that are deemed to be material weaknesses or that may require prospective or retroactive changes to our financial statements, or may identify other areas for further attention or improvement. Inferior internal controls could also cause investors to lose confidence in our reported financial information, which could have a negative effect on the trading price of our stock.

We are required to disclose changes made in our internal controls and procedures on a quarterly basis and our management is required to assess the effectiveness of these controls annually. However, for as long as we are an EGC or a "smaller reporting company," our independent registered public accounting firm will not be required to attest to the effectiveness of our internal control over financial reporting pursuant to Section 404. We could be an EGC for up to five years following the completion of our IPO and will qualify as a "smaller reporting company" if the market value of our common stock held by non-affiliates is below $250 million (or $700 million if our annual revenue is less than $100 million) as of June 30 in any given year. An independent assessment of the effectiveness of our internal control over financial reporting could detect problems that our management's assessment might not. Undetected material weaknesses in our internal control over financial reporting could lead to financial statement restatements and require us to incur the expense of remediation.

If we experience material weaknesses or deficiencies in the future, or otherwise fail to establish and maintain effective internal controls, we may be unable to produce timely and accurate financial statements, and we may conclude that our internal control over financial reporting is not effective, which could adversely impact our investors' confidence and our stock price.

We expect to continue our efforts to improve our control processes, though there can be no assurance that our efforts will ultimately be successful or avoid potential material weaknesses, and we expect to continue incurring additional costs as a result of these efforts. If we are unable to successfully remediate any material weaknesses in our internal control over financial reporting, the accuracy and timing of our financial reporting may be adversely affected, we may be unable to maintain compliance with securities law requirements regarding timely filing of periodic reports in addition to applicable stock exchange listing requirements, investors may lose confidence in our financial reporting, and our stock price may decline as a result. We also could become subject to investigations by Nasdaq, the SEC or other regulatory authorities.

Our disclosure controls and procedures may not prevent or detect all errors or acts of fraud.

Our disclosure controls and procedures are designed to reasonably assure that information required to be disclosed by us in reports we file or submit under the Exchange Act is accumulated and communicated to management, recorded, processed, summarized and reported within the time periods specified in the rules and forms of the SEC. We believe that any disclosure controls and procedures or internal controls and procedures, no matter how well conceived and operated, can provide only reasonable, not absolute, assurance that the objectives of the control system are met. These inherent limitations include the realities that judgments in decision-making can be faulty, and that breakdowns can occur because of simple error or mistake. Additionally, controls can be circumvented by the individual acts of some persons, by collusion of two or more people or by an unauthorized override of the controls.

Accordingly, because of the inherent limitations in our control system, misstatements or insufficient disclosures due to error or fraud may occur and not be detected.

A significant portion of our total outstanding shares are restricted from immediate resale but may be sold into the market in the near future, which could cause the market price of our common stock to drop significantly.

Sales of a substantial number of shares of our common stock in the public market could occur at any time, subject to certain restrictions described below. These sales, or the perception in the market that holders of a large number of shares intend to sell shares, could reduce the market price of our common stock. As of August 1, 2022, holders of an aggregate of approximately 4.5 million shares of our common stock will have rights, subject to certain conditions, to require us to file registration statements covering their shares or to include their shares in registration statements that we may file for ourselves or other stockholders. In addition, shares reserved for issuance upon the exercise of stock options outstanding under our equity incentive plans will become eligible for sale in the public market in the future. We have registered all shares of common stock that we may issue under our equity compensation plans, which can be freely sold in the public market upon issuance, subject to volume limitations applicable to affiliates.

We do not intend to pay dividends on our common stock, so any returns will be limited to the value of our stock.

We have never declared or paid any cash dividends on our common stock. We currently anticipate that we will retain future earnings for the development, operation and expansion of our business and do not anticipate declaring or paying any cash dividends for the foreseeable future. Any return to stockholders will therefore be limited to the appreciation of their stock. For example, our Term Loan Agreement restricts our ability to pay certain kinds of dividends or to make certain kinds of distributions on account of our capital stock, and we may enter into agreements in the future with similar restrictions. As a result, capital appreciation, if any, of our common stock will be your sole source of gain for the foreseeable future.

Provisions in our amended and restated certificate of incorporation and by-laws, as well as provisions of Delaware law, could make it more difficult for a third party to acquire us or increase the cost of acquiring us, even if doing so would benefit our stockholders or remove our current management.

Our amended and restated certificate of incorporation, amended and restated by-laws and Delaware law contain provisions that may have the effect of delaying or preventing a change in control of us or changes in our management. Our amended and restated certificate of incorporation and by-laws, include provisions that:

- authorize “blank check” preferred stock, which could be issued by our board of directors without stockholder approval and may contain voting, liquidation, dividend and other rights superior to our common stock;
- create a classified board of directors whose members serve staggered three-year terms;
- specify that special meetings of our stockholders can be called only by our board of directors, the chairperson of our board of directors, our chief executive officer or our president;
- prohibit stockholder action by written consent;
- establish an advance notice procedure for stockholder approvals to be brought before an annual meeting of our stockholders, including proposed nominations of persons for election to our board of directors;
- provide that our directors may be removed only for cause;
- provide that vacancies on our board of directors may be filled only by a majority of directors then in office, even though less than a quorum;
- specify that no stockholder is permitted to cumulate votes at any election of directors;
- expressly authorize our board of directors to modify, alter or repeal our amended and restated by-laws; and require supermajority votes of the holders of our common stock to amend specified provisions of our amended and restated certificate of incorporation and amended and restated by-laws.

These provisions, alone or together, could delay or prevent hostile takeovers and changes in control or changes in our management.

In addition, because we are incorporated in Delaware, we are governed by the provisions of Section 203 of the Delaware General Corporation Law, which limits the ability of stockholders owning in excess of 15% of our outstanding voting stock to merge or combine with us.

Any provision of our amended and restated certificate of incorporation or amended and restated by-laws or Delaware law that has the effect of delaying or deterring a change in control could limit the opportunity for our stockholders to receive a premium for their shares of our common stock, and could also affect the price that some investors are willing to pay for our common stock.

Our bylaws contain exclusive forum provisions, which may limit a stockholder's ability to bring a claim in a judicial forum it finds favorable and may discourage lawsuits with respect to such claims.

Our amended and restated bylaws provide that, unless we consent in writing to an alternative forum, the Court of Chancery of the State of Delaware will be the sole and exclusive forum for any state law claim for (1) any derivative action or proceeding brought on our behalf; (2) any action asserting a claim of breach of or based on a fiduciary duty owed by any of our current or former directors, officers or other employees to us or our stockholders; (3) any action asserting a claim against us or any of our current or former directors, officers, employees or stockholders arising pursuant to any provision of the Delaware General Corporation Law, our amended and restated certificate of incorporation or our amended and restated bylaws; or (4) any action asserting a claim governed by the internal affairs doctrine, or the Delaware Forum Provision. The Delaware Forum Provision will not apply to any causes of action arising under the Securities Act or the Exchange Act. Our amended and restated bylaws further provide that, unless we consent in writing to an alternative forum, the United States District Court for the District of Massachusetts will be the exclusive forum for resolving any complaint asserting a cause of action arising under the Securities Act, or the Federal Forum Provision, as our principal executive offices are located in Cambridge, Massachusetts. In addition, our amended and restated bylaws provide that any person or entity purchasing or otherwise acquiring any interest in shares of our capital stock is deemed to have notice of and consented to the foregoing Delaware Forum Provision and the Federal Forum Provision; provided, however, that stockholders cannot and will not be deemed to have waived our compliance with the U.S. federal securities laws and the rules and regulations thereunder.

We recognize that the Delaware Forum Provision and the Federal Forum Provision may impose additional litigation costs on stockholders in pursuing any such claims, particularly if the stockholders do not reside in or near the State of Delaware or the Commonwealth of Massachusetts. Additionally, these forum selection clauses in our amended and restated bylaws may limit our stockholders' ability to bring a claim in a judicial forum that they find favorable for disputes with us or our directors, officers or employees, which may discourage such lawsuits against us and our directors, officers and employees even though an action, if successful, might benefit our stockholders. Section 22 of the Securities Act creates a concurrent jurisdiction for state and federal courts over all suits brought concerning a duty or liability created by the securities laws, rules and regulations thereunder. While the Delaware Supreme Court and other state courts have upheld the validity of federal forum selection provisions purporting to require claims under the Securities Act be brought in federal court, there is uncertainty as to whether other courts will enforce our Federal Forum Provision. The Federal Forum Provision may also impose additional litigation costs on stockholders who assert the provision is unenforceable, and if the Federal Forum Provision is found to be unenforceable, we may incur additional costs with resolving such matters. The Court of Chancery of the State of Delaware and the United States District Court for the District of Massachusetts may also reach different judgments or results than would other courts, including courts where a stockholder considering an action may be located or would otherwise choose to bring the action, and such judgments may be more or less favorable to us than our stockholders.

General Risk Factors

Unfavorable global economic conditions could adversely affect our business, financial condition or results of operations.

Our results of operations could be adversely affected by general conditions in the global economy and in the global financial markets. For example, the COVID-19 pandemic has caused extreme volatility and disruptions in the capital and credit markets. In addition, Russia's invasion of Ukraine may lead to a prolonged, adverse impact on global economic, social and market conditions. A severe or prolonged economic downturn could result in a variety of risks to our business, including weakened demand for our product candidates and our ability to raise additional capital when needed on acceptable terms, if at all. A weak or declining economy could also strain our suppliers, possibly resulting in supply disruption, or cause delays in payments for our services by third-party payors or our collaborators. For example, while we do not have any current operations in Ukraine or Russia, we do not know the extent to which Russia's invasion of Ukraine could impact any of our current suppliers and their ability to provide us with supplies and services. Any of the foregoing could harm our business and we cannot anticipate all of the ways in which the current economic climate and financial market conditions could adversely impact our business, financial condition, results of operations and prospects.

We or the third parties upon whom we depend may be adversely affected by earthquakes or other natural disasters and our business continuity and disaster recovery plans may not adequately protect us from a serious disaster.

Earthquakes or other natural disasters could severely disrupt our operations, and have a material adverse effect on our business, results of operations, financial condition and prospects. If a natural disaster, power outage or other event occurred that prevented us from using all or a significant portion of our headquarters, that damaged critical infrastructure, such as the manufacturing facilities of our third-party contract manufacturers, or that otherwise disrupted operations, it may be difficult or, in certain cases, impossible for us to continue our business for a substantial period of time. The disaster recovery and business continuity plans we have in place currently are limited and are unlikely to prove adequate in the event of a serious disaster or similar event. We may incur substantial expenses as a result of the limited nature of our disaster recovery and business continuity plans, which, particularly when taken together with our lack of earthquake insurance, could have a material adverse effect on our business, financial condition, results of operations and prospects.

Our internal computer systems, or those of our collaborators or other contractors or consultants, may fail or suffer security breaches, which could result in a material disruption of our product development programs.

Despite our security measures, our internal computer systems and those of our current and any future collaborators and other contractors or consultants are vulnerable to damage from computer viruses, unauthorized access, natural disasters, terrorism, war and telecommunication and electrical failures. For example, in 2017 we were subjected to a cyberattack by a third party, which led to the theft of a portion of our funds. We implemented remedial measures promptly following this breach and do not believe that this breach had a material adverse effect on our business. In addition, in February 2019, one of our vendors was subject to a cyberattack by a third party, which resulted in the payment by us of a fraudulent invoice. We have implemented remedial measures following this breach and do not believe that this breach had a material effect on our business. However, if any cyberattack or data breach were to occur in the future and cause interruptions in our or our collaborators', contractors' or consultants' operations, it could result in a material disruption of our development programs and our business operations, whether due to a loss of our business data, trade secrets or other proprietary information or other similar disruptions. For example, the loss of clinical trial data from completed or future clinical trials could result in delays in our regulatory approval efforts and significantly increase our costs to recover or reproduce the data. To the extent that any disruption or security breach were to result in a loss of, or damage to, our data or applications, or inappropriate disclosure of confidential or proprietary information, we could incur liability, our competitive position could be harmed and the further development and commercialization of our product candidates could be delayed.

Changes in tax law could adversely affect our business and financial condition.

The rules dealing with U.S. federal, state, and local income taxation are constantly under review by persons involved in the legislative process and by the Internal Revenue Service and the U.S. Treasury Department. Changes to tax laws (which changes may have retroactive application) could adversely affect us or holders of our common stock. In recent years, many such changes have been made and changes are likely to continue to occur in the future. Future changes in tax laws could have a material adverse effect on our business, cash flow, financial condition or results of operations. We urge investors to consult with their legal and tax advisers regarding the implications of potential changes in tax laws on an investment in our common stock.

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

Not applicable.

Item 3. Defaults Upon Senior Securities.

Not applicable.

Item 4. Mine Safety Disclosures.

Not applicable.

Item 5. Other Information.

The following description is intended to provide a summary of the terms of the MSA (as defined below), which is filed as Exhibit 10.3 to this Quarterly Report on Form 10-Q. The following description is not a complete description of the MSA and is qualified in its entirety by reference to the full text of the MSA, which is incorporated by reference herein.

Agreement with Miltenyi Biotec, Inc.

On November 30, 2021, the Company entered into an Amended and Restated Master Services Agreement (the "MSA") with Miltenyi Biotec, Inc., a California corporation and wholly-owned subsidiary of Miltenyi Biotec B.V. & Co. KG ("Miltenyi"), for custom *ex vivo* cellular manufacturing services (the "MSA"), which restated and superseded a Master Services Agreement with Miltenyi dated October 9, 2017. Under the MSA, Miltenyi provides development and manufacturing services with respect to one or more cell-based therapeutic products on behalf of the Company, and in particular Miltenyi manufactures drug product for the Company. Although a relationship with Miltenyi has been in effect for several years, we expect to heavily rely on Miltenyi services going forward. Under the MSA, the Company can enter into various statements of work for cell-based product manufacturing and related services. There is no minimum or maximum number of statements of work required under the MSA. In respect of drug product manufacturing, the Company supplies Miltenyi with certain raw materials (e.g., human cells) and Miltenyi then produces drug product on behalf of the Company in accordance with Company specifications. The MSA requires that Miltenyi strive to manufacture products that substantially conform to the Company's specifications. As payment for the work that Miltenyi performs, the Company is obligated to pay fees associated with each statement of work, as well as certain expenses incurred by Miltenyi in the course of providing the services and manufacturing. Pursuant to the MSA, any intellectual property necessary to perform the services and manufacturing that is owned by the parties remains the property of that party. Miltenyi has granted the Company a limited, worldwide, non-exclusive license, under certain of its intellectual property rights solely to research, develop, make, have made, and use non-commercial products (e.g., clinical study drug). The term of the MSA is for a period of three years from the effective date and, thereafter, shall automatically renew for successive one-year periods, unless either party provides written notice to the other of its desire not to renew at least ninety days prior to the expiration of the then-current term. The MSA can also be terminated by either party for a material breach upon sixty days' prior written notice, or upon fifteen days' prior written notice for breach of any payment obligation if the breaching party has not cured such breach by the end of such applicable period.

Item 6. Exhibits.

Exhibit Number	Description
3.1	Fourth Amended and Restated Certificate of Incorporation of the Registrant (filed as Exhibit 3.1 to our Current Report on Form 8-K filed on June 25, 2018 (File No. 001-38537) and incorporated herein by reference).
3.2	Certificate of Change of Registered Agent and/or Registered Office of the Registrant (filed as Exhibit 3.2 to our Quarterly Report on Form 10-Q filed on November 5, 2020 (File No. 001-38537) and incorporated herein by reference).
3.3	Amended and Restated By-laws of the Registrant (filed as Exhibit 3.2 to our Current Report on Form 8-K (File No 001-38537) filed on June 25, 2018 and incorporated herein by reference).
10.1	Second Amendment to the AVROBIO, Inc. 2018 Stock Option and Incentive Plan (filed as Exhibit 10.1 to our Current Report on Form 8-K filed on June 10, 2022 (File No. 001-38537) and incorporated herein by reference).
10.2	Amendment No. 2 to Employment Agreement, by and between the Registrant and Chris Mason dated April 25, 2022, (Filed as Exhibit 10.1 to our Quarterly Report on Form 10-Q filed on May 10, 2022 (file No. 001-38537) and incorporated herein by reference).
10.3	Amended and Restated Master Services Agreement, by and between the Registrant and Miltenyi Biotec, Inc., dated November 20, 2021.
31.1	Certification of Principal Executive Officer Pursuant to Rules 13a-14(a) and 15d-14(a) under the Securities Exchange Act of 1934, as Adopted Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.
31.2	Certification of Principal Financial Executive Officer Pursuant to Rules 13a-14(a) and 15d-14(a) under the Securities Exchange Act of 1934, as Adopted Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.
32.1*	Certification of Principal Executive Officer and Principal Financial Officer Pursuant to 18 U.S.C. Section 1350, as Adopted Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.
101.INS	Interactive Data Files pursuant to Rule 405 of Regulation S-T formatted in Inline Extensible Business Reporting Language (“Inline XBRL”).
101.SCH	Inline XBRL Taxonomy Extension Schema Document.
101.CAL	Inline XBRL Taxonomy Extension Calculation Linkbase Document.
101.DEF	Inline XBRL Taxonomy Extension Definition Linkbase Document.
101.LAB	Inline XBRL Taxonomy Extension Label Linkbase Document.
101.PRE	Inline XBRL Taxonomy Extension Presentation Linkbase Document.
104	Cover Page Interactive Data File (formatted as inline XBRL with applicable taxonomy extension information contained in Exhibits 101.*).

Indicates a management contract or any compensatory plan, contract or arrangement.

* Indicates the exhibit is being furnished, not filed, with this report.

**The Registrant has redacted provisions or terms of this Exhibit pursuant to Regulation S-K item 601(b)(10)(iv). The Registrant agrees to furnish an unredacted copy of the Exhibit to the SEC upon request.

SIGNATURES

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

AVROBIO, INC.

Date: August 9, 2022 By: /s/ Geoff MacKay

Geoff MacKay
President, Chief Executive Officer, and Principal Executive Officer

Date: August 9, 2022 By: /s/ Erik Ostrowski

Erik Ostrowski
Chief Financial Officer and Principal Financial and Accounting Officer

EXHIBIT 10.3

CERTAIN IDENTIFIED INFORMATION HAS BEEN EXCLUDED FROM THIS EXHIBIT BECAUSE IT IS BOTH NOT MATERIAL AND IS OF THE TYPE THAT THE REGISTRANT TREATS AS PRIVATE OR CONFIDENTIAL. THIS REDACTED INFORMATION HAS BEEN MARKED IN THIS EXHIBIT WITH THREE ASTERISKS [***].

AMENDED AND RESTATED MASTER SERVICES AGREEMENT
for Custom *Ex Vivo Cellular* Manufacturing Services

THIS AMENDED AND RESTATED MASTER SERVICES AGREEMENT (this "**Agreement**") is entered into as of Nov. 30, 2021 (the "**Effective Date**"), by and between **MILTENYI BIOTEC, INC.**, a California corporation and wholly-owned subsidiary of Miltenyi Biotec B.V. & Co. KG, having a principal place of business at 2303 Lindbergh St., Auburn, CA 95602, USA ("**MBI**"), and **AVROBIO, INC**., a Delaware corporation, having a principal place of business at One Kendall Square, Building 300, Suite 201, Cambridge, MA 02139, USA ("**Client**") (each individually a "**Party**" and collectively the "**Parties**").

RECITALS

WHEREAS, Client has expertise in the field of innovative cellular therapies and is engaged in the development of cellular therapy products for use in patient treatment;

WHEREAS, MBI provides contract development and manufacturing services with respect to cell-based therapeutic products for clinical applications;

WHEREAS, Client desires to engage MBI to perform, and MBI is willing to perform, development and manufacturing services with respect to one or more cell-based therapeutic product(s) on behalf of Client, on the terms and subject to the conditions set forth in this Agreement; and

WHEREAS, MBI and Client entered into the Master Services Agreement dated October 9, 2017 (the "Prior Agreement"), and now, subject to Section 12.4, wish to replace the Prior Agreement in its entirety with the Agreement set forth herein as of the Effective Date.

AGREEMENT

NOW, THEREFORE, in consideration of the foregoing and the mutual covenants and premises contained in this Agreement, and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties hereto agree as follows:

1. **DEFINITIONS; INTERPRETATION**.

1.1 "**Affiliate**" shall mean, with respect to a Party to this Agreement, any corporation, company or other business entity controlled by, controlling, or under common control with such Party. For the purposes of this definition, the term "control" (including, with correlative meanings, the terms "controlled by" and "under common control with") shall mean the possession, directly or indirectly, of more than 50% of the outstanding voting securities of a corporation or comparable equity interest in any other type of business entity, or the power to direct the management and policies of such corporation, company or other business entity.

1.2 "**Agreed Standards**" shall mean, to the exclusion of any other standards: (a) with respect to particular Services or Manufacturing, under an SOW, the agreed standards for performance of such Services or Manufacturing, as expressly specified in such SOW; or (b) with respect to any Results to be generated by Services or Product to be Manufactured under an SOW, the agreed standards for generation of such Results or Manufacture of such Product, which shall include any relevant Specifications, as expressly specified in such SOW or in the applicable Quality Agreement (if any).

1.3 "**Applicable Laws**" shall mean all relevant federal, state and local laws, statutes, rules, regulations, and ordinances in the United States applicable to the Parties or their respective obligations under this Agreement, including Manufacture of Product at the Facility. Applicable Laws include, only in the case of Manufacture of GMP Product Batches, as such GMP Manufacture is expressly stated in the relevant SOW or Quality Agreement, (a) the FD&C Act; (b) GMP; and (c) all applicable regulations and guidelines of the FDA and/or any other relevant regulatory authority in the United States applicable to the Manufacture of Product for the agreed purpose of use; in each case, together, with any and all amendments thereto.

1.4 "**Bankruptcy Event**" shall mean that: (a) MBI becomes insolvent; or (b) voluntary or involuntary proceedings by or against MBI are instituted in bankruptcy or under any insolvency law, which proceedings, if involuntary, shall not have been dismissed within ninety (90) calendar days after the date of filing; or (c) a receiver or custodian is appointed for MBI, or proceedings are instituted by or against MBI for corporate reorganization or the dissolution of MBI, which proceedings, if involuntary, shall not have been dismissed within ninety (90) calendar days after the date of filing; or (d) MBI makes an assignment of substantially all of its assets for the benefit of its creditors, or substantially all of the assets of MBI are seized or attached and not released within ninety (90) calendar days thereafter.

1.5 "**Batch**" shall mean a specific quantity of Product that is intended to be of uniform character and quality and is produced during the same cycle of Manufacture.

1.6 "**Batch Documentation**" shall mean all of the documentation associated with the Manufacture and testing of a given GMP Product Batch, including master batch record(s), executed batch records, QC data, deviation reports, and the Certificate of Analysis and Certificate of Compliance. For the avoidance of doubt, Batch Documentation shall be considered Client Property and Client Confidential Information, but only to the extent such Batch Documentation does not incorporate MBI Technology.

1.7 "**Cancellation Fee**" shall have the meaning provided in Section 3.4.

1.8 "**Certificate of Analysis**" means a document, signed by an authorized representative of MBI, describing the applicable Specifications for, and testing methods applied to, a Batch of Product, and the results of such testing.

1.9 "**Certificate of Compliance**" means a document, signed by an authorized representative of MBI, attesting that a particular Batch of Product was Manufactured in accordance with GMP.

1.10 "**Change Order**" means an order issued pursuant to Section 2.3 hereof, authorizing additional Services or Manufacturing, or changes thereto, under a Statement of Work.

1.11 "**Client Equipment**" means the equipment, if any, identified on the applicable SOW as being provided by Client or purchased or otherwise acquired by MBI on Client's behalf at Client's expense.

1.12 "**Client Information**" shall mean any Information that is disclosed by Client to MBI and/or its Affiliates for use in the performance of the applicable Project.

1.13 "**Client Materials**" shall mean any and all biological and/or chemical materials that are transferred by or on behalf of Client to MBI and/or its Affiliates for use in the performance of the applicable Project; but excluding Client-Supplied Raw Materials.

1.14 "**Client Property**" shall have the meaning provided in Section 7.1.

1.15 "**Client-Supplied Raw Materials**" shall have the meaning provided in Section 3.3.

1.16 "**Client Technology**" means (a) Client Materials, Client-Supplied Raw Materials, and any intermediates, components, or derivatives thereof; (b) Product and any intermediates, components, or derivatives of Product; (c) Specifications; (d) Client Information; and (e) the methods, techniques, trade secrets, copyrights, know-how, data, documentation, regulatory submissions, specifications and other intellectual property of any kind (whether or not protectable under patent, trademark, copyright or similar laws) owned by or licensed to Client (i) existing prior to the Effective Date, (ii) developed or obtained by, or on behalf of, Client independent of this Agreement, or (iii) developed by MBI (or its Affiliates or subcontractors) in connection with the performance of its obligations hereunder that (1) is identified as Results for the relevant SOW, (2) specifically relates to any Client Information, Client Materials, Client- Supplied Raw Materials, or Client Confidential Information, and (3) does not otherwise fall under the definition of MBI Technology.

1.17 "**Confidential Information**" of a Party shall mean, subject to the exceptions set forth in Section 8.2, any and all Information that is disclosed or made available by or on behalf of such Party (the "**Disclosing Party**") to the other Party (the "**Receiving Party**") or any of the Receiving Party's Representatives, either before or after the Effective Date, in connection with this Agreement or pursuant to the Prior Agreement; in each case, whether in writing, orally, visually, or otherwise. For clarity, all "Confidential Information" (as such term is defined in the Prior Agreement) disclosed or made available by or on behalf of the Disclosing Party to the Receiving Party or any of its Representatives pursuant to or in connection with the Prior Agreement shall be deemed the Confidential Information of such Disclosing Party for purposes of this Agreement.

1.18 "**Deposit**" shall have the meaning provided in Section 4.7.

1.19 "**Disclosing Party**" shall have the meaning provided in Section 1.17.

1.20 "**Expenses**" shall have the meaning provided in Section 4.2.

1.21 "**Facility**" shall mean the Product manufacturing facility of MBI or its Affiliates at which any Product is Manufactured hereunder.

1.22 "**FD&C Act**" shall mean the United States Federal Food, Drug and Cosmetic Act and regulations promulgated thereunder, as each may be amended from time to time.

1.23 "**FDA**" shall mean the United States Food and Drug Administration or the successor thereto.

1.24 "**Fee**" shall have the meaning provided in Section 4.1.

1.25 "**GMP**" shall mean current good manufacturing practices for the production of biological products for the United States as set forth in Parts 210, 211 and 600 of Title 21 of the U.S. Code of Federal Regulations (21 CFR 210 and 211), and as set forth in Parts 1270 and 1271 of Title 21 of the U.S. Code of Federal Regulations (21 CFR 1270 and 1271), as applicable, as each may be amended from time to time

after the Effective Date, and as interpreted by ICH Harmonised Tripartite Guidelines applicable to biotechnological/biological products; in each case, as applicable to investigational biological products for use in human clinical trials.

1.26 "**GMP Product Batch**" shall mean a Batch of Product supplied, or to be supplied, to Client hereunder that the applicable SOW expressly specifies is to be Manufactured in accordance with GMP.

1.27 "**Information**" shall mean any and all technical information and know-how, including without limitation, data, instructions, processes, formulae, trade secrets, expert opinions and other information (in written or other tangible form) including, without limitation, any biological, chemical, pharmacological, toxicological, clinical, assay, control and manufacturing data, biological materials, manufacturing or related technology, analytical methodology, chemical and quality control procedures, protocols, techniques, improvements and results of experimentation and testing.

1.28 "**MBI Technology**" shall mean: (a) MBI's proprietary instrument systems (e.g., [***], including, without limitation, all software, protocols operating instructions, etc.), reagents and consumables, and the Manufacturing Process that MBI uses in the Manufacture of Products on behalf of its clients, including all Information relating thereto, that is either (i) owned or controlled by MBI or its Affiliates on the Effective Date or (ii) developed or acquired, and owned or controlled, by MBI or its Affiliates during the Term independently of any activities conducted pursuant to this Agreement; and (b) any improvement, modification or enhancement to such MBI proprietary instrument systems, reagents or consumables or Manufacturing Process (and all Information related thereto) that (i) is made, created, authored, conceived or reduced to practice during the Term (whether or not in the course and as a result of performing Services or Manufacturing), (ii) is not specific to the Product, and (iii) does not specifically relate to any Client Information or proprietary Client Materials or Client-Supplied Raw Materials; including, in each case, all patent and other intellectual property rights in or to any of the foregoing.

1.29 "**Manufacture**" or "**Manufacturing**" or "**Manufactured**" shall mean, with respect to a given Product and as may be set forth in more detail in the applicable SOW, all operations in the manufacture and supply of such Product to Client (and/or its Affiliates and designees) hereunder in accordance with this Agreement, including the acquisition, receipt, incoming inspection, storage and handling of Raw Materials, and the manufacturing, formulation, finishing, filling, production, warehousing, storage, handling, quality control testing including in-process, release and stability testing), bulk packaging, primary and secondary packaging, and labeling, release and delivery of Product to Client (and/or its Affiliates and designees).

1.30 "**Manufacturing Process**" shall mean any and all processes (or any step in any process) and environment used or planned to be used by MBI or its Affiliates to Manufacture a Product, as evidenced in MBI's master batch record for such Product, including, without limitation, any and all steps and operations performed by MBI or its Affiliates in connection with the preparation or optimization of Manufacturing, and in-process and quality controls or other analytical procedures performed by MBI or its Affiliates in connection with the Manufacture of Product.

1.31 "**Master File**" shall mean MBI's regulatory support file(s) submitted by MBI to FDA (or, if mutually agreed in writing on a case-by-case basis, another regulatory authority) which MBI permits its clients to reference in such clients' regulatory submissions with respect to investigational new Products that contain or incorporate, or are manufactured using, MBI Technology and/or otherwise manufactured and supplied by MBI, as amended or updated by MBI from time to time in its sole discretion but subject to Section 6.1.

1.32 "**Materials**" shall have the meaning provided in Section 2.8.

1.33 "**Non-Conforming Product**" shall have the meaning provided in Section 5.3.

1.34 "**Permit**" shall mean any application, accreditation, permit, authorization, license, approval, registration, franchise, certificate, permission, exemption, consent, variance (including zoning variance approval), or equivalent decision or document of, from, or required or issued by any governmental authority or under any Applicable Laws for the operation of the Facility and/or performance of Services or Manufacturing, as the foregoing may be amended or supplemented from time to time.

1.35 "**Prior Agreement**" shall mean the Master Services Agreement between the Parties effective as of October 9, 2017.

1.36 "**Product**" shall mean a cell-based therapeutic product Manufactured, or to be Manufactured, by MBI on behalf of Client pursuant to an SOW.

1.37 "**Project**" shall have the meaning provided in Section 2.2.

1.38 "**Quality Agreement**" shall mean a written agreement between Client and MBI, to be entered into prior to initiation of Manufacturing of any GMP Product Batch, that defines the quality roles and responsibilities of each Party in connection with the Manufacture of GMP Product Batches hereunder.

1.39 "**Raw Materials**" shall mean starting materials, cells, reagents, cell culture media or processing formulations, components, consumables, disposables, excipients, other ingredients and packaging and labeling materials used in the Manufacture of any Product.

1.40 "**Receiving Party**" shall have the meaning provided in Section 1.17.

1.41 "**Regulatory Filings**" shall have the meaning provided in Section 6.1.

1.42 "**Representatives**" shall mean the applicable Party's Affiliates, and their officers, directors, employees, consultants, agents and representatives.

1.43 "**Results**" shall mean any and all data, results, reports and samples (interim and/or final) from the Services performed by MBI and/or its Affiliates that the applicable SOW expressly identifies as deliverables to be disclosed or provided by MBI to Client. For the avoidance of doubt, and notwithstanding any provision of this Agreement to the contrary, Results specifically exclude all MBI Technology (including, without limitation, the Manufacturing Process) and any Master File(s). For the avoidance of doubt, any GMP Product Batch shall not be considered Results of Services.

1.44 "**Services**" shall mean the particular tasks to be performed by MBI and/or its Affiliates for a given Project under this Agreement, as more fully set out in the applicable SOW, the output of which shall be considered Results. For the avoidance of doubt, Services exclude Manufacturing of any GMP Product Batch.

1.45 "**SOW**" shall mean a written statement of work for a given Project under which MBI agrees to perform such Project under this Agreement, as amended or modified in accordance with the terms of this Agreement. Each SOW shall be agreed upon by the Parties on a Project-by-Project basis as set forth in Section 2.2, and shall be deemed to include any amendments or applicable Change Orders thereto made in accordance with the terms of this Agreement. Each mutually agreed SOW shall be deemed attached hereto and included in Exhibit A.

1.46 "**Specifications**" shall mean, for a given Project and with respect to a particular Product, the release and acceptance criteria to which such Product should conform to be considered acceptable for its intended use, which criteria shall be included in, or attached as an exhibit to, the applicable SOW or the corresponding Quality Agreement (or an amendment to either of the foregoing, or a Change Order in the case of an SOW).

1.47 "**Term**" shall have the meaning provided in Section 10.1.

1.48 "**Third Party**" shall mean any entity other than MBI, Client and any of their respective Affiliates.

1.49 "**Undisputed Payment**" shall have the meaning provided in Section 4.6.

2. **SCOPE OF AGREEMENT; PERFORMANCE OF SERVICES**.

2.1 **Scope of Agreement**. As a master form of contract, this Agreement allows the Parties to contract for multiple Projects through the issuance of multiple SOWs as described in Section 2.2, without having to re-negotiate the basic terms and conditions contained herein. The Parties will also agree upon a Quality Agreement containing quality assurance provisions for the Manufacture of Product hereunder, which agreement is incorporated by reference herein.

2.2 **Statements of Work**. The specific Services or Manufacturing to be provided by MBI for each Project under this Agreement (each, a "**Project**") shall be separately specified in an SOW. Each SOW shall become effective only upon signature by both Parties and, upon such signature, shall be deemed attached to this Agreement as part of Exhibit A. SOWs shall be sequentially numbered, shall specifically refer to this Agreement, and shall incorporate the terms and conditions hereof by reference. Each SOW shall also set forth, upon terms mutually agreeable to the Parties, the specific Services or Manufacturing to be performed by MBI, including Results to be provided to Client, as applicable, the anticipated time line and schedule for the performance of such Services or Manufacturing, and the Fees to be paid by Client to MBI for the performance of such Services or Manufacturing, as well as any other relevant terms and conditions. If a Project includes the development or production of specific deliverables, the specifications of such deliverables shall be set forth in the relevant SOW. If an SOW provides for MBI to Manufacture any GMP Product Batch, the Specifications of such Product shall be set forth in such SOW or in the Quality Agreement (as applicable), and such SOW shall expressly specify whether or not such Product is to be Manufactured in accordance with GMP. There shall be no minimum or maximum number of SOWs to be entered into under this Agreement. Each SOW shall be subject to all of the terms and conditions of this Agreement in addition to the specific details set forth in the SOW. To the extent any terms or conditions of an SOW conflict with the terms and conditions of this Agreement, the terms and conditions of this Agreement shall control, unless the SOW expressly states the intent of the Parties that a particular provision of such SOW supersede this Agreement with respect to a particular matter in such SOW. However, if there is any conflict, discrepancy, or inconsistency between the terms of this Agreement or any SOW and those of the Quality Agreement, the Quality Agreement shall control solely in respect of the allocation of the Parties' quality-related performance obligations. However, this Agreement or the SOW, as applicable and subject to the previous sentence, shall control in all other respects, including in respect of financial obligations and risk allocation. Any modification or addition to the Services or Manufacturing as described in an existing SOW will require execution of a written Change Order in accordance with Section 2.3, and no change, modification or waiver to the SOW will be effective unless specifically set out in the Change Order.

2.3 **Change Orders**. Modifications or additions to the Services or Manufacturing shall be accomplished through the use of a Change Order. A Change Order must be in writing and signed by each

Party in order to be effective. The signatures of the Parties to a Change Order may be transmitted by facsimile or as a PDF attachment to electronic mail, and such facsimile or PDF will, for all purposes, be deemed to be the original signature of such Party whose signature it reproduces and will be binding upon such Party. The procedure for creating a Change Order is as follows: (a) Client shall submit a written request to MBI specifying the additions or modifications to the Services or Manufacturing desired (the "**Change Notice**"); and (b) if MBI is prepared to add to or modify the Services or Manufacturing as requested by Client, it shall prepare and submit an amendment to the SOW to Client which shall include a description of the changes and any additional Fees, and which shall be negotiated by the Parties in good faith. On obtaining the Client's written signature to the Change Order, the Change Order will become part of the SOW. Client acknowledges and agrees that any material change to the Services or Manufacturing may result in an extension of the agreed timelines and/or may cause an increase in the Fee amount and Expenses.

2.4 **Client-Supplied Information and Materials**. Promptly following the execution of an SOW by the Parties (or at such other time as specified in such SOW), Client shall disclose to MBI the Client Information for such Project specified in the SOW and, subject to Section 2.8, transfer to MBI the Client Materials and Client-Supplied Raw Materials for such Project in the form(s) and quantity(ies) specified in such SOW. All Client Information and Client-Supplied Raw Materials and Client Materials i) will remain the sole property of Client, ii) will be used only in furtherance of the Services or Manufacturing, as applicable, in accordance with this Agreement and SOWs, iii) will not be used or delivered to or for the benefit of any Third Party without the prior written consent of Client, and iv) will be used in compliance with all Applicable Laws. Upon completion of the relevant SOW, MBI agrees to destroy or return to Client all unused quantities of Client Materials and Client-Supplied Raw Materials according to Client's written directions. MBI will promptly notify Client if at any time it believes any Client Materials, Client-Supplied Raw Materials, or any derivatives, intermediates or components thereof, have been damaged, lost or stolen. Client acknowledges and agrees that MBI shall not be liable for any failure or delay in the performance of Services or Manufacturing hereunder to the extent such failure or delay is caused by any failure or delay of Client in disclosing Client Information or transferring Client Materials and Client-Supplied Raw Materials in accordance with its obligations under the applicable SOW and that, in each case, are necessary for MBI's performance of such Services or Manufacturing.

2.5 **Supply of Equipment**. Unless otherwise agreed in an SOW, MBI will supply all equipment necessary to perform the Services or Manufacturing, except that Client will supply the Client Equipment, if any. Client Equipment will not be used by MBI except in performance of Services or Manufacturing under the applicable SOW. Title to Client Equipment will remain with Client and MBI will ensure that Client Equipment is properly labeled as Client property and remains free and clear of any liens or encumbrances arising due to the acts or omissions of MBI. At Client's written request upon completion or termination of the relevant SOW(s), Client Equipment will be returned to Client, or to Client's designee, at Client's expense for any packaging and shipping costs. Unless expressly provided otherwise in the relevant SOW(s), MBI will be responsible for maintenance of the Client Equipment at Client's expense but subject to Client's prior written approval of such expense, not to be unreasonably withheld or delayed. To the extent Client provides or purchases spare parts for Client Equipment, such spare parts will remain the property of Client and will be used by MBI only for maintenance of Client Equipment. MBI will immediately notify Client if at any time it believes any Client Equipment has been damaged, lost or stolen.

2.6 **Performance of Services**. MBI agrees to perform the Services set forth in each SOW in material compliance with the applicable warranties provided in Section 9.2 of this Agreement, the terms and conditions of this Agreement, and such SOW. MBI will perform all Services at the Facility, provide all staff necessary to perform the Services in accordance with the terms of the applicable SOW and this Agreement, and hold at such Facility all Client Materials, Client-Supplied Raw Materials, Client Equipment and other items used in the Services. MBI will not change the location of such Facility or, except as

permitted under Section 2.7, use any additional facility for the performance of Services under this Agreement, without at least [***] days prior written notice to, and prior written consent from, Client, which consent will not be unreasonably withheld or delayed (it being understood and agreed that Client may withhold consent pending satisfactory completion of a quality assurance audit and/or regulatory impact assessment of the new location or additional facility, as the case may be). MBI shall use commercially reasonable efforts to perform the Services under each SOW in an efficient and timely manner substantially in accordance with the time line and schedule set forth in such SOW, provided that MBI does not guarantee that any specific delivery date(s) will be met. MBI shall notify Client in writing promptly upon becoming aware of any circumstance that will, or could reasonably be expected to, result in any delay in performance of the Services, and the Parties shall cooperate in good faith to avoid or minimize any such delay.

2.7 **Subcontracting**. Subject to the prior written consent of Client, MBI may subcontract Services or Manufacturing (or any portion thereof) under an SOW to an Affiliate of MBI or to any Third Party, provided that no such subcontracting shall relieve MBI of any of its obligations hereunder, and MBI shall at all times be responsible for the compliance of its Affiliate and Third Party subcontractors with the terms and conditions of this Agreement and the applicable SOW. Any agreement entered into by MBI and an Affiliate or Third Party shall provide, at a minimum, for confidentiality obligations, ownership and allocation of intellectual property rights, record-keeping, access, and rights to Results that are consistent with the intent and terms of this Agreement.

2.8 **Materials**. In connection with this Agreement, a Party may provide to the other Party certain biological or chemical materials, including, without limitation, Client Materials (collectively, "**Materials**"). Except as otherwise expressly set forth in this Agreement or the applicable SOW, all such Materials will remain the sole property of the providing Party, will be used only in furtherance of the activities expressly contemplated by this Agreement, will not be used or delivered to or for the benefit of any Third Party without the prior written consent of the providing Party, and will be used in compliance with all Applicable Laws. The Materials supplied under this Agreement must be used with prudence and appropriate caution in any experimental work because not all of their characteristics may be known. Except as expressly set forth herein or the applicable SOW, THE MATERIALS ARE PROVIDED "AS IS" AND WITHOUT ANY REPRESENTATION OR WARRANTY, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR ANY PARTICULAR PURPOSE OR ANY WARRANTY THAT THE USE OF THE MATERIALS WILL NOT INFRINGE OR VIOLATE ANY PATENT OR OTHER PROPRIETARY RIGHTS OF ANY THIRD PARTY. For purposes of this Section the term "Materials" does not include Product supplied by MBI.

3. MANUFACTURING AND SUPPLY OF PRODUCTS.

3.1 **Specifications; Testing**. Subject to Sections 9.3 and 9.5, MBI shall strive to Manufacture Product that will substantially conform to the applicable Specifications for such Product as set forth in the SOW. For the avoidance of doubt, given the highly experimental nature of Client's Product and limited Manufacturing history of such Product, MBI does not guarantee that any Product will fully conform with Specifications. Client shall take full responsibility for the suitability of the Specifications for obtaining a Product which possesses all desired characteristics and is suitable for the Manufacture of Product. MBI assumes no responsibility for any deficiency of the Specifications in this regard. MBI shall test each Batch of Product in accordance with the applicable SOW or Quality Agreement and supply Client with: (a) a Certificate of Analysis for such Batch; (b) if such Batch is a GMP Product Batch, a Certificate of Compliance for such GMP Product Batch; and (c) the other Batch Documentation regarding the Manufacture of such Batch(es).

3.2 **Manufacture of Product**. MBI shall Manufacture Products in material compliance with the applicable warranties provided in Section 9.3 of this Agreement, the terms and conditions of this Agreement, the applicable SOW, and the Quality Agreement. MBI will perform all Manufacturing at the Facility, provide all staff necessary to perform the Manufacturing in accordance with the terms of the applicable SOW and this Agreement, and hold at such Facility all Client Materials, Client-Supplied Raw Materials, Client Equipment and other items used in the Manufacturing. MBI will not change the location of such Facility or, except as permitted under Section 2.7, use any additional facility for the performance of Manufacturing under this Agreement, without at least [***] days prior written notice to, and prior written consent from, Client, which consent will not be unreasonably withheld or delayed (it being understood and agreed that Client may withhold consent pending satisfactory completion of a quality assurance audit and/or regulatory impact assessment of the new location or additional facility, as the case may be). MBI shall use commercially reasonable efforts to perform the Manufacturing under each SOW in an efficient and timely manner substantially in accordance with the time line and schedule set forth in such SOW, provided that MBI does not guarantee that any specific delivery date(s) will be met. MBI shall notify Client in writing promptly upon becoming aware of any circumstance that will, or could reasonably be expected to, result in any delay in performance of the Manufacturing, and the Parties shall cooperate in good faith to avoid or minimize any such delay. MBI represents and warrants to Client that it has and will maintain during the duration of any Project performed under an applicable SOW all Permits necessary for the conduct of the Manufacturing. MBI shall not make or use any Product, or sell or otherwise distribute Product to a Third Party for any purpose, in each case unless specifically authorized in writing under this Agreement.

3.3 **Raw Materials**. Except as otherwise expressly set forth in any SOW, MBI will purchase all generally available Raw Materials required for the Manufacture of Products, subject to Section 4.2. If an SOW provides for Client to supply any Raw Material (including any human cells) to MBI ("**Client-Supplied Raw Material**"), Client shall provide, or cause its designee to provide, to MBI, at no cost to MBI, the Client-Supplied Raw Materials in sufficient quantities and of appropriate quality (including, if applicable, complying with any applicable specifications for such Client-Supplied Raw Materials) for use in the Manufacture of Product. In the case of Client-Supplied Raw Material for use in the Manufacture of any GMP Product Batches, Client shall be solely responsible for the qualification of all suppliers of such Client-Supplied Raw Material and for ensuring that such Client-Supplied Raw Material is of suitable quality and grade (USP or EP) for Client's intended use. Client will at all times retain title to and ownership of the Client-Supplied Raw Materials. MBI will store all Raw Materials, including Client-Supplied Raw Materials, at no cost for the duration of the applicable Project, after which MBI shall have the right to charge Client additional fees if longer storage is requested by Client.

3.4 **Batch Scheduling; Cancellation Fees**. All GMP Product Batches to be Manufactured under this Agreement shall be run on a per patient basis and scheduled as mutually agreed by the Parties in good faith and in accordance with the relevant SOW, provided that Client shall use all reasonable efforts to ensure that each such Batch is scheduled at least [***] days in advance. Except in the case of termination of this Agreement and/or one or more SOWs by Client pursuant to Section 10.2 for MBI's uncured material breach or pursuant to Section 10.3(b), if Client, on or within [***] days of the mutually agreed scheduled date of commencement of performance of the relevant Batch, (i) cancels or postpones the relevant GMP Product Batch, or (ii) causes the cancellation or postponement by MBI of such Batch by failing to provide the agreed Client Information, Client Materials, and/or Client-Supplied Raw Materials in sufficient time, quantity and quality for such run(s) (in which case MBI shall promptly notify Client in writing of such cancellation), or fails to timely pay any amount that is an Undisputed Payment due and outstanding under any SOW, in which case MBI will provide written notice of its intent to cancel such Batch, and Client shall have [***] days to make payment in full for said Undisputed Payment to avoid cancellation, Client shall pay to MBI a cancellation fee (the "**Cancellation Fee**") as specified in the relevant SOW For the avoidance of doubt, any postponement of a GMP Product Batch shall be subject to mutual written agreement, and shall incur the Cancellation Fee as specified in the relevant SOW.

For clarity, to trigger payment of the Cancellation Fee, the cancellation or postponement of a Batch has to be requested or caused by Client and not caused by MBI. For clarity, in no event shall any specific economic consequences of cancellation or postponement be greater than the amounts otherwise due to MBI had the relevant Batch(es) not been cancelled or postponed.

3.5 **Process/Specifications Changes**. Notwithstanding Section 2.3, any change or modification to the Manufacturing Process or Specifications for any Product must be approved in advance by both Parties in writing, and will be made in accordance with the change control provisions of the applicable Quality Agreement and SOW.

4. **PAYMENT**.

4.1 **Fees, Expenses and Applicable Taxes**. For the Services and Manufacturing provided by MBI and its Affiliates hereunder, Client agrees to pay MBI: (a) the Fees set forth in the applicable SOW ("**Fees**"); (b) the Expenses reasonably incurred by MBI and/or its Affiliates in the course of providing the Services and Manufacturing, in accordance with Section 4.2; and (c) any Applicable Taxes, in accordance with Section 4.5.

4.2 **Expenses**. Client acknowledges that actual costs and expenses incurred by MBI in performing the Services or Manufacturing under an SOW may differ from the estimated costs set forth in such SOW. Accordingly, in addition to the agreed Fees and estimated costs specified in an SOW, Client shall pay or reimburse MBI for the following documented costs and expenses (including reasonable costs for travel, accommodation, lodging) incurred by MBI in connection with the performance of Services or Manufacturing (collectively, the "**Expenses**"):

(a) the actual cost of any quantity(ies) of Raw Materials (other than Client-Supplied Raw Materials) necessary for the performance of Services or Manufacturing that exceed the anticipated cost or required quantity(ies) of such Raw Materials under the original SOW, or any applicable Change Order thereto, for which the additional quantities Client is responsible and for so long as the need for additional Raw Materials shall not be caused by MBI's willful misconduct nor gross negligence;

(b) the actual cost of outside professional services to MBI provided that such services are set forth in the SOW or otherwise approved by Client in advance and performed in accordance with Client's instructions and the terms of this Agreement and the SOW, or any applicable Change Order thereto; and

(c) the actual fees and costs charged to MBI by a Third Party auditor for the conduct of any "without cause" GMP compliance audit pursuant to Section 6.2 and the costs for material and labor incurred by MBI in reasonably preparing for and cooperating with such "without cause" audit (to be charged to Client at applicable MBI standard rates, currently [***] and subject to annual revision); and

(d) the costs and expenses (including without limitation labor and material costs) reasonably incurred by MBI in accordance with Sections 6.4, 6.5, or Section 6.5 and not covered under (c) above (to be charged to Client at applicable MBI standard rates, currently [***] and subject to annual revision).

4.3 **Invoices; Payment**. MBI shall provide to Client for each SOW one or more separate invoices (to be delivered at intervals specified in such SOW) for the Fees earned and Expenses or Cancellation Fees incurred in performing Services or Manufacturing under such SOW, each such invoice summarizing the Services or Manufacturing performed during that period of time under that SOW. MBI

will keep accurate financial records of out-of-pocket costs and Expenses incurred in the performance of Services and Manufacturing and invoice calculations.

4.4 **Manner and Place of Payment**. Except as otherwise specified in an SOW, Client shall pay each undisputed invoice within [***] days of receipt. All undisputed invoiced amounts shall be paid in full by the Client without deduction or set off. All payments due to MBI under this Agreement shall be made in U.S. Dollars by wire or electronic fund transfer in immediately available funds to a bank and account designated in writing by MBI. Client shall be responsible for payment of all bank charges assessed by the originating bank associated with such manner of payment. Payment by credit card is expressly excluded as a means for payment for any of the Services or Manufacturing provided under one or more SOWs.

4.5 **Applicable Taxes**. Client will pay, upon receipt of invoice from MBI, any applicable sales, use, consumption, goods and services, and value-added taxes, duties, assessments and other charges and expenses imposed by any government authority arising out of the provision of Services or Manufacturing and/or the delivery of Products to Client under this Agreement and the applicable SOW, except taxes imposed on MBI's (or its Affiliates') income ("**Applicable Taxes**").

4.6 **Late/Disputed Payments**. In the event that any Undisputed Payment due under this Agreement is not made when due, the payment shall accrue interest at a rate of [***] per month for the period from the due date for payment until the date of actual payment; provided, however, that in no event shall such rate exceed the maximum legal annual interest rate. An "**Undisputed Payment**" means an amount owed by Client to MBI for which there is no good faith dispute made by Client in accordance with the provisions of this Section 4.6. The payment of such interest shall not limit MBI from exercising any other rights it may have as a consequence of the lateness of any payment. If Client disputes any payment amount, Client shall notify MBI in writing within [***] days of receipt of the invoice requesting such payment regarding the nature and amount that is disputed in reasonable detail. The Parties shall work in good faith to resolve the disputed payment amount in a timely manner, during which time interest shall not accrue on the disputed amount. For the avoidance of doubt, MBI reserves the right to suspend any and all Services or Manufacturing in the event that Client fails to timely pay one or more invoices due and outstanding under any SOW, as applicable.

4.7 **Deposit**. If and to the extent agreed upon in an SOW, Client will pay to MBI a deposit for amounts payable to MBI under such SOW ("**Deposit**"). In the event Client has paid a Deposit, MBI will hold the Deposit on Client's behalf and credit the Deposit to amounts owed to MBI by Client as set forth in the applicable SOW. In the event that Client has failed to pay any undisputed amounts when due, MBI will, upon written notice to Client, apply any Deposit to such undisputed amounts as of the date such amounts are due. Upon completion or termination of an SOW, any unused portion of a Deposit will be refunded to Client within [***] days of such completion or termination.

5. DELIVERY; ACCEPTANCE AND REJECTION.

5.1 **Quality Control Documentation**. Except as otherwise specified in an SOW or any Quality Agreement executed hereunder, prior to the delivery of any Batch of Product to Client, MBI shall provide Client with the relevant Batch Documentation. MBI agrees not to ship Product to Client prior to acceptance in accordance with Section 5.3.

5.2 **Delivery**. Except as otherwise specified in an SOW, all Product shall be delivered [***]. MBI will package Product in accordance with Client's reasonable written instructions. Subject to Section 5.1 and Section 5.3, Client shall arrange for its designated carrier to collect each shipment of Product from the Facility no later than [***] days after MBI's delivery to Client of the Batch Documentation for such

shipment, and if Client does not cause such designated carrier to do so within such [***] day period, MBI shall have the right to charge, and Client shall pay, additional Fees at MBI's then-standard rates for storage of such Product beyond such [***] day period. Client shall be responsible for insuring all Product upon MBI's delivery thereof to the designated carrier at the Facility. Client shall provide MBI with proof of export for MBI tax filing purposes. All shipments will be subject to the standard terms and conditions of the designated carrier, and MBI shall have no liability to Client for any loss, damage or delay in a shipment attributable to the designated carrier or to events occurring during or after delivery by MBI to the carrier.

5.3 **Acceptance and Rejection**. Client shall have the right to reject any GMP Product Batch of Non-Conforming Product. As used herein, "**Non-Conforming Product**" shall mean any GMP Product Batch which, before or at the time of delivery to the common carrier specified by Client at the Facility, materially fails to conform to any of MBI's applicable warranties provided in Section 9.3 of this Agreement. Client shall inspect each GMP Product Batch and review associated Batch Documentation, and may test samples of the Batch against the Specifications, and shall notify MBI in writing of its acceptance or rejection of such GMP Product Batch within [***] days of receipt of such Batch Documentation. If Client fails to notify MBI in writing of its rejection of any GMP Product Batch within [***] days of receipt of the Batch Documentation, Client shall be deemed to have irrevocably accepted such GMP Product Batch. If Client timely delivers notice of rejection of any GMP Product Batch to MBI, MBI shall notify Client as promptly as reasonably possible whether or not it accepts Client's basis for rejection. If MBI in good faith disagrees with Client's assertion that certain GMP Product Batch is Non-Conforming Product, the Batch Documentation and a sample of such GMP Product Batch shall be promptly submitted (which will not exceed [***] days) to a mutually acceptable Third Party laboratory. Such Third Party laboratory shall determine whether or not such GMP Product Batch is Non-Conforming Product, and the Parties agree that such laboratory's determination shall be final and binding on the Parties. The Party against whom the Third Party tester rules shall bear all costs of the Third Party testing. In the event that there is a quality investigation of the GMP Product Batch, the timing for acceptance or rejection of the GMP Product Batch shall be extended by mutual agreement after completion of the quality investigation.

5.4 **Sole Remedy for Delivery of Non-Conforming Product**. In the event (a) MBI agrees or the Third Party laboratory determines that a GMP Product Batch is Non-Conforming Product and (b) such non-conformity resulted solely from the [***] of MBI, then MBI, at Client's option, shall either (i) at MBI's expense, subject to Client supplying replacement Client-Supplied Raw Materials at Client's sole expense and paying for the Non-Conforming Product, replace such Non-Conforming Product as promptly as practicable after receipt of replacement Client-Supplied Raw Materials from Client, or (ii) refund the Fees paid by Client for the Non-Conforming Product. This Section 5.4 sets forth MBI's entire liability and Client's SOLE REMEDY for delivery of Non-Conforming Product. For clarity, and without limiting the generality of the foregoing, if the non-conformity of any Non-Conforming Product is the result of non-conformity of any Client-Supplied Raw Materials that was not solely caused by MBI or its Representatives, or if Client elects to use the Non-Conforming Product for its intended clinical purpose, then Client shall not be entitled to the foregoing remedy. For clarity, Client may request that such Non-Conforming Product be delivered to Client for research purposes, subject to payment of a mutually agreed reasonable fee for such Non-Conforming Product.

6. **REGULATORY**.

6.1 **Regulatory Filings; Master File**. Client shall be solely responsible for filing and maintaining all investigational new drug applications, applications for regulatory or marketing approval, and regulatory or marketing approvals with respect to any Product (collectively, "**Regulatory Filings**"), which, for the avoidance of doubt, exclude any applicable Master File(s). Client acknowledges that MBI shall at all times be the sole and exclusive owner of the Master File(s). Upon Client's written request, MBI shall submit a letter of authorization to FDA authorizing FDA to access and refer to the applicable Master

File(s) in support of Client's Regulatory Filings with respect to any Product and shall promptly provide Client with a copy of such letter of authorization. For clarity, neither this Section nor any other provision of this Agreement shall be construed to obligate MBI to disclose the contents of the Master File(s) to Client or otherwise to provide Client or its Representatives with access to the Master File. Notwithstanding the foregoing, MBI will cooperate with Client, at Client's expense, to provide information directly to foreign regulatory authorities, under appropriate and suitable confidentiality conditions, such as utilization of commercially confidential information protection under HMA/EMA guidance, to support Client's Regulatory Filings in jurisdictions outside the U.S., and with respect to jurisdictions in which the regulatory authorities will not accept the necessary information from MBI directly to support Client's Regulatory Filing, MBI will make the necessary information available to Client directly, solely for use in connection with Client's Regulatory Filing; provided however, that the disclosure of MBI's Confidential Information under this sentence shall exclusively be effected to specifically named Client employees who have signed, each on his/her individual behalf, a non-disclosure agreement adequately protecting MBI's confidentiality interests relating to such MBI Confidential Information prior to such disclosure. Upon MBI's request, the Parties shall discuss and reasonably agree on any additional or alternative means that may be required or useful to protect MBI's confidentiality interests for this purpose.

6.2 **Audits; Performance Observation**.

(a) For "without cause" audits, Client and its Representatives shall have the right, acting reasonably, upon not less than [***] days advance notice and during regular business hours, and no more than once in any given [***] month period during the Term hereof, to inspect and audit the Facility used for Manufacture of Product, and MBI's records at the Facility that are relevant to the Product to assure compliance with MBI's obligations under this Agreement and the applicable SOW, including for compliance with the Agreed Standards, Applicable Laws, including GMP if applicable, and other prevailing quality system requirements. Such inspection and audit shall be limited to those portions of the Facility that are involved in the Manufacture of the Product, and shall be conducted in a manner so as to minimize disruption of business operations. MBI and its Affiliates reserve the right, at its sole discretion, to exempt certain documentation from such audit by Client if and to the extent this is reasonably required in order to protect MBI's Technology and Confidential Information of MBI's other clients, and to the extent that disclosure of such information under such audit is not required by an Authority (as defined below). All information disclosed to or otherwise observed by Client or its Representatives during any such audit or inspection shall be deemed Confidential Information of MBI or its Affiliates, respectively. If Client appoints any Third Party to perform such audit, Client warrants and represents that such Third Party will abide by confidentiality obligations no less stringent than those contained in this Agreement. Client's representatives shall at all times while present at the Facility comply with all applicable health, safety, environmental and security laws and applicable MBI (or Affiliate) standard policies and procedures.

(b) If required for Client's submission of any Regulatory Filing to FDA or equivalent regulatory authority ("**Authority**") or necessary for approval thereof by FDA or other Authority, MBI shall permit representatives of the relevant Authority, or cause an appropriately qualified Third Party mutually selected by MBI and Client, to conduct a GMP compliance audit at the Facility, at Client's sole expense, subject to any reimbursement by Client as described in Section 4.2. As a condition to allowing such Third Party auditor to conduct a GMP compliance audit at the Facility, MBI will require such Third Party auditor to execute a non-disclosure agreement with MBI. The Third Party auditor shall not have the right to copy any notes, data, records or other documentation maintained by MBI. The contents of such Third Party auditor's audit report shall be limited to the minimum information legally required for Client's submission of the applicable Regulatory Filing or necessary for approval thereof by FDA or other relevant Authority. MBI shall deliver a copy of the audit report to Client promptly following the issuance thereof. In no event shall any such audit report disclose or include any MBI Technology or other Confidential Information of MBI (including, without limitation, the Manufacturing Process or any portion thereof).

(c) MBI will permit Client or its Representatives to observe and consult with MBI during the performance of Services or Manufacturing under this Agreement, subject to MBI's person in plant policies regarding conduct of Client and its Representatives while in the Facility.

6.3 **Adverse Event Reporting**. Client shall be responsible for all reporting to regulatory authorities of adverse events associated with the use of any Product.

6.4 **Regulatory Inspections**. In the event MBI receives any correspondence from any regulatory or governmental agency relating specifically to a Product, or any notice of inspection or any inspection visit by any regulatory or governmental authority relating specifically to a Product, MBI shall notify Client thereof and shall keep Client informed of any written observations (or any other written communication) by such regulatory or governmental authority that could reasonably be expected to have a material adverse impact on MBI's ability to supply Product and of MBI's response to any such observation, per the specific details in the Quality Agreement. MBI will use reasonable efforts to consult with Client before responding to each such communication relating specifically to Product. In addition to any express obligations under any Quality Agreement, MBI shall promptly furnish Client with summaries of all reports, documents and correspondence with respect to any such inquiries, visits or inspections.

6.5 **Audit and Inspection Costs**. Client shall reimburse MBI and its Affiliates for all Expenses reasonably incurred by MBI and/or its Affiliates (as the case may be) in connection with (i) the Facility audits pursuant to Section 6.2 and (ii) any regulatory inspections by, or correspondence with, any regulatory or governmental agency pursuant to Section 6.4.

6.6 **Assistance**. MBI shall, if and as requested, consult with and provide reasonable assistance to Client with regard to regulatory matters concerning the Product, as appropriate, and Client shall be charged for any Expenses arising therefrom.

7. OWNERSHIP OF INTELLECTUAL PROPERTY.

7.1 **Client Property**. MBI acknowledges and agrees that, as between the Parties, Client Technology constitutes the sole and exclusive property of Client. Except as expressly set forth in Section 7.2, all right, title and interest in and to Results generated by or on behalf of MBI in the performance of Services under any SOW, including all patent and other intellectual property rights therein (collectively, "**Client Property**"), will be owned solely by Client. MBI hereby assigns to Client all right, title and interest in and to Client Property. MBI represents and warrants to Client that each employee, agent, consultant and subcontractor of MBI or its Affiliates performing any Services hereunder is obligated to assign all right, title and interest in and to Client Property to MBI. MBI shall, and shall cause its Affiliates and its and their employees, agents, consultants and subcontractors to, sign and deliver to Client all writings and do all such things as may be necessary or appropriate to vest in Client all right, title and interest in and to Client Property. Client may, in its sole discretion, file and prosecute in its own name and at its own expense, patent applications on any patentable inventions within the Results. Upon the request of Client, and at Client's expense, MBI will assist Client in the preparation, filing and prosecution of such patent applications and will execute and deliver any and all instruments necessary to effectuate the ownership of such patent applications and patents and to enable Client to file and prosecute such patent applications in any country.

7.2 **MBI Technology**. Client Property shall not include MBI Technology, and Client acknowledges and agrees that, as between the Parties, all MBI Technology is and shall continue to be owned solely and exclusively by MBI. In order to provide Client with freedom to operate with respect to any Results or GMP Product Batch delivered by MBI to Client pursuant to this Agreement, and subject to the terms and conditions of this Agreement, MBI hereby grants to Client a limited, worldwide, non-exclusive license, under MBI Technology solely to use Results or GMP Product Batch delivered by MBI to Client

hereunder to research, develop, make, have made, and use non-commercial products [***]. The foregoing license shall not include the right to sublicense to any party other than an Affiliate or relevant bona fide commercial partner, but Client, its Affiliates and relevant bona fide commercial partners shall have the right to use contract research organizations to perform such research, preclinical development and clinical development activities on behalf of Client. For clarity, and notwithstanding the foregoing or any other provision of this Agreement to the contrary, MBI does not grant, and Client shall not have, any license, under MBI Technology or otherwise, to [***].

7.3 **No Implied License**. Neither Client nor MBI grants or transfers to the other by operation of this Agreement any right or license under any patent right, copyright right, trademark right or other proprietary right of such Party, except as expressly set forth in this Agreement.

7.4 **Technology Transfer**. If Client elects to Manufacture Product, or to have Product Manufactured by a Third Party, then MBI will provide to Client or its designee, all Manufacturing related information, including documentation, technical assistance, materials and cooperation by appropriate employees of MBI as Client or its designee may reasonably require in order to Manufacture Product. Client will compensate MBI for such assistance at MBI's then standard hourly rate(s).

8. **CONFIDENTIALITY**.

8.1 **Confidentiality Obligation**. Except to the extent expressly authorized by this Agreement, the Receiving Party agrees that, during the Term and for [***] years thereafter (the "**Confidentiality Period**"), it shall keep confidential and shall not publish or otherwise disclose to any Third Party, and shall not use for any purpose other than as expressly provided for in this Agreement, any Confidential Information of the Disclosing Party The Receiving Party may disclose Confidential Information to those of the Receiving Party's Representatives who have a need for such Confidential Information, provided that the Receiving Party shall advise such Representatives of the confidential nature thereof, shall insure that each such Representative is bound in writing by obligations of confidentiality and non-use at least as stringent as those contained in this Agreement, and shall be responsible for the compliance of its Representatives with the terms of this Agreement. The Receiving Party shall use at least the same standard of care as it uses to protect proprietary or confidential information of its own (but in no event less than reasonable care) to ensure that its Representatives do not disclose or make any unauthorized use of the Confidential Information. The Receiving Party shall promptly notify the Disclosing Party upon discovery of any unauthorized use or disclosure of the Confidential Information.

8.2 **Exceptions**. The Receiving Party's obligations under Section 8.1 shall not apply to any information that the Receiving Party can prove by competent evidence: (a) is now, or hereafter becomes, through no act or failure to act on the part of the Receiving Party in breach of this Agreement, the Prior Agreement or any prior confidentiality agreement between the Parties hereto, generally known or available; (b) is known by the Receiving Party at the time of receiving such information from the Disclosing Party, as evidenced by its pre-existing written records; (c) is hereafter furnished to the Receiving Party by a Third Party, as a matter of right and without restriction on disclosure; or (d) is independently discovered or developed by the Receiving Party, without the aid, use, or application of any Confidential Information disclosed or made available to the Receiving Party by the Disclosing Party, as evidenced by the Receiving Party's contemporaneously-maintained written records.

8.3 **Authorized Disclosure**. Notwithstanding the provisions of Section 8.1, the Receiving Party may disclose Confidential Information, without violating its obligations under this Agreement, to the extent the disclosure is:

(a) required by a valid order of a court or other governmental body of competent jurisdiction or is otherwise required by Applicable Laws; provided that the Receiving Party shall, prior to disclosure, give reasonable prior written notice to the Disclosing Party of such required disclosure and, at the Disclosing Party's request and expense, shall cooperate with the Disclosing Party's efforts to contest such requirement, to obtain a protective order requiring that the Confidential Information so disclosed be used only for the purposes for which the order was issued or the law or regulation required, and/or to obtain other confidential treatment of such Confidential Information; or

(b) reasonably necessary to enforce the Receiving Party's rights under this Agreement.

8.4 **Confidentiality of this Agreement**. This Agreement and its terms are considered Confidential Information of both Parties, and each Party shall keep confidential and shall not publish or otherwise disclose the terms of this Agreement without the prior written consent of the other Party, except as expressly permitted by Section 8.3.

8.5 **Use of Names**. Except as otherwise required by Applicable Laws, neither Party shall make any public statement concerning this Agreement or the transactions contemplated by this Agreement or use the other Party's name or trademarks in any advertising, sales, or promotional material or in any publication without the prior written consent of the other Party.

9. **REPRESENTATIONS AND WARRANTIES; DISCLAIMER; LIMITATION OF LIABILITY**.

9.1 **Mutual Representations and Warranties**. Each Party represents and warrants to the other that: (a) it is duly organized and validly existing under the laws of its jurisdiction of incorporation or formation, and has full corporate or other power and authority to enter into this Agreement and to carry out the provisions hereof; (b) it is duly authorized to execute and deliver this Agreement and to perform its obligations hereunder; and (c) this Agreement is legally binding upon it, enforceable in accordance with its terms, and does not conflict with any agreement, instrument, or understanding, oral or written, to which it is a party or by which it may be bound.

9.2 **Limited Services Warranty**. MBI represents and warrants that (a) it will perform the Services under each SOW in a workmanlike manner and with professional diligence and skill in accordance with prevailing industry standards, and in material compliance with Agreed Standards and Applicable Laws; (b) the Services will be performed with requisite care, skill and diligence, by individuals who are appropriately trained and qualified; and (c) to MBI's knowledge as of the Effective Date, MBI has not received any written communication alleging that the practice of MBI Technology infringes the patent rights or misappropriates the trade secrets of any Third Party and it will promptly notify Client in writing should it become aware of any claims asserting such violation. In the event of a material error by MBI in the performance of any Services that renders the Results invalid, MBI shall, at Client's option and as Client's SOLE REMEDY, either (i) repeat those particular Services at MBI's expense, subject to Client providing MBI, at no cost to MBI, with any Client Materials and Client-Supplied Raw Materials necessary for the performance of such Services, or (ii) refund to Client the Fees actually paid for those particular Services. No claim for breach of MBI's warranty under this Section 9.2 with respect to Services performed under an SOW may be brought more than [***] months after completion of the applicable Project.

9.3 **Product Warranty**. MBI represents and warrants to Client with respect to each Batch of Product supplied hereunder that: (a) such Batch will have been Manufactured in material compliance with the Agreed Standards, Applicable Laws, the Quality Agreement and the Manufacturing Process; and (b) provided that Client has paid all relevant Fees and Expenses relating thereto, when delivered, Client will have good and marketable title, free and clear of any liability, pledge, lien, restriction, claim, charge,

security interest and/or other encumbrance, to such Batch of Product; provided, however, that MBI shall have no responsibility whatsoever with respect to any deficiency of Product that, directly or indirectly, is caused by or results from MBI's reliance on or use of Client Materials, Client-Supplied Raw Materials, and/or Client Information. Client's remedies for MBI's breach of this warranty shall include those expressly set forth in Section 5.4.

9.4 **No Debarment Warranty**. MBI, its Affiliates, approved subcontractors, and each of their respective officers and directors, as applicable, and any person used by MBI, its Affiliates or approved subcontractors to perform Services or Manufacturing under this Agreement: (i) have not been debarred and are not subject to a pending debarment pursuant to section 306 of the United States Food, Drug and Cosmetic Act, 21 U.S.C. § 335a; (ii) are not ineligible to participate in any federal and/or state healthcare programs or federal procurement or non-procurement programs (as that term is defined in 42 U.S.C. § 1320a-7b(f)); (iii) are not disqualified by any government or regulatory authorities from performing specific services, and are not subject to a pending disqualification proceeding; and (iv) have not been convicted of a criminal offense related to the provision of healthcare items or services and are not subject to any such pending action. MBI will notify Client immediately if MBI, its Affiliates, or approved subcontractors, or any person used to perform Services or Manufacturing under this Agreement, or any of their respective officers or directors, as applicable, is subject to the foregoing, or if any action, suit, claim, investigation, or proceeding relating to the foregoing is pending, or to the best of MBI's knowledge, is threatened.

9.5 **Client Warranties**. Client represents and warrants to MBI that (i) all Client Materials and Client-Supplied Raw Materials supplied by Client to MBI hereunder shall conform in all material respects to the applicable specifications, if any, for such Client Materials and Client-Supplied Raw Materials specified in the applicable SOW or the Quality Agreement (as applicable), in each case, as in effect at the time of delivery to MBI; and (ii) Client Information provided to MBI hereunder is, to Client's knowledge, true, accurate, complete and suitable in all material respects for the performance of the relevant Services under the applicable SOW. Client hereby covenants to MBI to use all Results and Product(s) delivered to Client hereunder at all times in accordance with Applicable Laws.

9.6 **Disclaimer**. Except as expressly set forth herein, EACH PARTY EXPRESSLY DISCLAIMS ANY AND ALL WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, THE WARRANTIES OF DESIGN, MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NON-INFRINGEMENT OF THE INTELLECTUAL PROPERTY RIGHTS OF THIRD PARTIES, OR ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICES. Without limiting the generality of the foregoing, Client acknowledges and agrees that, due to the complex nature of the subject matter hereof, MBI does not make, and hereby disclaims, any representation or warranty: (a) as to the safety or usefulness for any purpose of any Results or Product delivered hereunder, including, without limitation, the safety or usefulness of any Results or Product for Client's intended use thereof; (b) that MBI's performance of the Services or Manufacturing will yield a specific desired result; or (c) that any Results or Product will be acceptable to any regulatory governmental agency to which it is presented, or that Client will be able to market or otherwise exploit any product obtained from the use thereof.

9.7 **Limitation of Liability**. EXCEPT FOR LIABILITY FOR BREACH OF THE OBLIGATIONS IN ARTICLE 7.3, INFRINGEMENT OF THE OTHER PARTY'S INTELLECTUAL PROPERTY, OR INTENTIONAL BREACH OF CONTRACT, GROSS NEGLIGENCE OR WILLFUL MISCONDUCT, IN NO EVENT SHALL EITHER PARTY BE ENTITLED TO RECOVER FROM THE OTHER PARTY ANY SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR PUNITIVE DAMAGES ARISING OUT OF OR IN CONNECTION WITH THIS AGREEMENT, EVEN IF THE OTHER PARTY HAD NOTICE OF THE POSSIBILITY OF SUCH DAMAGES In addition, in no event shall: (a) MBI's aggregate liability to Client arising out of or relating to this Agreement exceed [***] the total Fees paid or

payable by Client to MBI under the applicable SOW giving rise to such liability during the [***] month period immediately preceding the event giving rise to such liability; and (b) MBI have any liability whatsoever to Client or any Third Party arising out of or in connection with the research, development, manufacture, use, handling, storage, sale or other disposition of any Product by or on behalf of Client or any of its Affiliates or licensees.

9.8 **Liability for Clinical Trials**. As between MBI and Client, Client agrees that it shall be Client's sole responsibility to determine that Product will be safe for human use, and Client hereby assumes the sole responsibility and liability for any injuries, claims, actions, damages, losses, or liability of any kind, including direct, indirect, incidental, consequential, or punitive damages resulting from or arising out of or in connection with the administration, possession, use, misuse, or nonuse of the Product, by or on behalf of Client or its Affiliates in clinical trials or other studies or treatment involving human subjects, provided that any such claims, actions, etc. are not the result of the gross negligence or willful misconduct of MBI, and Client agrees to defend, indemnify and hold MBI harmless from and against any Third Party claims arising therefrom, in accordance with Section 11.1 below.

9.9 **Insurance**. Each Party agrees to self-insure, or to provide and maintain during the Term of this Agreement, at its sole expense, comprehensive insurance, including general liability insurance and product liability insurance, covering the Party's respective activities in connection with this Agreement, in accordance with Applicable Laws. The insurance shall provide appropriate limits of liability in accordance with generally accepted standards. Each Party will upon reasonable request furnish to the other certificates of insurance evidencing that such insurance is in effect. Each Party shall serve prompt notice on the other in the event that such insurance should be materially adversely changed or terminated for any reason.

10. TERM AND TERMINATION.

10.1 **Term**. The term of this Agreement shall commence on the Effective Date and, subject to earlier termination of this Agreement in accordance with this Article 10, shall continue for a period of three (3) years from the Effective Date and thereafter shall automatically renew for successive one (1)-year periods, unless either Party provides written notice to the other Party of its desire not to renew at least ninety (90) days prior to the expiration of the then-current term (the initial three-year term, together with any renewal terms, collectively, the "**Term**"); provided, however, that if Services or Manufacturing under any SOW are in progress as of the expiration of the Term, this Agreement shall continue in effect solely with respect to such Services or Manufacturing until completion of such Services or Manufacturing or the earlier termination of such SOW in accordance with this Article 10.

10.2 **Termination for Material Breach**. Each Party shall have the right to terminate this Agreement or any SOW upon sixty (60) days' (or, in the case of breach of any payment obligation, fifteen (15) days') prior written notice to the other Party upon or after the material breach of this Agreement or any SOW by the other Party if the breaching Party has not cured such breach by the end of such sixty (60)-day (or fifteen (15)-day, as applicable) period. If such notice of breach is for breach of an SOW, such notice shall note the specific SOW under which such breach is claimed. Notwithstanding the foregoing, in the event of a good faith dispute as to whether performance has been made by either Party pursuant to this Agreement, including any good faith dispute as to payments due under this Agreement, the relevant cure period with respect thereto will be tolled pending resolution of such dispute in accordance with the applicable provisions of this Agreement; provided, that if such dispute relates to payment, the cure period will only apply with respect to payment of disputed amounts, and not with respect to undisputed amounts.

10.3 **Termination at Will**. Client may terminate this Agreement or any SOW at any time upon (a) ninety (90) days' prior written notice to MBI, or (b) written notice to MBI following a Bankruptcy Event.

10.4 **Payment Upon Termination**. In the event of termination of this Agreement before completion of the Services or Manufacturing specified in any SOW, or termination of any SOW before completion of the Services or Manufacturing specified in such SOW, Client shall pay MBI for all Services or Manufacturing completed through the date of termination in accordance with this Agreement and such SOW, including, except as provided for below, reasonable and documented out-of-pocket costs and non- cancellable obligations incurred by MBI in accordance with this Agreement and such SOW and Expenses incurred by MBI in accordance with Section 4.2, and if applicable, the Cancellation Fee(s) due under Section 3.4 with respect to any Manufacturing run cancelled by virtue of such termination, prior to MBI's delivery of all relevant Client Property and completed GMP Product Batches (as applicable) to Client. As promptly as practicable after the termination of any SOW (either individually or as a result of termination of this Agreement), MBI shall deliver to Client a written itemized statement of (i) all Services or Manufacturing performed under such SOW, (ii) the Fees payable by Client for such Services or Manufacturing, and (iii) the actual Expenses and non-cancelable Expenses reasonably incurred by MBI in accordance with this Agreement and such SOW, and (iv) if applicable, the Cancellation Fee(s) payable by Client under Section 3.4, and Client shall pay the undisputed invoiced amount within [***] days of receipt of invoice. MBI shall use commercially reasonable efforts to mitigate the amounts payable by Client hereunder in the case of early termination.

10.5 **Return of Confidential Information and Client Materials**. In the event of expiration or termination of this Agreement, the Receiving Party shall return to the Disclosing Party all Confidential Information of the Disclosing Party (including all copies thereof) in the Receiving Party's possession; provided, however, that the Receiving Party may retain one copy of such Confidential Information in the Receiving Party's secure archives for the sole purpose of monitoring compliance with its obligations hereunder or as required by Applicable Laws. Further, upon request, MBI will also promptly return all Client Materials and Client-Supplied Raw Materials, at Client's expense.

10.6 **Accrued Rights; Survival**. Except as expressly set forth in Section 10.4 or 10.5 or in this Section 10.6, upon expiration or any termination of this Agreement, all rights and obligations of the Parties under this Agreement shall terminate and be of no further force or effect. Notwithstanding the forgoing, the rights and obligations of this Agreement will survive and control all SOWs, under which Services or Manufacturing are still being performed by MBI, despite the expiration or termination of this Agreement. The expiration or termination of this Agreement for any reason shall not release either Party from any liability or obligation that, at the time of such expiration or termination, has already accrued to the other Party or that is attributable to a period prior to such expiration or termination, nor will expiration or any termination of this Agreement preclude either Party from pursuing all rights and remedies it may have under this Agreement, or at law or in equity, with respect to breach of this Agreement. In the event of expiration or any termination of this Agreement, the provisions of Sections [***] of this Agreement shall survive such expiration or termination in accordance with their respective terms and conditions.

11. **INDEMNIFICATION**.

11.1 **By Client**. Client hereby agrees to save, defend, indemnify, and hold harmless MBI and its Representatives (each, an "**MBI Indemnitee**") from and against any and all losses, damages (including direct, indirect, incidental, consequential, or punitive damages), expenses, costs (including reasonable legal expense and attorneys' fees) and liabilities of any kind (collectively, "**Losses**"), to which any MBI Indemnitee may become subject as a result of any claim, demand, action, or other proceeding by any Third Party (each a "**Third-Party Claim**") to the extent such Losses arise directly or indirectly out of: (a) the transfer or disclosure to MBI of Client Materials, Client Information or Client-Supplied Raw Materials; (b) the research, development, manufacture, use, handling, storage, sale, or other disposition by or on behalf of Client or any of its Affiliates or Third Party licensees, of any Result or Product; (c) the gross negligence or willful misconduct of any Client Indemnitee (defined below); or (d) the breach by Client of any warranty,

representation, covenant, or agreement made by Client in this Agreement; except, in each case, to the extent such Losses result from the gross negligence or willful misconduct of any MBI Indemnitee or the breach by MBI of any warranty, representation, covenant, or agreement made by MBI in this Agreement.

11.2 **By MBI**. MBI hereby agrees to save, defend, indemnify, and hold harmless Client and its Representatives (each, a "**Client Indemnitee**") from and against any and all Losses to which any Client Indemnitee may become subject as a result of any Third-Party Claim, to the extent such Losses arise directly or indirectly out of: (a) the gross negligence or willful misconduct of any MBI Indemnitee; or (b) the breach by MBI of any warranty, representation, covenant, or agreement made by MBI in this Agreement; except, in each case, to the extent such Losses result from the gross negligence or willful misconduct of any Client Indemnitee or the breach by Client of any warranty, representation, covenant or agreement made by Client in this Agreement.

11.3 **Control of Defense**. In the event a Client Indemnitee or MBI Indemnitee seeks indemnification under Section 11.1 or Section 11.2, it shall: (a) inform the other Party (the "**Indemnifying Party**") of a Third-Party Claim as soon as reasonably practicable (and in any event within [***] days) after it receives notice of the claim; (b) shall permit the Indemnifying Party to assume direction and control of the defense of the claim (including the right to settle the claim solely for monetary consideration with no admission of fault and using legal counsel of its choice) at the Indemnifying Party's expense; and (c) shall cooperate as reasonably requested (at the expense of the Indemnifying Party) in the defense of the claim; provided, however, no Indemnitee shall be required to admit fault or responsibility in connection with any settlement. An Indemnitee's failure to perform any obligations under this Section shall not relieve the Indemnifying Party of its obligations under this Article 11 except to the extent that the Indemnifying Party can demonstrate that it has been materially prejudiced as a result of such failure. An Indemnitee shall have the right participate in and observe the proceedings through its own separate legal counsel at its own expense.

12. **MISCELLANEOUS**.

12.1 **Compliance with Laws; Cooperation**. In exercising their rights under this Agreement and the applicable SOWs, and performing any obligations thereunder, the Parties shall fully comply in all material respects with the requirements of any and all Applicable Laws of any governmental body having jurisdiction over the exercise of rights under this Agreement. Each Party shall make reasonable efforts to furnish to the other Party any information reasonably requested or required by that Party during the Term of this Agreement or any extensions thereof to enable the requesting Party to comply with the requirements of any U.S., state and/or government agency.

12.2 **Non-Solicitation**. During the Term and for [***] months thereafter, neither Party shall solicit or seek to hire as an employee, or solicit or seek to engage as a consultant, any current employee of the other Party that was involved in the provision or utilization of Services or Manufacturing; provided, however, that this provision will not prevent either Party from causing to be placed any general advertisement or similar notice, including in newspapers, trade publications, through social media, on internet job boards and sites, or use of professional recruiters, that is not targeted specifically at employees of the other Party.

12.3 **Independent Contractor Relationship**. MBI's relationship with Client is that of an independent contractor, and nothing in this Agreement should be construed to create a partnership, joint venture, or employer-employee relationship. Neither Party is an agent of the other Party or authorized to make any representation, contract, or commitment on behalf of the other Party. MBI will be responsible for and will withhold and/or pay any and all applicable federal, state or local taxes, payroll taxes, workers' compensation contributions, unemployment insurance contributions, or other payroll deductions from the

compensation of MBI's employees and other MBI personnel. MBI understands and agrees that it is solely responsible for such matters and that it will indemnify Client and hold Client harmless from all claims and demands in connection with such matters.

12.4 **Entire Agreement; Amendment**. This Agreement (including the SOWs and Exhibit(s) attached hereto) constitutes the final, complete, and exclusive agreement of the Parties with respect to the subject matter hereof. For clarity and notwithstanding the foregoing, any SOW executed by the Parties expressly referencing the Prior Agreement shall be governed by the Prior Agreement and not this Agreement, and any SOW executed by the Parties expressly referencing this Agreement shall be governed by this Agreement and not the Prior Agreement. This Agreement (including its Exhibits and SOWs) may not be changed, modified, amended, or supplemented except by a written instrument signed by both Parties.

12.5 **Non-Waiver**. The failure of a Party to insist upon strict performance of any provision of this Agreement or to exercise any right arising out of this Agreement shall neither impair that provision or right nor constitute a waiver of that provision or right, in whole or in part, in that instance or in any other instance. Any waiver by a Party of a particular provision or right shall be in writing, shall be as to a particular matter and, if applicable, for a particular period of time and shall be signed by such Party.

12.6 **Severability**. If any provision of this Agreement should be held invalid or unenforceable, the remaining provisions shall be unaffected and shall remain in full force and effect, to the extent consistent with the intent of the Parties as evidenced by this Agreement as a whole and the invalid or unenforceable provision will be changed and interpreted so as to best accomplish the objectives of such unenforceable or invalid provision and the intent of the Parties, within the limits of Applicable Laws.

12.7 **Assignment**. Neither this Agreement nor any rights or obligations hereunder may be assigned by either Party without the prior written consent of the other Party (which consent shall not be unreasonably withheld); provided, however, that either Party may assign this Agreement and its rights and obligations hereunder without the other Party's consent (but with notice to the other Party): (a) in connection with the transfer or sale of all or substantially all of the business of such Party to which this Agreement relates to a Third Party, whether by merger, sale of stock, sale of assets, or otherwise; or (b) to an Affiliate, provided that the assigning Party shall remain liable and responsible to the non-assigning Party hereto for the performance and observance of all such duties and obligations by such Affiliate. The rights and obligations of the Parties under this Agreement shall be binding upon and inure to the benefit of the successors and permitted assigns of the Parties and the name of a Party appearing herein will be deemed to include the name of such Party's successors and permitted assigns to the extent necessary to carry out the intent of this section. Any assignment not in accordance with this Agreement shall be void.

12.8 **Governing Law; Venue**. This Agreement and any dispute arising from the performance or breach hereof or any SOW executed hereunder shall be governed by and construed and enforced in accordance with the laws of the State of Delaware and the federal laws of the United States of America, without reference to conflicts of laws principles. The exclusive venue of any dispute arising out of or in connection with the performance or breach of this Agreement shall be the state and/or federal courts in the State of Delaware, USA, and the Parties hereby consent to the personal jurisdiction of such courts. [***]. Notwithstanding the foregoing, a Party may apply to any court of competent jurisdiction for temporary or preliminary injunctive relief.

12.9 **Force Majeure**. Except for the obligation to make payment when due, each Party shall be excused from liability for the failure or delay in performance of its obligations under this Agreement, upon prompt written notice of such cause being given to the other Party, by reason of any force majeure event beyond such Party's reasonable control including but not limited to Acts of God, fire, flood, explosion, earthquake, or other natural forces, war, civil unrest, acts of terrorism, accident, destruction, or

other casualty, any lack or failure of transportation facilities or public utilities, any lack or failure of supply of raw materials, any strike or labor disturbance, or any other event similar to those enumerated above. Such excuse from liability shall be effective only to the extent and duration of the event(s) causing the failure or delay in performance and provided that the Party has not caused such event(s) to occur and the Party so affected shall use its commercially reasonable efforts to avoid or remove the cause or causes of nonperformance and observance expeditiously. All delivery dates under this Agreement that have been affected by force majeure shall be tolled for the duration of such force majeure.

12.10 **Notices**. Any notice to be given under this Agreement must be in writing and delivered either in person, by any method of certified or registered mail (postage prepaid, return receipt requested), or by internationally-recognized express courier (such as FedEx, UPS, DHL), or by email, to the Party to be notified at its address(es) given below, or at any address such Party has previously designated by prior written notice to the other pursuant to the foregoing. Notice shall be deemed sufficiently given for all purposes upon the date of confirmed receipt, including, if delivered by email, upon the date upon which the receipt of such email is confirmed by the recipient thereof by return email or other written or electronic confirmation.

If to MBI: Miltenyi Biotec, Inc.
2303 Lindbergh Road
Auburn, CA 95602
Attn: General Manager
[***]

with a copy to: Miltenyi Biotec, Inc.
2303 Lindbergh Road
Auburn, CA 95602
Attn: Finance Dept.
[***]

And to: Miltenyi Biotec B.V. & Co. KG
Friedrich-Ebert-Straße 68
51429 Bergisch Gladbach
Germany
Attn: Group General Counsel

If to Client: AVROBIO, Inc.
One Kendall Square
Building 300, Suite 201
Cambridge, MA 02139, USA
Attn: Chief Executive Officer
[***]

With a copy to: General Counsel at the same address
[***]

12.11 **Interpretation**. The headings of clauses contained in this Agreement preceding the text of the sections, subsections, and paragraphs hereof are inserted solely for convenience and ease of reference only and shall not constitute any part of this Agreement, or have any effect on its interpretation or construction. In this Agreement, (i) the meaning of defined terms shall be equally applicable to both the singular and plural forms of the terms defined; (ii) "or" and "any" are not exclusive; and (iii) the use of the words "including," "includes" and "include" in this Agreement to refer to specific examples shall be

construed to mean "including, without limitation" or "including, but not limited to" and shall not be construed to mean that the examples given are an exclusive list of the topics covered; and (iv) a reference to a law includes any amendment or modification to such law and any rules or regulations issued thereunder. Unless otherwise specified, references in this Agreement to any Article shall include all Sections, subsections, and paragraphs in such Article, references to any Section shall include all subsections and paragraphs in such Section, and references in this Agreement to any subsection shall include all paragraphs in such subsection. Ambiguities and uncertainties in this Agreement, if any, shall not be interpreted against either Party, irrespective of which Party may be deemed to have caused the ambiguity or uncertainty to exist. This Agreement has been prepared in the English language, and the English language shall control its interpretation. In addition, all notices required or permitted to be given hereunder, and all written, electronic, oral, or other communications between the Parties regarding this Agreement shall be in the English language.

12.12 **No Third Party Rights**. The provisions of this Agreement are for the exclusive benefit of the Parties and their successors and permitted assigns, and no other person shall have any right or claim against any Party by reason of these provisions or be entitled to enforce any of these provisions against any Party.

12.13 **Counterparts**. This Agreement, including any SOWs and Change Orders, may be executed in counterparts, each of which shall be deemed an original document, and all of which, together with this writing, shall be deemed one instrument. The signatures of the Parties to this Agreement may be transmitted as a PDF attachment to electronic mail, and such PDF will, for all purposes, be deemed to be the original signature of such Party whose signature it reproduces and will be binding upon such Party.

REMAINDER OF PAGE LEFT INTENTIONALLY BLANK

SIGNATURE PAGE TO FOLLOW

IN WITNESS WHEREOF, the Parties hereto have executed this Master Services Agreement on the Effective Date.

MILTENYI BIOTEC, INC.	**AVROBIO, INC.**
By: /s/ Leonard Pulig	By: /s/ Kim Raineri
Name: Leonard Pulig	Name: Kim Raineri
Title: President and General Manager	Title: Chief Manufacturing and Technology Officer

EXHIBIT A

STATEMENTS OF WORK

Exhibit 31.1

CERTIFICATION PURSUANT TO
RULES 13a-14(a) AND 15d-14(a) UNDER THE SECURITIES EXCHANGE ACT OF 1934,
AS ADOPTED PURSUANT TO SECTION 302 OF THE SARBANES-OXLEY ACT OF 2002

I, Geoff MacKay, certify that:

1. I have reviewed this Quarterly Report on Form 10-Q of AVROBIO, Inc.;

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

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

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

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

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

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

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

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

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

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

Date: August 9, 2022

By: /s/ Geoff MacKay

Geoff MacKay
Chief Executive Officer
(Principal Executive Officer)

Exhibit 31.2

CERTIFICATION PURSUANT TO
RULES 13a-14(a) AND 15d-14(a) UNDER THE SECURITIES EXCHANGE ACT OF 1934,
AS ADOPTED PURSUANT TO SECTION 302 OF THE SARBANES-OXLEY ACT OF 2002

I, Erik Ostrowski, certify that:

1. I have reviewed this Quarterly Report on Form 10-Q of AVROBIO, Inc.;

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

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

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

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

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

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

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

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

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

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

Date: August 9, 2022

By: /s/ Erik Ostrowski

Erik Ostrowski
Chief Financial Officer
(Principal Financial Officer)

Exhibit 32.1

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

In connection with the Quarterly Report of AVROBIO, Inc. (the "Company") on Form 10-Q for the period ending June 30, 2022 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), each of the undersigned officers of the Company certifies, pursuant to 18 U.S.C. § 1350, as adopted pursuant to § 906 of the Sarbanes-Oxley Act of 2002, to the best of his or her knowledge that:

(1) The Report fully complies with the requirements of section 13(a) or 15(d) of the Securities Exchange Act of 1934; and

(2) The information contained in the Report fairly presents, in all material respects, the financial condition and result of operations of the Company.

Date: August 9, 2022 By: /s/ Geoff MacKay

Geoff MacKay
Chief Executive Officer
(Principal Executive Officer)

Date: August 9, 2022 By: /s/ Erik Ostrowski

Erik Ostrowski
Chief Financial Officer
(Principal Financial Officer)