Table of Contents

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

FORM 10-Q

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

For the quarterly period ended June 30, 2019.

☐ **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: 001-37625

Voyager Therapeutics, Inc.
(Exact name of Registrant as specified in its charter)

Delaware	**46-3003182**
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification No.)**
75 Sidney Street, Cambridge, Massachusetts	**02139**
(Address of principal executive offices)	**(Zip Code)**

(857) 259-5340
(Registrant's telephone number, including area code)

Not Applicable
(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, $0.001 par value	VYGR	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, a 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 ☒

The number of outstanding shares of the registrant's common stock, par value $0.001 per share, as of August 2, 2019 was 36,933,937.

Forward-Looking Statements

This Quarterly Report on Form 10-Q contains forward-looking statements that involve substantial risks and uncertainties. All statements other than statements of historical facts contained in this Quarterly Report on Form 10-Q, including statements regarding our strategy, future operations, future financial position, future revenue, projected costs, prospects, plans, objectives of management and expected market growth, are forward-looking statements. These statements involve known and unknown risks, uncertainties and other important factors that may cause our actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by the forward-looking statements.

The words “anticipate,” “believe,” “estimate,” “expect,” “intend,” “may,” “might,” “plan,” “predict,” “project,” “target,” “potential,” “contemplate,” “anticipate,” “goals,” “will,” “would,” “could,” “should,” “continue,” and similar expressions are intended to identify forward-looking statements, although not all forward-looking statements contain these identifying words. These forward-looking statements include, among other things, statements about:

- our plans to develop and commercialize our product candidates based on adeno-associated virus, or AAV, gene therapy;
- our ability to identify and optimize product candidates and novel AAV gene therapy capsids;
- our ongoing and planned clinical trials and related timelines, including our ability to continue to advance VY-AADC as a treatment for Parkinson’s disease through the Phase 1b clinical trial, the separate Phase 1 clinical trial, and the RESTORE-1 Phase 2 clinical trial, and our preclinical development efforts and studies;
- formulation changes to our product candidates that may require us to conduct additional clinical studies to bridge our modified product candidates to earlier versions;
- the timing of and our ability to submit applications, and obtain and maintain regulatory approvals for our product candidates, including our ability to file Investigational New Drug applications for our programs including VY-HTT01 for the treatment of Huntington’s disease, VY-SOD102 for the treatment of a monogenic form of amyotrophic lateral sclerosis, and VY-FXN01 for the treatment of Friedreich’s ataxia;
- our estimates regarding expenses, future revenues, capital requirements, and needs for additional financing;
- our ability to continue to develop our gene therapy platform;
- our ability to develop a manufacturing capability compliant with current good manufacturing practices for our product candidates;
- our ability to access, develop, and obtain regulatory clearance for devices to deliver our AAV gene therapies to critical targets of neurological disease;
- our intellectual property position and our ability to obtain, maintain and enforce intellectual property protection for our proprietary assets;
- our estimates regarding the size of the potential markets for our product candidates and our ability to serve those markets;
- the rate and degree of market acceptance of our product candidates for any indication once approved;
- our strategic collaborations with AbbVie Biotechnology Ltd and AbbVie Ireland Unlimited Company, or collectively AbbVie, and Neurocrine Biosciences, Inc., or Neurocrine, including the possibility and timing of AbbVie exercising its options to certain of our programs as specified in the applicable collaboration agreements;

- our plans and ability to raise additional capital, including through equity offerings, debt financings, collaborations, strategic alliances, and licensing arrangements;
- our competitive position and the success of competing products that are or become available for the indications that we are pursuing;
- the impact of government laws and regulations including in the United States, the European Union, and other important geographies such as Japan;
- our ability to maintain consistency with results from the Phase 1b clinical trial and the separate Phase 1 clinical trial focused on posterior trajectory in future clinical trials, including the RESTORE-1 Phase 2 trial; and
- our ability to enter into future collaborations, strategic alliances, or licensing arrangements.

These forward-looking statements are only predictions and we may not actually achieve the plans, intentions or expectations disclosed in our forward-looking statements. You should not place undue reliance on our forward-looking statements. Actual results or events could differ materially from the plans, intentions and expectations disclosed in the forward-looking statements we make. We have based these forward-looking statements largely on our current expectations and projections about future events and trends that we believe may affect our business, financial condition and operating results. We have included important factors in the cautionary statements included in this Quarterly Report on Form 10-Q, particularly in “Part II, Item 1A - Risk Factors,” and in “Part I, Item 1A – Risk Factors” included in our Annual Report on Form 10-K filed with the Securities and Exchange Commission on February 26, 2019 that could cause actual future results or events to differ materially from the forward-looking statements that we make. Our forward-looking statements do not reflect the potential impact of any future acquisitions, mergers, dispositions, joint ventures or investments we may make.

You should read this Quarterly Report on Form 10-Q and the documents that we have filed as exhibits to this Quarterly Report on Form 10-Q with the understanding that our actual future results may be materially different from what we expect. We do not assume any obligation to update any forward-looking statements whether as a result of new information, future events or otherwise, except as required by applicable law.

VOYAGER THERAPEUTICS, INC.

FORM 10-Q

TABLE OF CONTENTS

PART I. FINANCIAL INFORMATION

Voyager Therapeutics, Inc.
Condensed Consolidated Balance Sheets
(amounts in thousands, except share and per share data)
(unaudited)

	June 30, 2019	December 31, 2018
Assets		
Current assets:		
Cash and cash equivalents	$ 79,885	$ 46,859
Marketable securities, current	247,577	108,947
Collaboration receivable	8,242	—
Unbilled receivable	1,821	—
Prepaid expenses and other current assets	3,250	6,675
Total current assets	340,775	162,481
Property and equipment, net	14,493	12,771
Deposits and other non-current assets	2,003	1,149
Operating lease, right-of-use asset	30,041	—
Marketable securities, non-current	1,280	628
Total assets	$ 388,592	$ 177,029
Liabilities and stockholders' equity		
Current liabilities:		
Accounts payable	$ 2,230	$ 1,038
Accrued expenses	11,782	9,788
Other current liabilities	2,843	—
Deferred revenue, current	52,291	20,847
Total current liabilities	69,146	31,673
Deferred revenue, non-current	167,436	92,199
Other non-current liabilities	33,606	6,711
Total liabilities	270,188	130,583
Commitments and contingencies (see note 8)		
Stockholders' equity:		
Preferred stock $0.001 par value: 5,000,000 shares authorized at June 30, 2019 and December 31, 2018; no shares issued and outstanding at June 30, 2019 and December 31, 2018	—	—
Common stock, $0.001 par value: 120,000,000 shares authorized at June 30, 2019 and December 31, 2018; 36,677,608 and 32,364,895 shares issued and outstanding at June 30, 2019 and December 31, 2018, respectively	37	32
Additional paid-in capital	403,334	315,598
Accumulated other comprehensive income (loss)	101	(133)
Accumulated deficit	(285,068)	(269,051)
Total stockholders' equity	118,404	46,446
Total liabilities and stockholders' equity	$ 388,592	$ 177,029

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

Voyager Therapeutics, Inc.
Condensed Consolidated Statements of Operations and Comprehensive Income (Loss)
(amounts in thousands, except share and per share data)
(unaudited)

	Three Months Ended June 30,		Six Months Ended June 30,	
	2019	2018	2019	2018
Collaboration revenue	$ 46,087	$ 2,575	$ 51,284	$ 3,517
Operating expenses:				
Research and development	28,576	16,507	53,407	31,360
General and administrative	8,322	11,762	17,981	18,945
Total operating expenses	36,898	28,269	71,388	50,305
Operating income (loss)	9,189	(25,694)	(20,104)	(46,788)
Other income:				
Interest income	2,097	870	3,242	1,458
Other (expense) income, net	(133)	(717)	845	(318)
Total other income	1,964	153	4,087	1,140
Income (loss) before income taxes	11,153	(25,541)	(16,017)	(45,648)
Income tax benefit	—	—	—	180
Net income (loss)	$ 11,153	$ (25,541)	$ (16,017)	$ (45,468)
Other comprehensive income				
Net unrealized gain on available-for-sale securities	176	37	234	42
Cumulative effect adjustment resulting from ASU No. 2016-01	—	—	—	120
Total other comprehensive income	176	37	234	162
Comprehensive income (loss)	$ 11,329	$ (25,504)	$ (15,783)	$ (45,306)
Net income (loss) per share, basic	$ 0.30	$ (0.80)	$ (0.46)	$ (1.43)
Net income (loss) per share, diluted	$ 0.29	$ (0.80)	$ (0.46)	$ (1.43)
Weighted-average common shares outstanding, basic	36,610,918	31,976,922	34,990,989	31,868,995
Weighted-average common shares outstanding, diluted	37,941,257	31,976,922	34,990,989	31,868,995

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

Voyager Therapeutics, Inc.
Condensed Consolidated Statements of Stockholders' Equity
(amounts in thousands, except share data)
(unaudited)

	Common Stock Shares	Common Stock Amount	Additional Paid-In Capital	Accumulated Other Comprehensive Income (Loss)	Accumulated Deficit	Stockholders' Equity (Deficit)
Balance at December 31, 2017	31,572,044	$ 32	$ 295,019	$ (287)	$ (160,713)	$ 134,051
Vesting of restricted stock	145,829	—	3	—	—	3
Exercises of vested stock options	132,733	—	1,412	—	—	1,412
Issuance of common stock under ESPP	38,392	—	418	—	—	418
Stock-based compensation expense	—	—	2,260	—	—	2,260
Life-to-date cumulative catchup on equity securities	—	—	—	120	—	120
Unrealized gain on available-for-sale securities, net of tax	—	—	—	5	—	5
Modified retrospective adjustment to beginning accumulated deficit and deferred revenue resulting from ASU No. 2014-09	—	—	—	—	(20,050)	(20,050)
Net loss	—	—	—	—	(19,926)	(19,926)
Balance at March 31, 2018	31,888,998	$ 32	$ 299,112	$ (162)	$ (200,689)	$ 98,293
Vesting of restricted stock	61,632	—	3	—	—	3
Exercises of vested stock options	113,318	—	1,116	—	—	1,116
Stock-based compensation expense	—	—	8,065	—	—	8,065
Unrealized gain on available-for-sale securities, net of tax	—	—	—	37	—	37
Net loss	—	—	—	—	(25,541)	(25,541)
Balance at June 30, 2018	32,063,948	$ 32	$ 308,296	$ (125)	$ (226,230)	$ 81,973
Balance at December 31, 2018	32,364,895	$ 32	$ 315,598	$ (133)	$ (269,051)	$ 46,446
Exercises of vested stock options	31,360	1	283	—	—	284
Issuance of common stock in connection with the Neurocrine Collaboration Agreement	4,179,728	4	77,613	—	—	77,617
Stock-based compensation expense	—	—	3,459	—	—	3,459
Unrealized gain on available-for-sale securities, net of tax	—	—	—	58	—	58
Net loss	—	—	—	—	(27,170)	(27,170)
Balance at March 31, 2019	36,575,983	$ 37	$ 396,953	$ (75)	$ (296,221)	$ 100,694
Exercises of vested stock options	57,461	—	714	—	—	714
Issuance of common stock under ESPP	44,164	—	471	—	—	471
Stock-based compensation expense	—	—	5,196	—	—	5,196
Unrealized gain on available-for-sale securities, net of tax	—	—	—	176	—	176
Net income	—	—	—	—	11,153	11,153
Balance at June 30, 2019	36,677,608	$ 37	$ 403,334	$ 101	$ (285,068)	$ 118,404

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

Voyager Therapeutics, Inc.
Condensed Consolidated Statements of Cash Flows
(amounts in thousands)
(unaudited)

	Six Months Ended June 30,	
	2019	**2018**
Cash flow from operating activities		
Net loss	$ (16,017)	$ (45,468)
Adjustments to reconcile net loss to net cash provided by operating activities:		
Stock-based compensation expense	8,771	10,436
Depreciation	1,292	972
Amortization of premiums and discounts on marketable securities	(1,844)	(908)
In-kind research and development expenses	616	176
Other non-cash items	(832)	355
Changes in operating assets and liabilities:		
Collaboration receivable	(8,242)	—
Unbilled receivable	(1,821)	—
Prepaid expenses and other current assets	2,966	(1,384)
Operating lease, right-of-use asset	1,382	—
Other non-current assets	(674)	(180)
Accounts payable	1,192	538
Accrued expenses	1,977	(3,911)
Operating lease liabilities	(1,226)	—
Deferred revenue	106,065	65,482
Net cash provided by operating activities	93,605	26,108
Cash flow from investing activities		
Purchases of property and equipment	(3,168)	(2,933)
Proceeds from sale of equipment	171	—
Purchases of marketable securities	(314,352)	(205,037)
Proceeds from maturities of marketable securities	177,800	207,000
Net cash used in investing activities	(139,549)	(970)
Cash flow from financing activities		
Proceeds from the exercise of stock options	998	2,528
Proceeds from the issuance of common stock in connection with the Neurocrine Collaboration Agreement, net	77,617	—
Proceeds from the purchase of common stock under ESPP	355	418
Net cash provided by financing activities	78,970	2,946
Net increase in cash, cash equivalents, and restricted cash	33,026	28,084
Cash, cash equivalents, and restricted cash beginning of period	47,594	32,265
Cash, cash equivalents, and restricted cash end of period	$ 80,620	$ 60,349
Supplemental disclosure of cash and non-cash activities		
Capital expenditures incurred but not yet paid	$ 17	$ —
Impact of adopting new accounting standards	$ —	$ 20,050

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

VOYAGER THERAPEUTICS, INC.

NOTES TO UNAUDITED CONDENSED CONSOLIDATED FINANCIAL STATEMENTS

1. Nature of business

Voyager Therapeutics, Inc. (the "Company") is a clinical-stage gene therapy company focused on developing life-changing treatments for patients suffering from severe neurological diseases. The Company is focused on neurological diseases where it believes an adeno-associated virus ("AAV") gene therapy approach that either increases or decreases the production of a specific protein can slow or reduce the symptoms experienced by patients, and therefore have a clinically meaningful impact. The Company has built a gene therapy platform that it believes positions itself to be a leading company at the intersection of AAV gene therapy and severe neurological disease. The Company's gene therapy platform enables it to engineer, optimize, manufacture and deliver its AAV-based gene therapies that have the potential to provide durable efficacy following a single administration.

Additionally, the Company is working to identify novel AAV capsids, which are the outer viral protein shells that enclose the genetic material of the virus payload. The Company's team of experts in the fields of AAV gene therapy and neuroscience first identifies and selects severe neurological diseases that are well-suited for treatment using AAV gene therapy. The Company then engineers and optimizes AAV vectors for delivery of the virus payload to the targeted tissue or cells. The Company's manufacturing process employs an established system that it believes will enable production of high quality AAV vectors at commercial scale. In addition to the Company's capsid optimization efforts, it leverages novel delivery paradigms, established routes of administration, and advances in dosing techniques to optimize delivery of its AAV gene therapies to target tissues, regions and cell types that are critical to the disease of interest. The Company believes it can achieve this directly, with targeted infusions to discrete regions of the brain or spinal cord, or systemically, in conjunction with its novel capsids.

The Company's business strategy focuses on discovering, developing, manufacturing, and commercializing its gene therapy programs. As part of this strategy, the Company has developed core competencies specific to AAV gene therapy development and manufacturing and is beginning to build its commercial infrastructure. This business strategy also includes business development activities that may include in-licensing activities or partnering certain programs in certain geographies with collaborators, as the Company has demonstrated through its collaboration with AbbVie Biotechnology Ltd (the "AbbVie Tau Collaboration"), its collaboration with AbbVie Ireland Unlimited Company (the "AbbVie Alpha-Synuclein Collaboration"), and its collaboration with Neurocrine Biosciences, Inc. (the "Neurocrine Collaboration"), and its collaboration with Sanofi Genzyme (the "Sanofi Genzyme Collaboration") which was terminated in June 2019. The Company is devoting substantially all of its efforts to product research and development, market development, and raising capital. The Company is subject to risks common to companies in the biotechnology and gene therapy industry, including but not limited to, the need to obtain sufficient capital to continue to fund its operations, risks of failure of preclinical studies and clinical trials, the need to obtain marketing approval for its product candidates, the need to successfully commercialize and gain market acceptance of its product candidates, dependence on key personnel, protection of proprietary technology, compliance with government regulations, development by competitors of technological innovations, and ability to transition from pilot-scale manufacturing to large-scale production of products.

The Company has incurred annual net operating losses in every year since inception. As of June 30, 2019, the Company had an accumulated deficit of $285.1 million. The Company has not generated any product revenue and has financed its operations primarily through public offerings, private placements of its equity securities, and funding from its collaborations.

Through June 30, 2019, the Company has raised approximately $640.0 million of proceeds from sales of convertible preferred stock and common stock, including its initial public offering and follow-on public offering, and proceeds from collaboration agreements. The Company believes that its cash, cash equivalents, and marketable debt securities of $327.5 million as of June 30, 2019, as well as amounts expected to be received for reimbursement of development costs from the Neurocrine Collaboration, are sufficient to fund its operating expenses and capital expenditure requirements into mid-2022. There can be no assurance that the Company will be able to obtain additional

debt or equity financing or generate product revenue or revenue from collaborative partners on terms acceptable to the Company, on a timely basis or at all. The failure of the Company to obtain sufficient funds on acceptable terms when needed could have a material adverse effect on the Company's business, results of operations, and financial condition.

2. Summary of significant accounting policies and basis of presentation

Basis of Presentation

The accompanying unaudited condensed consolidated financial statements of the Company have been prepared in accordance with accounting principles generally accepted in the United States ("GAAP") for interim financial reporting and as required by Regulation S-X, Rule 10-01. Accordingly, they do not include all of the information and footnotes required by GAAP for complete financial statements. For further information, refer to the consolidated financial statements and footnotes included in the Company's Annual Report on Form 10-K for the year ended December 31, 2018 as filed with the Securities and Exchange Commission ("SEC") on February 26, 2019. These interim condensed consolidated financial statements, in the opinion of management, reflect all normal recurring adjustments necessary for a fair presentation of the Company's financial position and results of operations for the periods presented. 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 Updates ("ASU") of the Financial Accounting Standards Board ("FASB"). See "*Recently Adopted Accounting Pronouncements*" below for discussion of the Company's adoption of new guidance effective January 1, 2019. All amounts and disclosures set forth in this Quarterly Report on Form 10-Q reflect adoption of these changes.

Principles of Consolidation

The unaudited interim consolidated financial statements include the accounts of the Company and its wholly owned subsidiary as disclosed in Note 2, Summary of Significant Accounting Policies, within the "Notes to Consolidated Financial Statements" accompanying the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2018. Intercompany accounts and transactions have been eliminated.

Use of Estimates

The preparation of consolidated financial statements in conformity with GAAP requires management to make estimates and assumptions that affect the amounts reported in the consolidated financial statements and accompanying notes. On an ongoing basis, the Company's management evaluates its estimates, which include, but are not limited to, estimates related to revenue recognition, accrued expenses, stock-based compensation expense, and income taxes. The Company bases its estimates on historical experience and other market specific or other relevant assumptions that it believes to be reasonable under the circumstances. Actual results may differ from those estimates or assumptions. Certain reclassifications have been made to prior periods to conform to current period presentation.

Leases

Effective January 1, 2019, the Company accounted for its operating leases in accordance with ASC Topic 842 *Leases* ("ASC 842"). ASC 842 provides guidance on accounting for lease arrangements by both lessors and lessees and requires lessees to recognize a lease liability and a right-of-use asset for most leases. The Company determines if an arrangement is a lease at inception. The Company's operating leases are included in operating lease right-of-use ("ROU") assets, other current liabilities, and other non-current liabilities on the condensed consolidated balance sheets.

ROU assets represent the Company's right to use an underlying asset for the lease term and lease liabilities represent the Company's obligation to make lease payments arising from the lease. Operating lease ROU assets and liabilities are recognized at adoption date based on the present value of lease payments over the lease term. As the Company's leases do not provide an implicit rate, an incremental borrowing rate was used based on the information available at the lease commencement date in determining the present value of lease payments. On future lease obligations, the implicit rate will be set when readily determinable. The operating lease ROU assets also include the effect of any lease payments made and exclude lease incentives. The Company's lease terms may include options to

extend or terminate the lease even when it is not reasonably certain that the option will be exercised. Lease expense for lease payments is recognized on a straight-line basis over the lease term. The Company has lease agreements with lease and non-lease components, which are accounted for separately. Non-lease components generally refer to common area maintenance charges related to the premises.

Revenue Recognition

The Company enters into collaboration agreements which are within the scope of ASC 606, *Revenue from Contracts with Customers* ("ASC 606"), under which the Company licenses rights to certain of the Company's product candidates and performs research and development services. The terms of these arrangements typically include payment of one or more of the following: non-refundable, upfront fees; reimbursement of research and development costs; development, regulatory, and commercial milestone payments; and royalties on net sales of licensed products.

Under ASC 606, an entity recognizes revenue when its customer obtains control of promised goods or services, in an amount that reflects the consideration which the entity expects to receive in exchange for those goods or services. To determine the appropriate amount of revenue to be recognized for arrangements determined to be within the scope of ASC 606, the Company performs the following five steps: (i) identification of the promised goods or services in the contract; (ii) determination of whether the promised goods or services are performance obligations including whether they are distinct in the context of the contract; (iii) measurement of the transaction price, including the constraint on variable consideration; (iv) allocation of the transaction price to the performance obligations; and (v) recognition of revenue when (or as) the Company satisfies each performance obligation. The Company only applies the five-step model to contracts when it is probable that the entity will collect consideration it is entitled to in exchange for the goods or services it transfers to the customer.

The promised goods or services in each arrangement typically consist of license rights to the Company's intellectual property and research and development services. The Company provides options to additional items in the contracts, which are accounted for as separate contracts when the customer elects to exercise such options, unless the option provides a material right to the customer. The Company evaluates the customer options for material rights, or options to acquire additional goods or services for free or at a discount. If the customer options are determined to represent a material right, the material right is recognized as a separate performance obligation at the outset of the arrangement. Performance obligations are promised goods or services in a contract to transfer a distinct good or service to the customer and are considered distinct when (i) the customer can benefit from the good or service on its own or together with other readily available resources and (ii) the promised good or service is separately identifiable from other promises in the contract. In assessing whether promised goods or services are distinct, the Company considers factors such as the stage of development of the underlying intellectual property, the capabilities of the customer to develop the intellectual property on its own or whether the required expertise is readily available and whether the goods or services are integral or dependent to other goods or services in the contract.

The Company estimates the transaction price based on the amount expected to be received for transferring the promised goods or services in the contract. The consideration may include fixed consideration or variable consideration. At the inception of each arrangement that includes variable consideration, the Company evaluates the amount of potential payments and the likelihood that the payments will be received. The Company utilizes either the most likely amount method or expected amount method to estimate the amount expected to be received based on which method best predicts the amount expected to be received. The amount of variable consideration which is included in the transaction price may be constrained, and is included in the transaction price only to the extent that it is probable that a significant reversal in the amount of the cumulative revenue recognized will not occur in a future period.

The Company's contracts often include development and regulatory milestone payments which are assessed under the most likely amount method and constrained if it is probable that a significant revenue reversal would occur. Milestone payments that are not within the Company's control or the licensee's control, such as regulatory approvals, are not considered probable of being achieved until those approvals are received. At the end of each reporting period, the Company re-evaluates the probability of achievement of such development milestones and any related constraint, and if necessary, adjusts its estimate of the overall transaction price. Any such adjustments are recorded on a cumulative catch-up basis, which would affect collaboration revenues in the period of adjustment. To date, the Company has not

recognized any consideration related to the achievement of development, regulatory, or commercial milestones resulting from any of the Company's collaboration arrangements.

For arrangements that include sales-based royalties, including milestone payments based on the level of sales, and the license is deemed to be the predominant item to which the royalties relate, the Company recognizes revenue at the later of (i) when the related sales occur, or (ii) when the performance obligation to which some or all of the royalty has been allocated has been satisfied (or partially satisfied). To date, the Company has not recognized any consideration related to sales-based royalty revenue resulting from any of the Company's collaboration arrangements.

The Company allocates the transaction price based on the estimated stand-alone selling price of each of the performance obligations. The Company must develop assumptions that require judgment to determine the stand-alone selling price for each performance obligation identified in the contract. The Company utilizes key assumptions to determine the stand-alone selling price for service obligations, which may include other comparable transactions, pricing considered in negotiating the transaction and the estimated costs. Additionally, in determining the standalone selling price for material rights, the Company utilizes comparable transactions, clinical trial success probabilities, and estimates of option exercise likelihood. Variable consideration is allocated specifically to one or more performance obligations in a contract when the terms of the variable consideration relate to the satisfaction of the performance obligation and the resulting amounts allocated are consistent with the amounts the Company would expect to receive for the satisfaction of each performance obligation.

The consideration allocated to each performance obligation is recognized as revenue when control is transferred for the related goods or services. For performance obligations which consist of licenses and other promises, the Company utilizes judgment to assess the nature of the combined performance obligation to determine whether the combined performance obligation is satisfied over time or at a point in time and, if over time, the appropriate method of measuring progress. The Company evaluates the measure of progress each reporting period and, if necessary, adjusts the measure of performance and related revenue recognition.

Upfront payments and fees are recorded as deferred revenue upon receipt or when due until the Company performs its obligations under these arrangements. Amounts are recorded as accounts receivable when the Company's right to consideration is unconditional.

Stock-based Compensation Expense

The Company accounts for its stock-based compensation awards in accordance with ASC Topic 718 *Compensation—Stock Compensation* ("ASC 718"). ASC 718 requires all stock-based payments to employees, nonemployees, and directors, including grants of restricted stock units and stock options, to be recognized as expense in the statements of operations based on their grant date fair values. The Company estimates the fair value of options granted using the Black-Scholes option pricing model. The Company uses the fair value of its common stock on the grant date to determine the fair value of restricted stock units.

The Black-Scholes option pricing model requires inputs based on certain subjective assumptions, including (a) the expected stock price volatility, (b) the calculation of expected term of the award, (c) the risk-free interest rate and (d) expected dividends. Due to a lack of company-specific historical and implied volatility data, the Company bases the estimate of expected volatility on the historical volatility of a group of similar companies that are publicly traded, blended with the most recent period of historic volatility of its common stock. The historical volatility is calculated based on a period of time commensurate with the expected term assumption. The computation of expected volatility is based on the historical volatility of a representative group of companies with similar characteristics to the Company, including stage of product development and life science industry focus. The Company uses the simplified method as prescribed by the SEC Staff Accounting Bulletin No. 107, *Share-Based Payment*, to calculate the expected term for stock options granted to employees as it does not have sufficient historical exercise data to provide a reasonable basis upon which to estimate the expected term. For stock options granted to non-employees, the Company utilizes the contractual term of the arrangement as the basis for the expected term assumption. The risk-free interest rate is based on a treasury instrument whose term is consistent with the expected term of the stock options. The expected dividend yield is assumed to be zero as the Company has never paid dividends and has no current plans to pay any dividends on its common stock.

The Company expenses the fair value of its stock-based compensation awards on a straight-line basis over the associated service period, which is generally the period in which the related services are received. The Company records the expense for stock-based compensation awards subject to performance conditions over the remaining service period when management determines that achievement of the performance condition is probable. Management evaluates if the achievement of a performance condition is probable based on the expected satisfaction of the performance conditions as of the reporting date.

Net Income (Loss) per Share

Basic net income (loss) per share is computed by dividing net income (loss) by the weighted-average number of common shares and restricted stock unit awards outstanding during the period. Diluted net income (loss) per share is computed using the weighted-average number of common shares and restricted stock unit awards outstanding during the period and, if dilutive, the weighted-average number of potential shares of common stock and restricted stock unit awards.

Recently Adopted Accounting Pronouncements

In February 2016, the FASB issued ASU No. 2016-02, a comprehensive new lease accounting standard, which provides revised guidance on accounting for lease arrangements by both lessors and lessees and requires lessees to recognize a lease liability and a right-of-use asset for most leases. In July 2018, the FASB issued ASU No. 2018-11, *Leases-Targeted Improvements* ("ASC 842"), which provides an additional transition method that allowed entities to initially apply the new lease requirements at the adoption date, not the earliest period presented, and recognize a cumulative effect adjustment to the opening balance of retained earnings in the period of adoption. The Company elected this transition method at the adoption date of January 1, 2019. The Company elected a package of practical expedients, under which an entity need not reassess whether any expired or existing contracts are or contain leases, the lease classification for any expired or existing leases, or initial direct costs for any existing leases. The impact of adopting ASC 842 was represented as a capitalization of a right-of-use asset of approximately $31.0 million with a corresponding lease liability of approximately $36.7 million to be recognized over the remaining life of the Company's leases.

In June 2018, the FASB issued ASU No. 2018-07, *Compensation-Stock Compensation: Improvements to Nonemployee Share-Based Payment Accounting* ("ASU 2018-07"). The new standard largely aligns the accounting for share-based payment awards issued to employees and nonemployees by expanding the scope of ASC 718 to apply to nonemployee share-based transactions, as long as the transaction is not effectively a form of financing. The adoption of ASU 2018-07 on January 1, 2019 did not have a material impact on the Company's consolidated financial statements.

Recent Accounting Pronouncements

In August 2018, the FASB issued ASU No. 2018-13, *Disclosure Framework - Changes to the Disclosure Requirements for Fair Value Measurement* ("ASU 2018-13"). This standard eliminates, adds and modifies certain disclosure requirements for fair value measurements as part of its disclosure framework project. ASU 2018-13 is effective for annual reporting periods beginning after December 15, 2019 and interim periods within those annual periods and early adoption is permitted. The Company is currently evaluating the potential impact that this guidance may have on its consolidated financial statements.

In June 2016, the FASB issued ASU No. 2016-13, *Measurement of Credit Losses on Financial Instruments* ("ASU 2016-13"). ASU 2016-13 will change how companies account for credit losses for most financial assets and certain other instruments. For trade receivables, loans and held-to-maturity debt securities, companies will be required to recognize an allowance for credit losses rather than reducing the carrying value of the asset. ASU 2016-13 is effective for fiscal years beginning after December 15, 2019, including interim periods within those fiscal years. Early adoption is permitted. The Company is currently evaluating the potential impact that this guidance may have on its consolidated financial statements.

3. Fair value measurements

Assets and liabilities measured at fair value on a recurring basis as of June 30, 2019 and December 31, 2018 are as follows:

Assets	Total	Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
June 30, 2019		(in thousands)		
Money market funds included in cash and cash equivalents	$ 79,108	$ 79,108	$ —	$ —
Marketable securities:				
U.S. Treasury notes	247,577	247,577	—	—
Equity securities	1,280	1,280	—	—
Total marketable securities	$ 248,857	$ 248,857	$ —	$ —
Warrants to purchase equity securities	414	—	414	—
Total	$ 328,379	$ 327,965	$ 414	$ —
December 31, 2018				
Money market funds included in cash and cash equivalents	$ 46,173	$ 46,173	$ —	$ —
Marketable securities:				
U.S. Treasury notes	108,947	108,947	—	—
Equity securities	628	628	—	—
Total marketable securities	$ 109,575	$ 109,575	$ —	$ —
Warrants to purchase equity securities	234	—	234	—
Total	$ 155,982	$ 155,748	$ 234	$ —

The Company measures the fair value of money market funds, U.S. Treasury notes and equity securities based on quoted prices in active markets for identical securities. The Level 2 equity securities include warrants used to purchase equity securities that are valued using the Black-Scholes model. The Black-Scholes option pricing model requires inputs based on certain subjective assumptions, including (a) the expected stock price volatility, (b) the calculation of expected term of the awards, (c) the risk-free interest rate, and (d) expected dividends. The assumptions utilized to value the warrants to purchase equity securities as of June 30, 2019 and December 31, 2018 are as follows:

	As of June 30, 2019	As of December 31, 2018
Risk-free interest rate	1.7 %	2.5 %
Expected dividend yield	— %	— %
Expected term (in years)	2.2	2.7
Expected volatility	88.8 %	112.7 %

The expected volatility is based on the historic volatility for the equity securities underlying the warrants and is calculated based on a period of time commensurate with the expected term assumption. The expected term is based on the remaining contractual life of the warrants on each measurement date. The risk-free interest rate is based on a treasury instrument whose term is consistent with the expected term of the warrants. The expected dividend yield is assumed to be zero as the entity that issued the warrants has never paid and has not indicated any intention to pay dividends.

4. Cash, cash equivalents, and available-for-sale marketable securities

Cash equivalents include all highly liquid investments maturing within 90 days from the date of purchase. Marketable securities consist of securities with original maturities greater than 90 days when purchased. The Company classifies these investments as available-for-sale and records them at fair value in the accompanying condensed

consolidated balance sheets. Unrealized gains or losses are included in accumulated other comprehensive income (loss). Premiums or discounts from par value are amortized to investment income over the life of the underlying investment.

The Company classifies marketable debt securities with a remaining maturity when purchased of greater than three months as available-for-sale. Marketable debt securities with a remaining maturity date greater than one year and marketable equity securities are classified as non-current where the Company has the intent and ability to hold these securities for at least the next 12 months. Available-for-sale debt securities are maintained by an investment manager and consist of U.S. Treasury notes. In 2016, the Company invested in a supplier and received common stock and warrants to purchase common stock in that entity. The common stock is included in non-current marketable securities and the warrants are included in non-current assets.

All available-for-sale securities are carried at fair value with the unrealized gains and losses included in other comprehensive income (loss) as a component of stockholders' equity until realized. Any premium or discount arising at purchase is amortized and/or accreted to interest income and/or expense. Realized gains and losses are determined using the specific identification method and are included in other income (expense). If any adjustment to fair value reflects a decline in value of the investment, the Company considers all available evidence to evaluate the extent to which the decline is "other-than-temporary" and, if so, recognizes the unrealized loss through a charge to the Company's condensed consolidated statement of operations and comprehensive loss. No other-than-temporary losses have been recognized.

Cash, cash equivalents, and marketable securities included the following at June 30, 2019 and December 31, 2018:

	Amortized Cost	Unrealized Gains	Unrealized Losses	Fair Value
	(in thousands)			
As of June 30, 2019				
Money market funds included in cash and cash equivalents	$ 79,108	$ —	$ —	$ 79,108
Marketable securities:				
U.S. Treasury notes	247,348	230	1	247,577
Equity securities	1,220	60	—	1,280
Total marketable securities	$ 248,568	$ 290	$ 1	$ 248,857
Total money market funds and marketable securities	$ 327,676	$ 290	$ 1	$ 327,965
As of December 31, 2018				
Money market funds included in cash and cash equivalents	$ 46,173	$ —	$ —	$ 46,173
Marketable securities:				
U.S. Treasury notes	108,951	1	5	108,947
Equity securities	1,220	—	592	628
Total marketable securities	$ 110,171	$ 1	$ 597	$ 109,575
Total money market funds and marketable securities	$ 156,344	$ 1	$ 597	$ 155,748

All of the Company's marketable debt securities at June 30, 2019, have a contractual maturity of one year or less.

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

	As of June 30, 2019	As of December 31, 2018
	(in thousands)	
Cash and cash equivalents	$ 79,885	$ 46,859
Restricted cash included in deposits and other non-current assets	735	735
Total cash, cash equivalents, and restricted cash	$ 80,620	$ 47,594

5. Accrued expenses

Accrued expenses as of June 30, 2019 and December 31, 2018 consist of the following:

	As of June 30, 2019	As of December 31, 2018
	(in thousands)	
Research and development costs	$ 6,908	$ 3,555
Employee compensation costs	2,319	3,780
Professional services	1,301	1,448
Accrued goods and services	976	784
Patent costs	162	120
Other	116	101
Total	$ 11,782	$ 9,788

6. Right-of-use asset and lease liabilities

The Company adopted ASC 842, which requires balance sheet recognition for leases. The Company adopted the standard using the modified retrospective approach with an effective date as of the beginning of the Company's fiscal year, January 1, 2019. Prior year interim periods were not recast under the new standard and therefore, those amounts are not presented below. The Company elected to utilize practical expedients available for expired or existing contracts which allowed the Company to carryforward historical assessments of (1) whether contracts are or contain leases, (2) lease classification, and (3) initial direct costs.

Operating Leases

During April 2014, the Company entered into an agreement to lease its 75 Sidney Street facility under a non-cancelable operating lease that would have expired, if not subsequently extended, on December 15, 2019. The lease includes two renewal options, each for five-year terms and at fair market value upon exercise. The lease contains escalating rent clauses which require higher rent payments in future years. The Company expenses rent on a straight-line basis over the term of the lease, including any rent-free periods.

In December 2015, the Company executed an amendment to extend the term of the 75 Sidney Street lease and also executed an agreement to lease an additional facility at 64 Sidney Street until December 31, 2024. The facility at 64 Sidney Street includes laboratory and office space and was ready for occupancy in early 2017.

In February 2018, the Company executed a second amendment to the 75 Sidney Street lease to lease additional space to support its continued growth. The additional facility includes laboratory and office space and was ready for occupancy in mid-2018.

In June 2018, the Company executed a third amendment to the 75 Sidney Street lease to lease additional space to further support its continued growth. The additional facility includes laboratory and office space, and was ready for occupancy in late 2018. The third amendment extended the term of the 75 Sidney Street lease to November 30, 2026. Additionally, the Company executed a second amendment to the 64 Sidney Street lease to extend that lease to November 30, 2026.

The Company has received leasehold improvement incentives from the landlord totaling $1.3 million and $3.5 million for 75 Sidney Street and 64 Sidney Street, respectively. The Company recorded these incentives as a component of its ROU asset and is amortizing these incentives as a reduction of rent expense over the life of the leases. The leasehold improvements have been capitalized as fixed assets. The Company is entitled to receive approximately $0.3 million of leasehold improvements for the additional space at 75 Sidney Street acquired under the third amendment to the 75 Sidney Street lease.

The Company's lease agreements require the Company to maintain a cash deposit or irrevocable letter of credit of $0.7 million payable to the landlord as security for the performance of its obligations under the leases. These amounts are recorded as restricted cash and included in deposits and other non-current assets in the accompanying condensed consolidated balance sheets.

The following table summarizes the Company's significant contractual obligations under operating leases as of payment due date by period at June 30, 2019:

	Total Minimum Lease Payments
	(in thousands)
2019 (remainder of year)	$ 2,756
2020	5,960
2021	6,138
2022	6,323
2023	6,512
2024+	20,897
Total future minimum lease payments	$ 48,586
Less: imputed interest	(13,138)
Total lease liability	$ 35,448
Reported as:	
Other current liabilities	$ 2,843
Other non-current liabilities	32,605
Total lease liability	$ 35,448

During the three and six months ended June 30, 2019, the Company incurred rent expense of $1.6 million and $3.0 million, respectively, for operating leases. During the three and six months ended June 30, 2018, the Company incurred rent expense of $1.0 million and $1.8 million, respectively, for operating leases. As of June 30, 2019, the weighted average remaining lease term was 7.4 years and the weighted average incremental borrowing rate used to determine the operating lease liability was 8.5%.

7. Other liabilities

As of June 30, 2019 and December 31, 2018, other current and non-current liabilities consisted of the following:

	As of June 30, 2019	As of December 31, 2018
	(in thousands)	
Other current liabilities		
Lease liability	2,843	—
Total other current liabilities	$ 2,843	$ —
Other non-current liabilities		
Lease liability	$ 32,605	$ —
Deferred rent	—	5,710
Other	1,001	1,001
Total other non-current liabilities	$ 33,606	$ 6,711

8. Commitments and contingencies

Significant Agreements

Sanofi Genzyme Collaboration Agreement

Summary of Agreement

In February 2015, the Company entered into a collaboration agreement with Sanofi Genzyme (the "Sanofi Genzyme Collaboration Agreement"), which included a non-refundable upfront payment of $65.0 million. In addition, contemporaneously with entering into the Sanofi Genzyme Collaboration Agreement, Sanofi Genzyme entered into a Series B Stock Purchase Agreement, under which Sanofi Genzyme purchased 10,000,000 shares of Series B Preferred Stock for $30.0 million. The fair value of the Series B Preferred Stock at the time of issuance was approximately $25.0 million. The $5.0 million premium over the fair value is accounted for as additional consideration under the Sanofi Genzyme Collaboration Agreement.

Under the Sanofi Genzyme Collaboration Agreement, the Company granted Sanofi Genzyme an exclusive option to license, develop and commercialize (i) ex-U.S. rights to the following programs, which are referred to as "Split Territory Programs"; VY-AADC ("Parkinson's Program"), VY-FXN01 ("Friedreich's ataxia Program"), a future program to be designated by Sanofi Genzyme ("Future Program"), and VY-HTT01 ("Huntington's Program") with an incremental option to co-commercialize VY-HTT01 in the United States and (ii) worldwide rights to VY-SMN101 ("Spinal Muscular Atrophy Program"). Sanofi Genzyme's option for the Split Territory Programs and the Spinal Muscular Atrophy Program is triggered following the completion of the first proof of principle human clinical study ("POP Study"), on a program-by-program basis.

Prior to any option exercise by Sanofi Genzyme, the Company would collaborate with Sanofi Genzyme in the development of products under each Split Territory Program and/or the Spinal Muscular Atrophy Program pursuant to a written development plan and under the guidance of an Alliance Joint Steering Committee ("AJSC"), comprised of an equal number of employees from the Company and Sanofi Genzyme.

Under the Sanofi Genzyme Collaboration Agreement, the Company was required to use commercially reasonable efforts to develop products under each Split Territory Program and the Spinal Muscular Atrophy Program through the completion of the applicable POP Study. During the development of these joint programs, the activities would be guided by a Development Advisory Committee ("DAC"). The DAC could elect to utilize certain Sanofi Genzyme technology relating to the Parkinson's Program, the Huntington's Program, or generally with the manufacture of Split Territory Program products.

The Company was solely responsible for all costs incurred in connection with the development of the Split Territory Programs and the Spinal Muscular Atrophy Program products prior to the exercise of an option by Sanofi Genzyme with the exception of the following: (i) at the Company's request and upon mutual agreement, Sanofi Genzyme would provide "in-kind" services valued at up to $5.0 million and (ii) Sanofi Genzyme would be responsible for the costs and expenses of activities under the Huntington's Program development plan to the extent such activities were covered by financial support Sanofi Genzyme was entitled to receive from a patient advocacy group.

With the exception of the Parkinson's Program, Sanofi Genzyme would be required to pay an option exercise payment of $20.0 million or $30.0 million for each Split Territory Program and Spinal Muscular Atrophy Program.

Upon Sanofi Genzyme's exercise of its option to license a given product in a Split Territory Program ("Split Territory Licensed Product"), the Company would have sole responsibility for the development of such Split Territory Licensed Product in the United States and Sanofi Genzyme would have sole responsibility for development of such Split Territory Licensed Product in the rest of the world. The Company and Sanofi Genzyme would have shared responsibility for execution of ongoing development of such Split Territory Licensed Product that is not specific to either territory, including costs associated therewith. The Company would be responsible for all commercialization activities relating to

Split Territory Licensed Products in the United States, including all of the associated costs. Sanofi Genzyme would be responsible for all commercialization activities relating to the Split Territory Licensed Products in the rest of the world, including all of the associated costs. If Sanofi Genzyme exercised its co-commercialization rights, Sanofi Genzyme would be the lead party responsible for all commercialization activities related to the Huntington's Program product (the "Huntington's Licensed Product") in the United States.

Upon exercise of its option to license a product in the Spinal Muscular Atrophy Program (the "Spinal Muscular Atrophy Licensed Product"), Sanofi Genzyme would have the sole right to develop the Spinal Muscular Atrophy Licensed Product worldwide. Sanofi Genzyme would be responsible for all of the development costs that occur after the option exercise date for the Spinal Muscular Atrophy Program. Sanofi Genzyme would also be responsible for worldwide commercialization activities relating to the Spinal Muscular Atrophy Licensed Product.

In October 2017, Sanofi Genzyme decided not to exercise its option for the Parkinson's Program (the "PD Opt-Out"). Sanofi Genzyme was required to pay the Company for specified regulatory and commercial milestones, if achieved, up to $540.0 million across all remaining programs. The Company was no longer entitled to receive a total of $105.0 million related to regulatory and commercial milestone payments for the Parkinson's Program as a result of the PD Opt-Out. The regulatory approval milestones were payable upon either regulatory approval in the United States or regulatory and reimbursement approval in the European Union and ranged from $40.0 million to $50.0 million per milestone, with an aggregate total of $220.0 million, after accounting for the PD Opt-Out. The remaining commercial milestones were payable upon achievement of specified annual net sales in each program and range from $50.0 million to $100.0 million per milestone, with an aggregate total of $320.0 million, after accounting for the PD Opt-Out.

In addition, to the extent any Split Territory Licensed Products or the Spinal Muscular Atrophy Licensed Product were commercialized, the Company would be entitled to tiered royalty payments ranging from the mid-single digits to mid-teens based on a percentage of net sales by Sanofi Genzyme. Sanofi Genzyme would be entitled to receive tiered royalty payments related to sales of a Split Territory Licensed Product ranging from the low-single digits to mid-single digits based on a percentage of net sales by the Company depending on whether the Company uses Sanofi Genzyme technology in the Split Territory Licensed Product. If Sanofi Genzyme elected to co-commercialize the Huntington's Licensed Product in the United States, the Company and Sanofi Genzyme would share in any profits or losses from Huntington's Licensed Product sales.

The Sanofi Genzyme Collaboration Agreement was to continue in effect until the later of (i) the expiration of the last to expire of the option rights and (ii) the expiration of all payment obligations unless sooner terminated by the Company or Sanofi Genzyme. The Company and Sanofi Genzyme had customary termination rights, including the right to terminate for an uncured material breach of the agreement committed by the other party, and Sanofi Genzyme had the right to terminate for convenience.

Termination of Agreement

On June 14, 2019, the Company and Sanofi Genzyme executed a termination agreement to terminate the Sanofi Genzyme Collaboration Agreement (the "Sanofi Genzyme Termination Agreement"). Under the terms of the Sanofi Genzyme Termination Agreement, Sanofi Genzyme relinquished its rights to the exclusive license options to the Huntington's Program, Friedreich's ataxia Program and the unnamed Future Program. The Company has been relieved of its obligations to perform the research and development services under those programs through completion of the respective POP Studies. As a result, the Company gained worldwide rights to the Huntington's Program and ex-U.S. rights to the Friedreich's ataxia Program. The ex-U.S. rights to the Friedreich's ataxia Program have been, in turn, transferred from the Company to Neurocrine Biosciences pursuant to the Neurocrine Collaboration Agreement. Additionally, the Company and Sanofi Genzyme entered into an Amended and Restated Option and License Agreement related to AAV capsids (the "Amended Capsid Agreement"). Under the Amended Capsid Agreement, Sanofi Genzyme has obtained exclusive option rights to exclusively license one or more select novel AAV capsids owned or controlled by the Company for exclusive use for up to two non-central nervous system ("non-CNS") indications.

Sanofi Genzyme has granted the Company exclusive, irrevocable, perpetual, royalty-free, fully-paid sublicensable (through multiple tiers), non-transferable, worldwide licenses in Sanofi Genzyme's interests in the

collaboration technology generated under or used in the Huntington's Program and the Friedreich's ataxia Program with respect to those programs pursuant to the Sanofi Genzyme Collaboration Agreement. In addition, Sanofi Genzyme has granted the Company non-exclusive, irrevocable, perpetual, royalty-free, fully-paid, sublicensable (through multiple tiers), non-transferable, worldwide licenses to the Sanofi Genzyme technology that was contributed to the Sanofi Genzyme Collaboration Agreement and was used in the development or manufacture of product candidates prior to the termination date.

Under the Sanofi Genzyme Termination Agreement, the Company paid Sanofi Genzyme $10.0 million up-front and has agreed to pay Sanofi Genzyme a $10.0 million milestone within fifteen days of the filing of an investigational new drug ("IND") application for a product candidate incorporating certain intellectual property rights developed under or substantially related to the Huntington's Program (a "Post-Termination HD Product"). The Company has agreed to pay Sanofi Genzyme (i) 50% of any income received from sublicensing arrangements related to Post-Termination HD Products in excess of specified thresholds and entered into prior to (x) the filing of an IND application for a Post-Termination HD Product or (y) the dosing of the first patient in a clinical trial for a Post-Termination HD Product in the United States or certain European countries, respectively and (ii) a low-double digit percentage of any income received from sublicensing arrangements outside the United States related to products incorporating intellectual property rights developed under, or substantially related to, the Friedreich's ataxia Program (the "Post-Termination FA Products") that are in excess of a specified threshold and entered into prior to the dosing of the first patient in a clinical trial for a Post-Termination FA Product in the United States or certain European countries, in each case, subject to certain limitations. The Company has also agreed to pay low-single digit royalties on net sales of Post-Termination HD Products. Under the Sanofi Genzyme Collaboration Agreement, the Company had rights to certain in-kind services. As of the termination date the Company waived its right to approximately $0.4 million in unused in-kind services, and the Company no longer has the right to receive any option payments, regulatory or commercial milestone payments or royalties from Sanofi Genzyme under the Sanofi Genzyme Collaboration Agreement.

The Company has granted Sanofi Genzyme an exclusive royalty-free, fully-paid, sublicensable (through multiple tiers), non-transferable, worldwide license under the Company's interest in the collaboration technology generated under or used in the Spinal Muscular Atrophy Program pursuant to the Sanofi Genzyme Collaboration Agreement to manufacture, develop, and commercialize any Spinal Muscular Atrophy product. Under the Amended Capsid Agreement, the Company has granted Sanofi Genzyme an exclusive option to evaluate up to four capsids for no consideration. During the capsid evaluation period, the Company has granted Sanofi Genzyme a non-exclusive license to the capsid intellectual property to conduct evaluation studies. In addition, Sanofi Genzyme is able to evaluate up to two additional capsids for a low six-figure payment per additional capsid. The Company is not obligated to perform any additional research on the capsids. Sanofi Genzyme shall have the right to obtain an exclusive license for up to two capsids, each in a specified non-CNS indication. At its discretion, Sanofi Genzyme may exercise both its options for the same capsid for different specified non-CNS indications. Upon its exercise of each option, Sanofi Genzyme has agreed to pay the Company a $1.0 million option exercise fee. Under the Amended Capsid Agreement, the Company is also entitled to receive potential development and regulatory milestone payments upon the achievement of certain milestone events for products containing licensed capsids ("Licensed Products") of up to an aggregate of $15.0 million per Licensed Product. In addition, for each specified indication, Sanofi Genzyme has agreed to pay to the Company a one-time sales milestone payment of $20.0 million, if aggregate worldwide net sales for all Licensed Products for such specified indication surpass a specified amount, and low-to-mid single-digit tiered royalty payments on worldwide net sales of Licensed Products, on a Licensed Product-by-Licensed Product basis.

Accounting Analysis

At inception, the Sanofi Genzyme Collaboration Agreement included the following performance obligations: (i) research and development services for each of the Split Territory Programs and the Spinal Muscular Atrophy Program, (ii) participation in the AJSC, (iii) participation in the DAC and (iv) a material right associated with an option to obtain a development and commercial license in the Parkinson's Program ("PD Material Right"). The Company determined that the option to obtain a development and commercial license in the Parkinson's Program was a material right under ASC 606 primarily because there were no additional option exercise payments payable by Sanofi Genzyme at the time of option exercise. Therefore, the PD Material Right was considered a performance obligation at the inception of the arrangement. The options in the other Split Territory Programs and the Spinal Muscular Atrophy Program do not provide

a material right to the customer that it would receive without entering into the contract principally because the option fees are at least equal to the standalone selling price for the underlying goods. Therefore, the other Split Territory Programs and the Spinal Muscular Atrophy Program options are not performance obligations at inception.

The Company has identified $74.6 million of total transaction price consisting of the $65.0 million upfront fee, the $5.0 million premium paid in excess of fair value of the Series B Preferred Stock and $4.6 million of Sanofi Genzyme “in-kind” funding, which represents the transaction price at adoption. Additional consideration to be paid to the Company upon the exercise of the license options by Sanofi Genzyme or upon reaching certain milestones are excluded from the transaction price as they relate to option fees and milestones that can only be achieved subsequent to the option exercise or are outside of the initial contract term.

The Company has allocated the transaction price to the separate performance obligations based on their relative standalone selling price. For all performance obligations, the Company determined the standalone selling price at contract inception based on each obligation’s estimated standalone selling price (“ESP”). The Company determined the ESP for the service related deliverable for the research and development activities based on internal estimates of the costs to perform the services, including expected internal expenses and expenses with third parties for services and supplies, marked up to include a reasonable profit margin and adjusted for the scope of the potential license. Significant inputs used to determine the total expense of the research and development activities include, the length of time required and the number and costs of various studies that will be performed to complete the applicable POP Study. The ESP for the AJSC and DAC have been estimated based on the costs incurred to participate in the committees, marked up to include a reasonable profit margin. The ESP for the PD Material Right was determined based on the estimated value of the license adjusted for the estimated probability that the option would be exercised by Sanofi Genzyme.

Based on the relative standalone selling price allocation, the allocation of the transaction price to the separate performance obligations was as follows:

Performance Obligation	Amount (in thousands)
Research and Development Services for:	
Huntington’s Program	$ 14,228
Parkinson’s Program	6,040
Friedreich’s ataxia Program	14,821
Spinal Muscular Atrophy Program	29,116
Future Program	2,239
Committee Obligations:	
AJSC	133
DAC	207
PD Material Right	7,855
Total	$ 74,639

The Company recognizes the amounts associated with research and development services and committee obligations on a proportional performance basis over the period of service using input-based measurements such as costs incurred to date, to estimate proportion performed, and remeasures its progress towards completion at the end of each reporting period. Contingent consideration related to the performance of in-kind services is considered in the transaction price based on the most-likely amount, which is the full amount of the services that the Company can require Sanofi Genzyme to complete. The amount allocated to the PD Material Right was initially deferred and recognized in full prior to the adoption of ASC 606.

During the three and six months ended June 30, 2019, the Company recognized $1.5 million and $2.9 million, respectively, of revenue related to research and development services and committee obligations performed under the Sanofi Genzyme Collaboration prior to the termination of the collaboration on June 14, 2019 (the “Termination Date”). During the three and six months ended June 30, 2018, the Company recognized $0.7 million and $1.2 million, respectively, of revenue to research and development services and committee obligations performed under the Sanofi Genzyme Collaboration.

Costs incurred relating to the programs that Sanofi Genzyme has the option to license under the Sanofi Genzyme Collaboration Agreement consist of internal and external research and development costs, which primarily include: salaries and benefits, lab supplies and preclinical research studies. These costs are included in research and development expenses in the Company's condensed consolidated statement of operations during the three and six months ended June 30, 2019 and 2018.

The Sanofi Genzyme Termination Agreement modifies both the pricing and scope of the Sanofi Genzyme Collaboration Agreement. As the modification does not add distinct goods or services to the Sanofi Genzyme Collaboration Agreement, the agreement is considered a modification of the original contract.

The Sanofi Genzyme Termination Agreement includes the following performance obligations: (i) worldwide license to collaboration technology and Sanofi Genzyme technology for the development, manufacturing and commercialization of the Huntington's Program and (ii) worldwide license to collaboration technology and Sanofi Genzyme technology for the development, manufacturing and commercialization for the Friedreich's ataxia Program. Such performance obligations were satisfied upon the Termination Date as control had transferred upon execution of the Sanofi Genzyme Termination Agreement. Therefore, the remainder of the transaction price under the Sanofi Genzyme Collaboration Agreement, which had not yet been recognized, was recognized as revenue upon the Termination Date.

The Company has recognized $28.7 million of revenue upon the Termination Date. This amount consists of $48.7 million of deferred revenue related to the original agreement as of the Termination Date, offset by (x) $10.0 million related to the fee paid by the Company to Sanofi Genzyme on the Termination Date, and (y) $10.0 million related to the milestone payment which the Company expects to pay to Sanofi Genzyme upon the potential filing of an IND for a product candidate in connection with the Huntington's Program. Further preclinical studies are underway with VY-HTT01 which, if successful, are expected to support a potential filing of an IND application in 2019. The Company has constrained $10.0 million of the remaining deferred revenue balance at the Termination Date as it expects to pay the milestone payment related to the potential filing of an IND for a product candidate in connection with the Huntington's Program in 2019. As a result, the Company will maintain a $10.0 million deferred revenue balance associated with the potential milestone payment. This deferral will be reversed upon payment of the milestone to Sanofi Genzyme. If the Company decides not to file an IND for a product candidate in connection with the Huntington's Program, the Company will recognize that amount as revenue upon determining that the IND filing is no longer likely. The $20.0 million payable by the Company to Sanofi Genzyme is treated as consideration payable to a customer and therefore accounted as a reduction of the transaction price.

In the three and six months ended June 30, 2019, the Company recognized total revenue of $30.2 million and $31.6 million related to services performed and the subsequent termination of the Sanofi Genzyme Collaboration Agreement. At June 30, 2019, $10.0 million remains in deferred revenue in the accompanying condensed consolidated balance sheet.

AbbVie Tau Collaboration Agreement

Summary of Agreement

In February 2018, the Company entered into an exclusive collaboration and option agreement (the "AbbVie Tau Collaboration Agreement") with AbbVie for the research, development and commercialization of AAV and other virus-based gene therapy products for the treatment of diseases of the central nervous system and other neurodegenerative diseases related to defective or excess aggregation of tau protein in the human brain, including Alzheimer's disease. Under the AbbVie Tau Collaboration Agreement, the Company and AbbVie have agreed to collaborate on the research and development of specified vectorized antibody compounds comprised of an AAV or other viral capsid and a virus vector genome that encodes one or more antibodies that target and bind to a tau protein. The collaboration is comprised of a research period (the "Research Period"), a development period (the "Development Period"), and an exclusive license option (the "License Option"). The AbbVie Tau Collaboration Agreement included a non-refundable upfront payment of $69.0 million for services during the Research Period.

During the Research Period, each party has agreed to identify up to five antibodies for inclusion in the collaboration. Subject to certain conditions and exceptions, the parties will select up to three antibodies (each, a

"Research Antibody") as candidates for creation of research compounds (each, a "Research Compound"), with AbbVie having the right to select two of the three Research Antibodies. The Company is required to use diligent efforts to conduct antibody engineering and other research activities to create Research Compounds and to develop product candidates containing or comprised of such Research Compounds ("Product Candidates"). The Company is solely responsible for its costs and expenses during the Research Period. During a specified portion of the Research Period, AbbVie may exercise one or more of its exclusive development options (each, a "Development Option") to select up to a total of three Research Compounds (the "Selected Research Compounds") and their corresponding Product Candidates (the "Selected Product Candidates") to proceed to the Development Period.

Upon AbbVie's exercise of a Development Option, AbbVie will pay the Company $80.0 million for the first Selected Research Compound and $30.0 million each for up to two additional Selected Research Compounds. During the Development Period, the Company is obligated to use diligent efforts to conduct development activities, including Investigational New Drug application-enabling and Phase 1 clinical trial activities, for the Selected Research Compounds and corresponding Selected Product Candidates. The Company will be solely responsible for the costs and expenses during the Development Period. During a specified portion of the Development Period (the "License Option Period"), AbbVie may exercise its License Option to further develop and commercialize all of the Research Compounds (the "Licensed Compounds"), and corresponding product candidates (the "Licensed Products"). Upon AbbVie's exercise of its License Option, AbbVie will provide a one-time payment of $75.0 million to the Company, and the Company will grant to AbbVie an exclusive, worldwide license, with the right to sublicense, under certain of the Company's intellectual property rights to develop and commercialize the Licensed Compounds and the Licensed Products for all human diagnostic, prophylactic and therapeutic uses. In addition, after AbbVie's exercise of the License Option, the Company has certain obligations to complete any remaining research and development activities that have not been completed for any Research Compounds and Product Candidates.

The Company's research and development activities will be conducted pursuant to the plans agreed to by the parties and overseen by a joint governance committee ("JGC") as detailed in the AbbVie Tau Collaboration Agreement. Any material amendment to the research or development plans must be mutually agreed to by the Company and AbbVie, which may be through the JGC.

Under the AbbVie Tau Collaboration Agreement, AbbVie is required to use commercially reasonable efforts to develop and commercialize at least one Licensed Product in each of the United States, Japan, the United Kingdom, Germany, France, Italy, and Spain. After exercise of the License Option, AbbVie is solely responsible for all development and commercialization activities relating to Licensed Compounds and Licensed Products at its sole cost and expense, subject to the agreed-upon research and development plans. The Company may elect to share in AbbVie's development costs relating to a Licensed Product on an indication-by-indication basis in exchange for a specified increase in royalties (a "Cost-Sharing Option"). If the Company exercises a Cost-Sharing Option, the Company may either reimburse AbbVie for AbbVie's applicable development costs or, in the case of certain budget overruns, AbbVie may instead deduct applicable development costs, up to a specified cap, from milestone and royalty payments owed by AbbVie to the Company.

Under the AbbVie Tau Collaboration Agreement, the Company is eligible to receive specified development and first-sale milestone payments for each Licensed Compound of up to an aggregate of $550.0 million in the case of an Alzheimer's disease indication, up to $230.0 million in the case of the first indication other than Alzheimer's disease and up to $115.0 million for a subsequent non-Alzheimer's disease indication. Additionally, the Company is eligible to receive tiered, escalating royalties, in a range from a high-single digit to a mid-to-high teen (or, if the Company has exercised its Cost-Sharing Option, low-twenties) percentage of aggregate net sales of Licensed Products on a Licensed Compound by Licensed Compound basis, subject to potential reductions in certain circumstances. For each Licensed Product, AbbVie also has the right to decrease or eliminate its royalty payments on such Licensed Product in exchange for a one-time payment by AbbVie at a fair market value to be negotiated by the parties or determined pursuant to dispute resolution procedures specified in the AbbVie Collaboration Agreement.

Unless earlier terminated, the AbbVie Tau Collaboration Agreement will expire on the earliest to occur of the expiration of (i) the Development Option Period, without AbbVie's exercise of a Development Option; (ii) the License Option Period, without AbbVie's exercise of its License Option; and (iii) the last-to-expire royalty term with respect to

all Licensed Products in all countries. The Company and AbbVie have customary termination rights including the right to terminate for an uncured material breach of the agreement committed by the other party, and AbbVie has the right to terminate for convenience.

Accounting Analysis

The Company assessed the promised goods and services under the AbbVie Tau Collaboration Agreement, in accordance with ASC 606, and determined that the AbbVie Tau Collaboration Agreement includes the following performance obligations: (i) research services during the Research Period (through the delivery of the final research report) including the identification of the Research Antibodies, conduct of research activities and provision of information to AbbVie to allow AbbVie to determine whether to exercise up to three development options to be rendered ("Research Services"), and (ii) a material right associated with the Development Option on the first Research Compound and associated Product Candidates ("First Development Option Material Right"). The first Development Option provides AbbVie with (i) additional development services on a selected Research Compound and (ii) the ability to exercise the License Option. The Company has concluded the option provides a material right as the consideration paid by AbbVie upon exercise of the first Development Option is less than the amount that the Company would otherwise expect to receive outside the context of the contract.

The Company has concluded that the First Development Option Material Right is a separate performance obligation under ASC 606 as AbbVie is provided additional services and a License Option for additional consideration that represents a significant discount from amounts that would otherwise be offered outside the context of the contract. The First Development Option Material Right is distinct from the other performance obligations in the arrangement as it is an option in the contract that is not required for AbbVie to obtain the benefit of the other promised goods or services in the arrangement. The First Development Option Material Right does not include the underlying goods or services that are delivered upon exercise of the option, but rather represents the value to the customer of having the right to obtain development services and the right to the License Option at an advantageous price.

The Company received a nonrefundable, upfront payment of $69.0 million as consideration under the AbbVie Collaboration Agreement, which represents the transaction price at inception. Additional consideration to be paid to the Company upon the exercise of the Development and License Options by AbbVie or upon reaching certain milestones are excluded from the transaction price as they relate to option fees and milestones that can only be achieved subsequent to the option exercise or are outside of the initial contact term.

The Company has allocated the transaction price to the separate performance obligations based on their relative standalone selling price. The Company determined the standalone selling price at contract inception based on each obligation's ESP. The Company determined the ESP for the research services obligation based on internal estimates of the costs to perform the services, including expected internal expenses and expenses with third parties for services and supplies, inclusive of a reasonable profit margin. Significant inputs used to determine the total expense of the research services include the length of time required, the internal hours expected to be incurred on the services and the number and costs of various studies that will be performed to complete the Research Plan. The ESP for the First Development Option Material Right was determined based on the fees AbbVie would pay to exercise the Development and License Options, the estimated costs to perform the development services, inclusive of a reasonable profit margin, the estimated value of the License Option using comparable transactions, and the probability that the Development and License Options would be exercised by AbbVie.

Based on the relative standalone selling price, the allocation of the transaction price to the separate performance obligations was as follows:

Performance Obligation	Amount
	(in thousands)
Research Services	$ 34,482
First Development Option Material Right	34,518
Total	$ 69,000

The Company recognizes the amounts associated with Research Services on a proportional performance basis over the period of service using input-based measurements of total cost of research incurred to estimate proportion performed and remeasures its progress towards completion at the end of each reporting period. The amount allocated to the First Development Option Material Right is recorded as deferred revenue and will be recognized either over the period in which goods and services underlying the option are transferred or upon expiry of the option.

During the three and six months ended June 30, 2019, the Company recognized $3.2 million and $4.9 million, respectively, of revenue associated with the AbbVie Tau Collaboration related to the Research Services performed during the period. During the three and six months ended June 30, 2018, the Company recognized $1.9 million and $2.3 million, respectively, of revenue associated with the AbbVie Tau Collaboration related to the Research Services performed during the period. As of June 30, 2019, there was $57.1 million of deferred revenue related to the AbbVie Tau Collaboration Agreement, which is classified as either current or non-current in the accompanying condensed consolidated balance sheet based on the period the goods or services are expected to be delivered.

Costs incurred relating to the AbbVie Tau Collaboration Agreement consist of internal and external research and development costs, which primarily include: salaries and benefits, lab supplies, and preclinical research studies. All of these costs are included in research and development expenses in the Company's condensed consolidated statement of operations during the three and six months ended June 30, 2019.

AbbVie Alpha Synuclein Collaboration Agreement

Summary of Agreement

In February 2019, the Company entered into an exclusive collaboration and option agreement ("the AbbVie Alpha-Synuclein Collaboration Agreement") with AbbVie, for the research, development and commercialization of AAV and other virus-based gene therapy products directed against pathological species of alpha-synuclein for the potential treatment of Parkinson's disease and other diseases characterized by the abnormal accumulation of misfolded alpha-synuclein protein ("synucleinopathies"). Under the AbbVie Alpha-Synuclein Collaboration Agreement, the Company and AbbVie have agreed to collaborate on the research and development of specified vectorized antibody compounds comprised of an AAV or other viral capsid and a virus vector genome that encodes one or more antibodies that target and bind to the alpha-synuclein protein. The collaboration is comprised of a research period (the "ASN Research Period"), an optional development period (the "ASN Development Period"), and an exclusive license option (the "ASN License Option"). The AbbVie Alpha-Synuclein Collaboration Agreement included a non-refundable upfront payment of $65.0 million for services during the ASN Research Period.

During the ASN Research Period, the Company is obligated to conduct research activities directed to constructing one or more virus vectors that encode antibodies designated by AbbVie (the "AbbVie Designated Antibodies") which initially are to be antibodies provided by AbbVie. The Company is obligated to use diligent efforts to conduct research activities to create research compounds ("ASN Research Compounds") and to develop product candidates containing or comprised of the ASN Research Compounds ("ASN Product Candidates"). The Company is solely responsible for the costs and expenses during the ASN Research Period. During a specified portion of the ASN Research Period, AbbVie may exercise one or more of its exclusive development options to select up to a total of four ASN Research Compounds and their corresponding ASN Product Candidates to proceed to the ASN Development Period.

Upon AbbVie's exercise of an option to proceed to the ASN Development Period (an "ASN Development Option"), AbbVie will pay the Company $80.0 million for the first ASN Research Compound and $30.0 million each for up to three additional ASN Research Compounds. During the ASN Development Period, the Company is obligated to use diligent efforts to conduct development activities, including IND application-enabling and Phase 1 clinical trial activities, for each selected ASN Research Compound and corresponding selected ASN Product Candidates. The Company is solely responsible for the costs and expenses during the ASN Development Period. During a specified portion of the ASN Development Period, AbbVie may exercise its ASN License Option to further develop and commercialize all of the ASN Research Compounds and corresponding ASN Product Candidates. Upon AbbVie's

exercise of its ASN License Option, the Company has agreed to grant to AbbVie an exclusive, worldwide license, with the right to sublicense, under certain of the Company's intellectual property rights to develop and commercialize the licensed compounds and the licensed products for all human diagnostic, prophylactic and therapeutic uses. In addition, after AbbVie's exercise of the ASN License Option, the Company has certain obligations to complete any remaining research and development activities that have not been completed for any ASN Research Compounds and ASN Product Candidates.

The Company's research and development activities are to be conducted pursuant to the plans agreed to by the parties and overseen by a joint governance committee (or "ASN JGC") as detailed in the AbbVie Alpha-Synuclein Collaboration Agreement. Any material amendment to the research or development plans, however, must be mutually agreed to by the parties, which may be through the ASN JGC.

Under the AbbVie Alpha-Synuclein Collaboration Agreement, AbbVie is required to use commercially reasonable efforts to develop and commercialize at least one licensed product in each of the United States, Japan, the United Kingdom, Germany, France, Italy and Spain. After exercise of the ASN License Option, AbbVie is solely responsible for all development and commercialization activities relating to licensed compounds and licensed products at its sole cost and expense, subject to the Company's obligation to complete any remaining research and development activities set forth in the agreed-upon research and development plans.

Under the terms of the AbbVie Alpha-Synuclein Collaboration Agreement, the Company is eligible to receive (i) specified development and first-sale milestone payments for each licensed compound of up to an aggregate of $450.0 million in the case of a Parkinson's disease indication and up to $185.0 million in the case of the first indication other than Parkinson's disease and $92.5 million for a subsequent non-Parkinson's disease indication; (ii) specified commercial milestone payments based on net sales for all licensed products and all indications up to an aggregate of $500.0 million; and (iii) tiered, escalating royalties, in the mid-single digit percentage range for aggregate net sales of licensed products on a licensed compound by licensed compound basis, subject to potential reductions in certain circumstances.

Unless earlier terminated, the AbbVie Alpha-Synuclein Collaboration Agreement expires on the earliest to occur of the expiration of (i) the ASN Development Period, without AbbVie's exercise of an ASN Development Option; (ii) the license option period, without AbbVie's exercise of its ASN License Option; and (iii) the last-to-expire royalty term with respect to all licensed products in all countries. The Company and AbbVie have customary termination rights including the right to terminate for an uncured material breach of the agreement committed by the other party, and AbbVie has the right to terminate for convenience.

Upon termination in certain cases, the vectorized antibody exclusivity and AbbVie designated exclusivity survives until the third anniversary of the termination date. If the parties mutually agree to terminate for infeasibility or AbbVie terminates for the Company's failure to deliver a final research or development report, neither the Company nor any of its affiliates may directly or indirectly exploit a vectorized antibody compound that targets or binds to the alpha-synuclein protein for 18 months after the termination date.

Accounting Analysis

The Company assessed the promised goods and services under the AbbVie Alpha-Synuclein Collaboration Agreement, in accordance with ASC 606, and determined that the AbbVie Alpha-Synuclein Collaboration Agreement includes the following performance obligations: (i) research services during the ASN Research Period (through the delivery of the final research report) including the conduct of research activities and provision of information to AbbVie to allow AbbVie to determine whether to exercise up to four ASN Development Options (collectively, the "ASN Research Services"), and (ii) a material right associated with the first ASN Development Option on the first ASN Research Compound and associated ASN Product Candidates ("ASN First Development Option Material Right"). The exercise of the first ASN Development Option provides AbbVie with (i) additional development services on a selected ASN Research Compound and (ii) the ability to exercise the ASN License Option. The Company has concluded the option provides a material right as the consideration paid by AbbVie upon exercise of the first ASN Development Option is less than the amount that the Company would otherwise expect to receive outside the context of the contract.

The Company has concluded that the ASN First Development Option Material Right is a separate performance obligation under ASC 606 as AbbVie is provided additional services and an ASN License Option for additional consideration that represents a significant discount from amounts that would otherwise be offered outside the context of the contract. The ASN First Development Option Material Right is distinct from the other performance obligations in the arrangement as it is an option in the contract that is not required for AbbVie to obtain the benefit of the other promised goods or services in the arrangement. The ASN First Development Option Material Right does not include the underlying goods or services that are delivered upon exercise of the option, but rather represents the value to the customer of having the right to obtain development services and the right to the ASN License Option at an advantageous price.

The Company received a nonrefundable, upfront payment of $65.0 million as consideration under the AbbVie Alpha-Synuclein Collaboration Agreement, which represents the transaction price at inception. Additional consideration to be paid to the Company upon the exercise of the ASN Development and ASN License Options by AbbVie or upon reaching certain milestones are excluded from the transaction price as they relate to option fees and milestones that can only be achieved subsequent to the option exercise or are outside of the initial contact term.

The Company has allocated the transaction price to the separate performance obligations based on their relative standalone selling price. The Company determined the standalone selling price at contract inception based on each obligation's ESP. The Company determined the ESP for the research services obligation based on internal estimates of the costs to perform the services, including expected internal expenses and expenses with third parties for services and supplies, inclusive of a reasonable profit margin. Significant inputs used to determine the total expense of the research services include the length of time required, the internal hours expected to be incurred on the services and the number and costs of various studies that will be performed to complete the agreed upon ASN research plan. The ESP for the ASN First Development Option Material Right was determined based on the fees AbbVie would pay to exercise the ASN Development and ASN License Options, the estimated costs to perform the development services, inclusive of a reasonable profit margin, the estimated value of the ASN License Option using comparable transactions, and the probability that the ASN Development and License Options would be exercised by AbbVie.

Based on the relative standalone selling price, the allocation of the transaction price to the separate performance obligations was as follows:

Performance Obligation	Amount
	(in thousands)
ASN Research Services	$ 23,768
ASN First Development Option Material Right	41,232
Total	$ 65,000

The Company recognizes the amounts associated with the ASN Research Services on a proportional performance basis over the period of service using input-based measurements of total cost of research incurred to estimate proportion performed and remeasures its progress towards completion at the end of each reporting period. The amount allocated to the ASN First Development Option Material Right is recorded as deferred revenue and will be recognized either over the period in which goods and services underlying the option are transferred or upon expiry of the option.

During the three and six months ended June 30, 2019, the Company recognized $0.2 million and $0.4 million of revenue, respectively, associated with the AbbVie Alpha-Synuclein Collaboration related to the ASN Research Services performed during the period then ended. As of June 30, 2019, there was $64.6 million of deferred revenue related to the AbbVie Alpha-Synuclein Collaboration Agreement, which is classified as either current or non-current in the accompanying condensed consolidated balance sheet based on the period the goods or services are expected to be delivered.

Costs incurred relating to the AbbVie Alpha-Synuclein Collaboration Agreement consist of internal and external research and development costs, which primarily include salaries and benefits, lab supplies, and preclinical

research studies. All of these costs are included in research and development expenses in the Company's condensed consolidated statement of operations during the three and six months ended June 30, 2019.

Neurocrine Collaboration Agreement

Summary of Agreement

In March 2019, the Company entered into an exclusive collaboration and option agreement with Neurocrine Biosciences (the "Neurocrine Collaboration Agreement") for the research, development and commercialization of certain of its AAV gene therapy products. Under the Neurocrine Collaboration Agreement, the Company has agreed to collaborate on the conduct of four collaboration programs (the "Neurocrine Programs") which include: (i) the AADC Program (the "AADC Program") for the treatment of Parkinson's disease, (ii) the FA Program (the "FA Program") for the treatment of Friedreich's ataxia including the development of the VY-FXN01 product candidate (collectively, the "Existing Programs"); and (iii) two programs to be determined by the Company and Neurocrine at a later date (the "Discovery Programs").

In June 2019, in conjunction with the termination of the Sanofi Genzyme Collaboration Agreement, the Company gained ex-U.S. rights to the VY-FXN01 Friedreich's ataxia Program. The ex-U.S. rights to VY-FXN01 were subsequently transferred from the Company to Neurocrine Biosciences under the terms of the Neurocrine Collaboration Agreement. To facilitate the transfer of the ex-U.S. rights to VY-FXN01 from the Company to Neurocrine, the Company and Neurocrine Biosciences executed an amendment to the Neurocrine Collaboration Agreement (the "June 2019 Modification"), and Neurocrine Biosciences paid $5.0 million to the Company. There were no other changes in pricing or scope of the obligations required to be performed under the Neurocrine Collaboration Agreement.

Under the terms of the Neurocrine Collaboration Agreement, the Company has agreed to collaborate with Neurocrine on, and to grant, exclusive, royalty-bearing, non-transferable, sublicensable licenses to certain of its intellectual property rights, for all human and veterinary diagnostic, prophylactic, and therapeutic uses, for the research, development, and commercialization of gene therapy products (the "Collaboration Products") on a worldwide basis under (i) the AADC Program; (ii) the FA Program; and (iii) each Discovery Program.

Pursuant to development plans to be agreed by the parties, which will be overseen by a joint steering committee ("JSC"), the Company has operational responsibility, subject to certain exceptions, for the conduct of each Neurocrine Program prior to the defined Transition Event for each Program, as described below, and is required to use commercially reasonable efforts to develop the corresponding Collaboration Products. Neurocrine has agreed to be responsible for all costs incurred by the Company in conducting these activities for each Neurocrine Program, in accordance with an agreed budget for each Neurocrine Program. If the Company breaches its development responsibilities or in certain circumstances upon a change in control, Neurocrine has the right but not the obligation to assume the activities under such Neurocrine Program.

Upon the occurrence of a specified event for each Neurocrine Program (a "Transition Event") Neurocrine has agreed to assume responsibility for development, manufacturing and commercialization activities for such Neurocrine Program from the Company and to pay milestones and royalties on future net sales as described further below. The Transition Events are (i) with respect to the AADC Program, the Company's receipt of topline data for the RESTORE-1 Phase 2 clinical trial for VY-AADC; (ii) with respect to the FA Program, the Company's receipt of topline data for the initial Phase 1 clinical trial for a Friedreich's ataxia program product candidate; and (iii) with respect to each Discovery Program, the preparation by the Company and the approval by Neurocrine of an IND application to be filed with the Food and Drug Administration (the "FDA") by Neurocrine for the first development candidate in such Discovery Program. For each Existing Program, the Company has the option (the "Co-Co Option") to co-develop and co-commercialize such Neurocrine Program upon the occurrence of a specified event (a "Co-Co Trigger Event"). Should the Company elect to exercise its Co-Co Option, the Company has agreed to enter into a cost- and profit-sharing arrangement with Neurocrine (a "Co-Co Agreement"), whereby it has agreed to jointly develop and commercialize Collaboration Products for such Neurocrine Existing Program ("Co-Co Products") and share in its costs, profits and losses, and the Company agrees to forfeit certain milestones and royalties on net sales in the United States during the effective period of the applicable Co-Co Agreement. The Co-Co Trigger Events are (i) with respect to the AADC

Program, the Company's receipt of topline data for the ongoing RESTORE-1 Phase 2 clinical trial for VY-AADC and (ii) with respect to the FA Program, the receipt of topline data for the initial Phase 1 clinical trial for a Friedreich's ataxia program product candidate.

Subject to exceptions specified in the Neurocrine Collaboration Agreement, profits and losses under the Company's Co-Co Option are agreed to be allocated (i) 50% to Neurocrine and 50% to the Company for a Collaboration Product from the AADC Program and (ii) 60% to Neurocrine and 40% to the Company for a Collaboration Product from the FA Program; provided, however, that Neurocrine may elect, within a specified period following the acceptance for filing of a BLA from the FDA, to pay a $35.0 million rate-shifting fee to the Company to change the allocation for the AADC Program to 55% to Neurocrine and 45% to the Company. The parties have agreed that each Co-Co Agreement will provide the Company the right to terminate for any reason upon prior written notice to Neurocrine and Neurocrine the right to terminate in certain circumstances upon change of control.

The Company's research and development activities under the Neurocrine Collaboration Agreement are to be conducted pursuant to plans agreed to by the parties, on a program-by-program basis, and overseen by the JSC, as detailed in the Neurocrine Collaboration Agreement.

The parties have committed to agree on a list of up to eight target genes (or "Targets") from which Neurocrine has the right to nominate Targets for the two Discovery Programs. Each Target for the Discovery Programs must be approved by a consensus of the JSC or the executive officers.

The Neurocrine Collaboration Agreement provides for an upfront non-refundable payment of $115.0 million, as well as for aggregate development and regulatory milestone payments from Neurocrine to the Company for Collaboration Products under (i) the AADC Program of up to $170.0 million; (ii) the FA Program of up to $195.0 million, and (iii) each of the two Discovery Programs of up to $130.0 million per Discovery Program. The Company may be entitled to receive aggregate commercial milestone payments for each Collaboration Product of up to $275.0 million, subject to an aggregate cap on commercial milestones across all Neurocrine Programs of $1.1 billion. Furthermore, in connection with the Neurocrine Collaboration Agreement, Neurocrine has purchased 4,179,728 shares of the Company's common stock at a price of $11.9625 per share, for an aggregate purchase price of $50.0 million.

Neurocrine has also agreed to pay the Company royalties, based on future net sales of the Collaboration Products. Such royalty percentages, for net sales in and outside the United States, as applicable, range (i) for the VY-AADC program, from the mid-teens to low thirties and the low-teens to low twenties, respectively; (ii) for the FA Program, from the low-teens to high-teens and high-single digits to mid-teens, respectively; and (iii) for each Discovery Program, from the high-single digits to mid-teens and mid-single digits to low-teens, respectively. On a country-by-country and program-by-program basis, royalty payments would commence on the first commercial sale of a Collaboration Product and terminate on the later of (a) the expiration of the last patent covering the Collaboration Product or its method of use in such country, (b) 10 years from the first commercial sale of the Collaboration Product in such country and (c) the expiration of regulatory exclusivity in such country, or the Royalty Term. Royalty payments may be reduced by up to 50% in specified circumstances, including expiration of patents rights related to a Collaboration Product, approval of biosimilar products in a given country or required payment of licensing fees to third parties related to the development and commercialization of any Collaboration Product. Additionally, the licenses granted to Neurocrine shall automatically convert to fully paid-up, non-royalty bearing, perpetual, irrevocable, exclusive licenses on a country-by-country and product-by-product basis upon the expiration of the Royalty Term applicable to such Collaboration Product in such country.

Under the terms of the Neurocrine Collaboration Agreement and subject to specified exceptions therein, each party owns the entire right, title and interest in and to all intellectual property rights made solely by its employees or agents in the course of the collaboration. The parties jointly own all rights, title and interest in and to all intellectual property rights made or invented jointly by employees or agents of both parties.

During the term of the Neurocrine Collaboration Agreement, neither party nor any of its respective affiliates is permitted to directly or indirectly exploit any AAV-based gene therapy products directed to a Target to which a Collaboration Product is directed, subject to specified exceptions including the parties' conduct of basic research.

Unless earlier terminated, the Neurocrine Collaboration Agreement expires on the later of (i) the expiration of the last to expire royalty term with respect to a Collaboration Product in all countries in the relevant territory or (ii) the expiration or termination of all Co-Co Agreements. Neurocrine may terminate the Neurocrine Collaboration Agreement in its entirety or on a program-by-program or country-by-country basis by providing at least (x) 180-day advance notice if such notice is provided prior to the first commercial sale of the Collaboration Product to which the termination applies or (y) one-year advance notice if such notice is provided after the first commercial sale of the Collaboration Product to which the termination applies. The Company may terminate the Neurocrine Collaboration Agreement, subject to specified conditions, if Neurocrine challenges the validity or enforceability of certain of the Company's intellectual property rights. Subject to a cure period, either party may terminate the Neurocrine Collaboration Agreement in the event of a material breach by the other party in whole or in part, subject to specified conditions.

Upon termination in certain cases, Neurocrine has agreed to grant to the Company licenses to certain Neurocrine intellectual property, subject to a negotiation between the parties to establish royalty rates for use of such intellectual property. In the event of a breach by the Company with respect to a Neurocrine Program, if such termination were to occur after a Transition Event, then (i) if a Co-Co Agreement is in effect with respect to such program, Neurocrine can terminate the Co-Co Agreement for such program and the Company would no longer have co-development and co-commercialization rights with respect to the Collaboration Product and (ii) subject to any license agreements, Neurocrine would no longer have any obligations with respect to any Collaboration Products resulting from such program.

Accounting Analysis

At inception, the Neurocrine Collaboration Agreement included the following performance obligations: (i) research and development services for each Existing Program combined with a development and commercialization license for each such program and (ii) research and development services for each Discovery Program combined with a development and commercialization license for each program. The research services and license on a program by program basis are not distinct as Neurocrine cannot benefit from such license on its own or from other resources commonly available in the industry, without the corresponding research services due to the unique and specialized expertise of the Company that is not readily available in the marketplace.

The Company has identified $92.4 million of fixed transaction price consisting of the $115.0 million upfront fee and $5.0 million payment from the June 2019 Modification, offset by a discount of $27.6 million related to the $50.0 million equity investment of 4,179,728 shares when measured at fair value on the date of issuance. The Company is also entitled to reimbursement of costs incurred by the Company prior to the Transition Events associated with each Neurocrine Program. These amounts are determinable based on program plans and budgets, and the Company has a contractual right to the payment of cost incurred under the agreed upon program plans. The Company has utilized the most likely amount approach to estimate the cost reimbursement to be $431.1 million, and has concluded that these amounts do not require a constraint and are included in the transaction price at inception. Additional consideration to be paid to the Company upon reaching certain milestones are excluded from the transaction price at inception due to the uncertainty of achieving the development and regulatory milestones.

The Company has allocated the fixed transaction price to the separate performance obligations based on the relative standalone selling price of each performance obligation or in the case of certain variable consideration to one or more performance obligations. The estimated standalone selling prices for performance obligations, that include a license and research services, were developed using the estimated selling price of the license, using comparable and market date, and an estimate of the overall effort to perform the research services along with a reasonable profit for research services.

The Company has concluded that the variable consideration related to the cost reimbursement of each program will be allocated to each respective program as the cost reimbursement relates specifically to the respective program services being performed under the Neurocrine Collaboration. The reimbursement of research services is considered to be at a market rate and the allocation of the fixed consideration to all of the performance obligations depicts the estimated amounts in which it would expect to receive for these obligations, absent the variable consideration related to

the research reimbursement. The total variable consideration allocated to each program related to the cost reimbursement was as follows:

Performance Obligation	Amount
	(in thousands)
Variable Consideration	
AADC Program	$ 170,209
FA Program	114,023
Discovery Program 1	73,416
Discovery Program 2	73,416
Total	$ 431,064

Based on the relative standalone selling price allocation, the allocation of the transaction price, exclusive of the variable consideration allocated to the individual performance obligations, to the separate performance obligations was as follows:

Performance Obligation	Amount
	(in thousands)
Fixed Consideration	
AADC Program	$ 80,373
FA Program	6,005
Discovery Program 1	3,002
Discovery Program 2	3,002
Total	$ 92,382

The Company recognizes the transaction price associated with each performance obligation on a proportional performance basis over the period of service using input-based measurements such as costs incurred to date, to estimate proportion performed, and remeasures its progress towards completion at the end of each reporting period.

During the three and six months ended June 30, 2019, the Company recognized $12.5 million and $14.4 million of revenue, respectively, associated with its collaboration with Neurocrine related to research and development services performed during the period and the corresponding cost reimbursement receivable. As of June 30, 2019, there was $88.0 million of deferred revenue related to the Neurocrine Collaboration Agreement, which is classified as either current or non-current in the accompanying condensed consolidated balance sheet based on the period the services are expected to be delivered. Additionally, as of June 30, 2019, there was $10.1 million of collaboration and unbilled receivables related to reimbursable costs expected to be received from Neurocrine for research and development services performed.

Costs incurred relating to the Collaboration Programs consist of internal and external research and development costs, which primarily include: salaries and benefits, lab supplies, preclinical research studies, clinical studies, consulting services, and commercial development. These costs are included in research and development expenses in the Company’s condensed consolidated statement of operations during the three and six months ended June 30, 2019.

The Company incurred approximately $0.8 million of costs to obtain the Neurocrine Collaboration Agreement which were payable only upon the close of the deal and therefore considered incremental costs of obtaining a contract with a customer and capitalized. The costs are recorded in prepaid expenses and other non-current assets and are being amortized over the period in which the research services will be provided.

MRI Interventions License and Securities Purchase Agreements

In September 2016, the Company entered into a securities purchase agreement (the “Securities Purchase Agreement”) and a license agreement (the “MRIC License Agreement”) with MRI Interventions, Inc. (“MRIC”). MRIC is the primary supplier of the ClearPoint® System, which is being used by the Company in ongoing development and clinical trials. Under the Securities Purchase Agreement, the Company paid $2.0 million for shares of MRIC common stock and a warrant to purchase additional shares of MRIC common stock. The Company also entered into the MRIC

License Agreement, which provided for certain rights to MRIC technology and for MRIC to transfer the rights and know-how to manufacture the ClearPoint System to enable the Company to utilize an alternative supplier for the ClearPoint System for use in the Company's development and clinical trials. During 2017, the Company terminated the MRIC License Agreement and all prior and future commitments and obligations under such agreement became null and void. As of June 30, 2019, the Company continues to hold the common stock and warrants to purchase additional shares of common stock as an available-for-sale security and non-current asset, respectively.

In May 2018, the Company entered into a master services and supply agreement with MRIC (the "MRIC Supply Agreement") which provides for MRIC to perform certain manufacturing, supply, development and services as requested by the Company, including the supply of the ClearPoint System and cannula devices. In March 2019, in connection with the MRIC Supply Agreement, the Company transferred its premarket notification (510(k)) clearance for its Variable Trajectory Array Guide ("V-TAG") delivery device to MRIC and MRIC assumed the role of specifications developer and manufacturer for the V-TAG device and related regulatory compliance obligations. Under the terms of the MRIC Supply Agreement, MRIC will manufacture and supply the V-TAG device exclusively to the Company's clinical sites for use in the RESTORE-1 Phase 2 clinical trial. The Company retained all of its intellectual property rights in the V-TAG device, and has the unrestricted right to require MRIC to transfer the 510(k) clearance back to the Company at the Company's request.

Other Agreements

During 2018 and 2017, the Company entered into various agreements with contract research organizations and institutions to license intellectual property. In consideration for the rights licensed under such agreements, the Company generally made upfront payments, which were recorded as research and development expense as the acquired technologies were considered in-process research and development. The agreements generally obligate the Company to make additional payments that are contingent upon specific clinical trial and regulatory approval milestones being achieved as well as royalties on future product sales. The agreements to license intellectual property include potential milestone payments that are dependent upon the development of products licensed under the agreements and contingent upon the achievement of clinical trial or regulatory approval milestones. As of June 30, 2019, the Company reached a milestone related to first patient dosing on the RESTORE-1 Phase 2 clinical trial which resulted in a $0.1 million milestone payment to one of its licensors. The Company can generally terminate the license agreements upon 30 to 90 days prior written notice.

During the year ended December 31, 2016, the Company entered into a research and development funding arrangement with a non-profit organization that provides up to $4.0 million in funding to the Company upon the achievement of clinical and development milestones. The agreement provides that the Company repay amounts received under certain circumstances including termination of the agreement, and to pay an amount up to 2.6 times the funding received upon successful development and commercialization of any products developed. During the year ended December 31, 2017, the Company earned a milestone payment of $1.0 million. The Company has evaluated the arrangement and has concluded that it represents a research and development financing arrangement as it is probable that the Company will repay amounts received under the arrangement. As a result, the $1.0 million earned to date is recorded as a non-current liability in the condensed consolidated balance sheet.

Litigation

The Company is not a party to any material legal matters or claims and did not have contingency reserves established for any litigation liabilities as of June 30, 2019 or December 31, 2018.

9. Preferred stock

The Company has authorized preferred stock amounting to 5,000,000 shares as of June 30, 2019 and December 31, 2018. The authorized preferred stock was classified under stockholders' equity at June 30, 2019 and December 31, 2018.

10. Stock-based compensation

2014 Stock Option and Grant Plan

In January 2014, the Company adopted the 2014 Stock Option and Grant Plan (the "2014 Plan"), under which it could grant incentive stock options, non-qualified stock options, restricted stock awards, unrestricted stock awards, or restricted stock units to purchase up to 823,529 shares of common stock to employees, officers, directors and consultants of the Company.

In April 2014, the Company amended the 2014 Plan to allow for the issuance of up to 1,411,764 shares of common stock. In August 2014, April 2015, August 2015, and October 2015, the Company further amended the 2014 Plan to allow for the issuance of up to 2,000,000, 2,047,058, 2,669,411, and 2,998,823 shares of common stock, respectively. During 2014 the Company issued only restricted stock awards under the 2014 Plan and during 2015 the Company only granted stock options under the 2014 Plan.

The terms of stock option agreements, including vesting requirements, were determined by the Board of Directors and were subject to the provisions of the 2014 Plan. Restricted stock awards granted by the Company generally vest based on each grantee's continued service with the Company during a specified period following grant. Stock options granted to employees generally vest over four years, with 25% vesting on the one year anniversary and 75% vesting ratably, on a monthly basis, over the remaining three years. Stock options granted to non-employee consultants generally vest monthly over a period of one to four years.

Founder Awards

In January 2014, the Company issued 1,188,233 shares of restricted stock to its founders at an original issuance price of $0.0425 per share. Of the total restricted shares awarded to the founders, 835,292 shares generally vested over one to four years, based on each founder's continued service to the Company in varying capacity as a Scientific Advisory Board member, consultant, director, officer or employee, as set forth in each grantee's individual restricted stock purchase agreement. These shares were fully vested as of June 30, 2019. Stock-based compensation expense associated with these time-based awards was recognized over the vesting period.

The remaining 352,941 of the shares issued begin vesting upon the achievement of certain performance objectives as well as continued service to the Company, as set forth in the agreements. These performance conditions are tied to certain milestone events specific to the Company's corporate goals, including but not limited to preclinical and clinical development milestones related to the Company's product candidates. Stock-based compensation expense associated with these performance-based awards is recognized when the achievement of the performance condition is considered probable, using management's best estimates. During 2016, management determined that the achievement of the performance milestone for one of the three performance-based awards had become probable and began recognizing stock-based compensation accordingly. The Company recorded $0.1 million and $0.3 million in stock-based compensation expense related to this award during the three and six months ended June 30, 2018, respectively. No stock-based compensation expense was recorded in 2019 related to this award as it was fully vested during 2018. No stock-based compensation expense was recorded for the remaining two founders' awards with performance-based vesting as of June 30, 2019 as the performance-based milestones related to these awards were not probable.

2015 Stock Option Plan

In October 2015, the Company's board of directors and stockholders approved the 2015 Stock Option and Incentive Plan (the "2015 Stock Option Plan"), which became effective upon the completion of the Company's initial public offering (the "IPO"). The 2015 Stock Option Plan provides the Company with the flexibility to use various equity-based incentive and other awards as compensation tools to motivate its workforce. These tools include stock options, stock appreciation rights, restricted stock, restricted stock units, unrestricted stock, performance share awards and cash-based awards. The 2015 Stock Option Plan replaced the 2014 Plan. Any options or awards outstanding under the 2014 Plan remained outstanding and effective. The number of shares initially reserved for issuance under the 2015 Stock Option Plan is the sum of (i) 1,311,812 shares of common stock and (ii) the number of shares under the 2014 Plan that are not needed to fulfill the Company's obligations for awards issued under the 2014 Plan as a result of forfeiture, expiration, cancellation, termination or net issuances of awards thereunder. The number of shares of common stock that

may be issued under the 2015 Stock Option Plan is also subject to increase on the first day of each fiscal year by up to 4% of the Company's issued and outstanding shares of common stock on the immediately preceding December 31.

Effective January 1, 2016, 2017, 2018, and 2019, an additional 1,069,971, 1,070,635, 1,285,200, and 1,302,830 shares, respectively, were added to the Company's 2015 Stock Option Plan for future issuance. As of June 30, 2019, there were 2,166,946 shares of common stock available for future award grants under the 2015 Stock Option Plan. During the three and six months ended June 30, 2019, the Company granted a total of 557,580 and 1,310,920 stock options, respectively, to employees and directors under the 2015 Stock Option Plan. During the three and six months ended June 30, 2019, the Company awarded a total of 65,052 and 419,457 restricted stock units, respectively, to employees under the 2015 Stock Option Plan. During the three and six months ended June 30, 2019, there were no new stock options issued to non-employees under the 2015 Stock Option Plan.

2015 Employee Stock Purchase Plan

In October 2015, the Company's board of directors and stockholders approved the 2015 Employee Stock Purchase Plan (the "2015 ESPP"). The 2015 ESPP became effective upon the closing of the IPO. Under the 2015 ESPP, all full-time employees of the Company are eligible to purchase common stock of the Company twice per year, at the end of each six-month payment period. During each payment period, eligible employees who so elect, may authorize payroll deductions in an amount of 1% to 10% (whole percentages only) of the employee's base pay for each payroll period. At the end of each payment period, the accumulated deductions are used to purchase shares of common stock from the Company at a discount. A total of 262,362 shares of common stock were initially authorized for issuance under this plan. The number of shares of common stock that may be issued under the 2015 ESPP is also subject to increase on the first day of each fiscal year by up to 1% of the Company's issued and outstanding shares of common stock on the immediately preceding December 31. Effective January 1, 2016, 2017, 2018, and 2019, 267,492, 267,658, 321,300, and 325,707 shares of common stock, respectively, were added to the 2015 ESPP.

Inducement Awards

In the three and six months ended June 30, 2019, the Company issued to two executives non-statutory stock options to purchase an aggregate of 338,750 shares of the Company's common stock and restricted stock unit awards for an aggregate of 58,125 units of the Company's common stock, in each case outside of the Company's 2015 Stock Option Plan as an inducement material to such executive's acceptance of an offer of employment with the Company in accordance with Nasdaq Listing Rule 5635(c)(4). The stock options will vest over a four-year period, with 25% of the shares underlying the option award vesting on the first anniversary of the award and the remaining 75% of the shares underlying the award vesting monthly thereafter over the subsequent 36-month period. The restricted stock units will vest over a three-year period, with 33% of the restricted stock units vesting on the first anniversary, 33% of the restricted stock units vesting on the second anniversary, and the remaining restricted stock units vesting on the third anniversary.

Stock-Based Compensation Expense

Total compensation cost recognized for all stock-based compensation awards in the statements of operations and comprehensive income (loss) is as follows:

	Three Months Ended June 30,		Six Months Ended June 30,	
	2019	2018	2019	2018
	(in thousands)			
Research and development	$ 3,256	$ 1,332	$ 4,671	$ 2,530
General and administrative	1,998	6,782	4,100	7,906
Total stock-based compensation expense	$ 5,254	$ 8,114	$ 8,771	$ 10,436

Stock-based compensation expense by type of award included within the consolidated statements of operations and comprehensive income (loss) was as follows:

	Three Months Ended June 30,		Six Months Ended June 30,	
	2019	2018	2019	2018
	(in thousands)			
Stock options	$ 4,528	$ 7,902	$ 7,304	$ 9,868
Restricted stock awards and units	668	163	1,351	457
Employee stock purchase plan awards	58	49	116	111
Total stock-based compensation expense	$ 5,254	$ 8,114	8,771	10,436

During the six months ended June 30, 2019, the Company entered into a consulting agreement (the “Sah Agreement”) with Dr. Dinah Sah, Ph.D., the Company’s former Chief Scientific Officer, pursuant to which Dr. Sah has agreed to provide consulting and advisory services, including but not limited to scientific guidance in connection with certain of the Company’s collaborations and research and development programs for a three-year period which commenced on June 28, 2019. In accordance with its terms, the Sah Agreement triggered an equity modification resulting in the recognition of $2.2 million of stock-based compensation expense related to the non-substantice service period of the Sah Agreement.

Restricted Stock Units

A summary of the status of and changes in unvested restricted stock unit activity under the Company’s equity award plans for the six months ended June 30, 2019 was as follows:

	Units	Weighted Average Grant Date Fair Value Per Unit
Unvested restricted stock units as of December 31, 2018	—	—
Granted	419,457	$ 10.91
Vested	—	—
Forfeited	(16,675)	$ 9.09
Unvested restricted stock units as of June 30, 2019	402,782	$ 10.98

Stock-based compensation of restricted stock units is based on the fair value of the Company’s common stock on the date of grant and recognized over the vesting period. The weighted average fair value of restricted stock units granted to employees during the three and six months ended June 30, 2019 was $20.74 and $10.91 per share, respectively. The restricted stock units granted in the three and six months ended June 30, 2019 vest in equal amounts, annually over three years. There were no restricted stock units granted to employees in the three and six months ended June 30, 2018. The expense related to restricted stock units granted to employees was $0.7 million and $1.4 million for the three and six months ended June 30, 2019, respectively.

As of June 30, 2019, the Company had unrecognized stock-based compensation expense related to its unvested restricted stock units of $3.6 million, which is expected to be recognized over the remaining average vesting period of 2.6 years.

Stock Options

The following is a summary of stock option activity for the six months ended June 30, 2019:

	Shares	Weighted Average Exercise Price	Remaining Contractual Life (in years)	Aggregate Intrinsic Value (in thousands)
Outstanding at December 31, 2018	4,225,152	$ 15.91		
Granted	1,310,920	$ 14.70		
Exercised	(88,821)	$ 11.24		
Cancelled or forfeited	(207,716)	$ 14.05		
Outstanding at June 30, 2019	5,239,535	$ 15.76	8.3	$ 60,649
Exercisable at June 30, 2019	1,972,340	$ 13.87	7.2	$ 26,574
Vested and expected to vest at June 30, 2019	5,239,535	$ 15.76	8.3	$ 60,649

Using the Black-Scholes option pricing model, the weighted-average fair value of options granted to employees and directors during the three and six months ended June 30, 2019 was $14.61 and $9.79 per share, respectively. The expense related to options granted to employees and directors was $4.5 million and $7.3 million for the three and six months ended June 30, 2019, respectively.

The weighted-average fair value of options granted to employees and directors during the three and six months ended June 30, 2018 was $13.88 and $15.92 per share, respectively. The expense related to awards granted to employees and directors was $7.9 million and $9.8 million for the three and six months ended June 30, 2018, respectively.

The fair value of each option issued to employees and directors was estimated at the date of grant using the Black-Scholes option pricing model with the following weighted-average assumptions:

	Three Months Ended June 30,		Six Months Ended June 30,	
	2019	2018	2019	2018
Risk-free interest rate	2.2 %	2.8 %	2.4 %	2.7 %
Expected dividend yield	— %	— %	— %	— %
Expected term (in years)	6.0	6.0	6.0	6.0
Expected volatility	75.1 %	74.7 %	75.1 %	74.4 %

There were no new equity awards granted to non-employees during the three and six months ended June 30, 2019. The expense related to stock option awards previously granted to non-employees was $0.1 million for the three and six months ended June 30, 2019. The expense related to awards previously granted to non-employees was $0.1 million and $0.2 million for the three and six months ended June 30, 2018, respectively.

As of June 30, 2019, the Company had unrecognized stock-based compensation expense related to its unvested stock options of $30.5 million which is expected to be recognized over the remaining weighted-average vesting period of 2.8 years.

11. Income taxes

Deferred tax assets and deferred tax liabilities are recognized based on temporary differences between the financial reporting and tax basis of assets and liabilities using statutory rates. A valuation allowance is recorded against deferred tax assets if it is more likely than not that some or all of the deferred tax assets will not be realized. Due to the uncertainty surrounding the realization of the favorable tax attributes in future tax returns, the Company has recorded a full valuation allowance against the Company’s otherwise recognizable net deferred tax assets.

For the three and six months ended June 30, 2019 and 2018, the Company recognized a de minimis tax expense in other comprehensive income related to the unrealized gain on available-for-sale securities.

12. Net income (loss) per share

The following table sets forth the outstanding potentially dilutive securities that have been excluded in the calculation of diluted net income (loss) per share because to include them would be anti-dilutive:

	Three Months Ended June 30,		Six Months Ended June 30,	
	2019	2018	2019	2018
Unvested restricted common stock awards	235,294	347,724	235,294	347,724
Unvested restricted common stock units	154,781	—	402,782	—
Outstanding stock options	4,157,197	6,700,282	5,239,535	6,700,282
Total	4,547,272	7,048,006	5,877,611	7,048,006

Basic net income (loss) and diluted weighted-average shares outstanding are as follows for the three and six months ended June 30, 2019 and 2018:

	Three Months Ended June 30,		Six Months Ended June 30,	
	2019	2018	2019	2018
	(in thousands, except share data)			
Numerator:				
Net income (loss)	$ 11,153	$ (25,541)	$ (16,017)	$ (45,468)
Denominator for basic net income (loss) per share:				
Weighted average shares outstanding	36,610,918	31,976,922	34,990,989	31,868,995
Denominator for diluted net income (loss) per share:				
Weighted average shares outstanding	36,610,918	31,976,922	34,990,989	31,868,995
Common stock options and restricted stock units	1,330,339	—	—	—
Weighted average shares and conversions	37,941,257	31,976,922	34,990,989	31,868,995

Basic net loss per share for the six months ended June 30, 2019 and 2018, is the same as diluted net loss per share as shown on the Company's condensed consolidated statement of operations.

13. Related-party transactions

During the three and six months ended June 30, 2019 and 2018, the Company received consulting and management services from one of its investors. The total amount of the services provided by this investor was de minimis during the three and six months ended June 30, 2019 and 2018.

ITEM 2. MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

The following discussion and analysis of our financial condition and results of operations should be read in conjunction with our unaudited condensed consolidated financial statements and related notes appearing elsewhere in this Quarterly Report on Form 10-Q and the audited financial information and the notes thereto included in our Annual Report on Form 10-K for the year ended December 31, 2018, which was filed with the Securities and Exchange Commission, or the SEC, on February 26, 2019.

Our actual results and timing of certain events may differ materially from the results discussed, projected, anticipated, or indicated in any forward-looking statements. We caution you that forward-looking statements are not guarantees of future performance and that our actual results of operations, financial condition and liquidity, and the development of the industry in which we operate may differ materially from the forward-looking statements contained in this Quarterly Report on Form 10-Q. In addition, even if our results of operations, financial condition and liquidity, and the development of the industry in which we operate are consistent with the forward-looking statements contained in this Quarterly Report on Form 10-Q, they may not be predictive of results or developments in future periods.

The following information and any forward-looking statements should be considered in light of factors discussed elsewhere in this Quarterly Report on Form 10-Q, including those risks identified under "Part II, Item 1A-Risk Factors."

These forward-looking statements are made under the safe harbor provisions of Section 27A of the Securities Act of 1933, as amended, or the Securities Act, and Section 21E of the Securities Exchange Act of 1934, as amended. These statements are neither promises nor guarantees. We caution readers not to place undue reliance on any forward-looking statements made by us, which speak only as of the date they are made. We disclaim any obligation, except as specifically required by law and the rules of the SEC, to publicly update or revise any such statements to reflect any change in our expectations or in events, conditions or circumstances on which any such statements may be based, or that may affect the likelihood that actual results will differ from those set forth in the forward-looking statements.

Overview

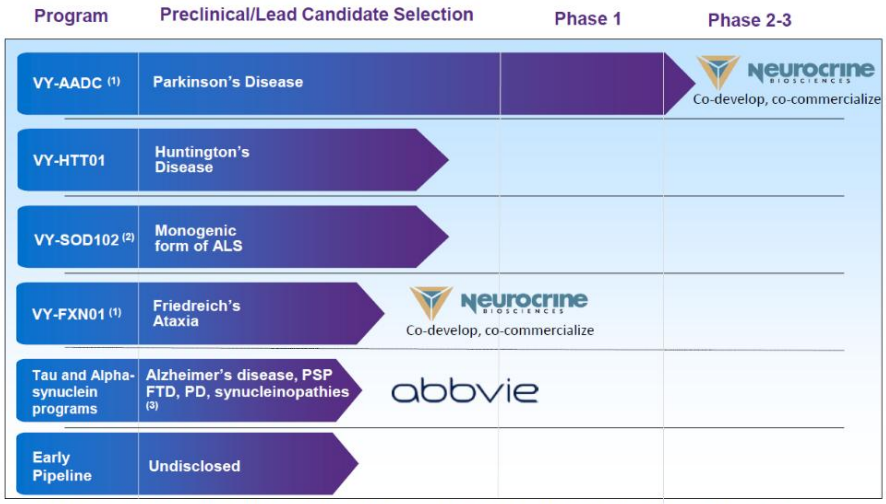
We are a clinical-stage gene therapy company focused on developing life-changing treatments for patients suffering from severe neurological diseases. We focus on neurological diseases where we believe an adeno-associated virus, or AAV, gene therapy approach that either increases or decreases the production of a specific protein can slow or reduce the symptoms experienced by patients, and therefore have a clinically meaningful impact. We have built a gene therapy platform that we believe positions us to be a leading company at the intersection of AAV gene therapy and severe neurological disease. Our gene therapy platform enables us to engineer, optimize, manufacture and deliver our AAV-based gene therapies that have the potential to provide durable efficacy following a single administration.

Additionally, we are working to identify novel AAV capsids, which are the outer viral protein shells that enclose the genetic material of the virus payload. Our team of experts in the fields of AAV gene therapy and neuroscience first identifies and selects severe neurological diseases that are well-suited for treatment using AAV gene therapy. We then engineer and optimize AAV vectors for delivery of the virus payload to the targeted tissue or cells. Our manufacturing process employs an established system that we believe will enable production of high quality AAV vectors at commercial scale. In addition to our capsid optimization efforts, we leverage novel delivery paradigms, established routes of administration, and advances in dosing techniques to optimize delivery of our AAV gene therapies to target tissues, regions and cell types that are critical to the disease of interest. We believe we can achieve this directly, with targeted infusions to discrete regions of the brain or spinal cord, or systemically, in conjunction with our novel capsids.

Our business strategy focuses on discovering, developing, manufacturing and commercializing our gene therapy programs. As part of this strategy, we have developed core competencies specific to AAV gene therapy development and manufacturing and are beginning to build our commercial infrastructure. This business strategy also includes business development activities that may include in-licensing activities or partnering certain programs in specific geographies with collaborators, as we have demonstrated through our collaborations, including those with Sanofi Genzyme, AbbVie,

and Neurocrine. Since our inception, our operations have focused on organizing and staffing our company, business planning, raising capital, establishing our intellectual property portfolio, determining which neurological diseases to pursue, advancing our product candidates including delivery and manufacturing, and conducting preclinical studies and clinical trials. We do not have any product candidates approved for sale and have not generated any revenue from product sales. We have funded our operations primarily through private placements of redeemable convertible preferred stock, public offerings of our common stock, and our strategic collaborations, including our collaboration with Sanofi Genzyme, or the Sanofi Genzyme Collaboration, which commenced in February 2015 and was terminated in June 2019, our collaboration with AbbVie focusing on tau-related diseases, or the AbbVie Tau Collaboration, which commenced in February 2018, our collaboration with AbbVie focusing on pathological species of alpha-synuclein, or the AbbVie Alpha-Synuclein Collaboration, which commenced in February 2019, and our collaboration with Neurocrine Biosciences, or the Neurocrine Collaboration, which commenced in March 2019.

Our pipeline of gene therapy programs is summarized in the table below:



Our pipeline consists of programs for severe neurological indications, including Parkinson's disease; Huntington's disease; a monogenic form of amyotrophic lateral sclerosis, or ALS; Friedreich's ataxia; tau-related diseases including Alzheimer's disease, frontotemporal dementia, or FTD, and progressive supranuclear palsy, or PSP; and alpha-synuclein related diseases for Parkinson's disease and other synucleinopathies. We may seek orphan drug designation, breakthrough therapy designation, or other expedited review processes for certain of our product candidates in the United States, Europe, and Japan.

Our most advanced clinical candidate, VY-AADC for the treatment of Parkinson's disease is included in our collaboration agreement with Neurocrine. We are evaluating VY-AADC in the Phase 1b clinical trial and the separate Phase 1 clinical trial exploring the delivery of VY-AADC using a posterior trajectory (PD-1101 and PD-1102, respectively). PD-1101 is an open-label, dose-ranging, Phase 1b clinical trial exploring a transfrontal (i.e., top of the head) surgical delivery route for VY-AADC to evaluate safety and efficacy. We enrolled 15 patients with advanced Parkinson's disease and assessed increased volume or concentration of VY-AADC in three separate cohorts consisting of five patients in each cohort. PD-1102 is a separate, open-label Phase 1 clinical trial exploring a posterior (i.e., back of the

head) surgical delivery route for VY-AADC that enrolled eight patients with advanced Parkinson's disease. We have completed enrollment in both PD-1101 and PD-1102 and continue to follow patients in these trials. Preliminary data from both trials demonstrate that VY-AADC has been well-tolerated, and that administration with VY-AADC improved patients' motor function and quality of life as measured by standard scores and measures used in Parkinson's disease trials. Results from PD-1101 have been reported beginning in late 2016 and most recently in November 2018. In May 2019 we provided 12-month results from PD-1102.

Recent results from PD-1102

The PD-1102 trial included eight patients with advanced Parkinson's disease. On average the baseline characteristics of patients enrolled in PD-1102 were generally consistent with the baseline characteristics of patients enrolled in PD-1101. In PD-1102, patients were on average 57 years of age with a Parkinson's disease diagnosis for an average of nine years, and all patients were not responding adequately to oral medications and were candidates for surgical intervention due to disabling motor complications. At baseline, PD-1102 patients' mean good on time without troublesome dyskinesia, or ON time, was 9.1 hours and mean off time when they have poor mobility, or OFF time, was 6.8 hours.

Administration of VY-AADC with the posterior trajectory resulted in a mean coverage of the putamen of 54% and reduced the infusion time by approximately two hours (from a mean of 5.2 hours to a mean of 3.1 hours) compared to PD-1101. In PD-1102, treatment with VY-AADC increased mean AADC enzyme activity in the putamen as measured by positron emission tomography, or PET, using [18F] fluorodopa, which we refer to as or 18F-DOPA, by 85%. AADC enzyme activity in the putamen as measured by PET using 18F-DOPA reflects the capacity of neurons in the brain to convert levodopa to dopamine.

Treatment with VY-AADC in PD-1102 improved patients' motor function from baseline to twelve months across multiple assessments. These assessments include patient self-reported diary ON and OFF times, including good ON time, Unified Parkinson's Disease Rating Scales, and activities of daily living measures. In addition, improvements in patients' motor function were achieved with a mean 28% reduction in Parkinson's disease medication dosage (measured as levodopa equivalents) from a baseline level of 1,500 mg/day when measured at 6 and 12 months.

Treatment with VY-AADC improved patients' mean good ON time by 1.7 hours from baseline and reduced mean OFF time by 2.2 hours from baseline to 12 months. Exploratory analyses in PD-1101 suggested that patients with high dyskinesia or an impulse control disorder, or ICD, at baseline may show different outcomes, especially in patient-reported diary measures. Clinical assessment of the subgroup of patients (n=4) with no or low baseline dyskinesia as measured by the Unified Dyskinesia Rating Scale score (≤ 30) and absence of ICD at baseline as determined by the investigator indicated that VY-AADC improved good ON time from baseline by 3.2 hours and reduced OFF time by 3.2 hours in patients at 12 months.

In addition to motor function, VY-AADC improved patients' quality of life as measured by the patient-reported 39-item Parkinson's Disease Questionnaire, known as PDQ-39. For PDQ-39, VY-AADC improved (reduced) patients' score by a mean change from baseline to 12 months of -7.6. Infusions of VY-AADC have been well-tolerated in the eight patients treated in PD-1102 with no serious adverse events, or SAEs, reported.

RESTORE-1 Phase 2 Clinical Trial

In December 2018, we announced randomization of the first patient in the RESTORE-1 Phase 2, randomized, double-blind, placebo-surgery controlled trial evaluating the safety and efficacy of VY-AADC for the treatment of Parkinson's disease in patients with motor fluctuations that are refractory to medical management. The RESTORE-1 Phase 2 trial includes a planned enrollment of 75 to 100 patients, who have been diagnosed with Parkinson's disease for at least four years, are not responding adequately to oral medications, and have at least three or more hours of OFF time during the day as measured by a validated self-reported patient diary. Patients who meet the eligibility criteria will be randomized (1:1) to one-time administration of VY-AADC, or placebo surgery.

For the RESTORE-1 Phase 2 clinical trial, we have selected a dose of up to 2.5 x 10^{12} vector genomes, or vg, which is defined as a maximum total bilateral dose. This dose is between the up to maximum total vector genome doses administered in Cohorts 2 and 3 from the Phase 1b trial when considering the higher volume administered with the posterior trajectory and vector produced using the baculovirus system.

The primary efficacy endpoint of the RESTORE-1 Phase 2 trial is the mean improvement from baseline to 12 months in good ON time as measured by a validated self-reported patient diary at 12 months. Secondary endpoints include mean improvement in diary OFF time, other motor function and quality of life measures from the United Parkinson's Disease Rating Scales (UPDRS-II,-III scores), the Parkinson's Disease Questionnaire (PDQ-39), and patient's global function as measured by the proportion of participants with improvement on the Clinical Global Impression (CGI) score. The trial will also measure non-motor symptoms from the Non-Motor Symptom Scale (NMSS), as well as safety.

Biomarker data collected during the RESTORE-1 Phase 2 trial will include measurements of the coverage of the putamen, the specific region of the brain targeted with VY-AADC, and measurements of AADC enzyme expression and activity in the putamen measured by PET using 18F-DOPA. Changes in patients' daily doses of oral levodopa and related medications will also be recorded.

Preclinical Pipeline Programs

We are pursuing additional product candidates in the preclinical stages of development, including treatment programs for Huntington's disease, ALS, Friedreich's ataxia, tau-related neurodegenerative diseases, and diseases characterized by the abnormal accumulation of misfolded alpha-synuclein protein, or synucleinopathies. If preclinical studies prove successful, we plan to file investigational new drug, or IND, applications for our Huntington's disease program during 2019.

In June 2019, we and Sanofi Genzyme executed a termination agreement to terminate the Sanofi Genzyme Collaboration Agreement, or the Sanofi Genzyme Termination Agreement. Under the terms of the Sanofi Genzyme Termination Agreement, Sanofi Genzyme relinquished its rights to the exclusive license options to VY-HTT01, or the Huntington's Program, VY-FXN01, or the Friedreich's ataxia Program and an unnamed future program to be designated by Sanofi Genzyme, or the Future Program. We have been relieved of our obligations to perform the research and development services under those programs through completion of the respective proof of principle human clinical studies, or POP Studies. As a result, we gained worldwide rights to the Huntington's Program and ex-U.S. rights to the Friedreich's ataxia program. The ex-U.S. rights to the Friedreich's ataxia Program have been, in turn, transferred from us to Neurocrine Biosciences pursuant to the Neurocrine Collaboration Agreement. Additionally, we and Sanofi Genzyme entered into the Amended and Restated Option and License Agreement related to AAV capsids, or the Amended Capsid Agreement. Under the Amended Capsid Agreement, Sanofi Genzyme obtains exclusive option rights to select up to two novel AAV capsids owned or controlled by us for exclusive use for up to an aggregate of two non-central nervous system, or non-CNS indications.

Under the Sanofi Genzyme Termination Agreement, we paid Sanofi Genzyme $10.0 million up-front and have agreed to pay Sanofi Genzyme a $10.0 million milestone payment within fifteen days of the filing of an IND application for a product candidate incorporating certain intellectual property rights developed under or substantially related to the Huntington's Program, which we refer to as a Post-Termination HD Product. We have agreed to pay Sanofi Genzyme (i) 50% of any income received from sublicensing arrangements related to Post-Termination HD Products in excess of specified thresholds and entered into prior to (x) the filing of an IND application for a Post-Termination HD Product or (y) the dosing of the first patient in a clinical trial for a Post-Termination HD Product in the United States or certain European countries, respectively and (ii) a low-double digit percentage of any income received from sublicensing arrangements outside the United States related to products incorporating intellectual property rights developed under, or substantially related to, the Friedreich's ataxia Program, which we refer to as Post-Termination FA Products, that are in excess of a specified threshold and entered into prior to the dosing of the first patient in a clinical trial for a Post-Termination FA Product in the United States or certain European countries, in each case, subject to certain limitations. We have also agreed to pay low-single-digit royalties on net sales of Post-Termination HD Products. Under the Sanofi Genzyme Collaboration Agreement, we had rights to certain in-kind services. As of the date of the Sanofi Genzyme

Termination Agreement, we waived our right to approximately $0.4 million in unused in-kind services, we have relinquished our rights to the spinal muscular atrophy program, and we no longer have the right to receive any option payments, regulatory or commercial milestone payments or royalties from Sanofi Genzyme under the Sanofi Genzyme Collaboration Agreement.

In 2017, we selected VY-HTT01 as our clinical candidate for the treatment of Huntington's disease. Recent preclinical delivery studies have further optimized the dosing paradigm to support filing of a potential IND application. VY-HTT01 is composed of an AAV capsid (AAV1) and a proprietary transgene that harnesses the RNA interference pathway to selectively knock down, or reduce, levels of HTT mRNA. In late 2018 and early 2019, we presented results demonstrating significant reduction of HTT mRNA at five weeks post-dosing in adult non-human primates using a magnetic resonance imaging, or MRI, guided surgical delivery of VY-HTT01 and a novel delivery paradigm targeting both the putamen and thalamus. Targeting the thalamus in addition to the putamen leverages more extensive and more preserved neuronal pathways to the cortex than delivery to the putamen alone. In adult non-human primates, at five weeks post-dosing, this novel dosing paradigm with VY-HTT01 resulted in well-tolerated and significant suppression of HTT in the striatum and in cortical neurons, which are critical in the progression of disease. Further preclinical studies are underway with VY-HTT01 which, if successful, are expected to support a potential filing of an IND application in 2019.

In late 2017, we initiated additional preclinical studies to further optimize our ALS program's therapeutic approach, including exploration of additional routes of administration and novel AAV capsids in large animal models. VY-SOD102, our clinical candidate for the treatment of a monogenic form of ALS, is composed of an AAV capsid and a proprietary transgene that harnesses the RNA interference pathway to selectively knock down, or reduce, levels of SOD1 mRNA. VY-SOD102 has the potential to durably reduce the levels of toxic mutant SOD1 protein in the spinal cord to slow the progression of disease. In late 2018 and early 2019, we presented data on VY-SOD102 administered with a novel delivery paradigm comprising a one-time infusion after laminectomy to the cervical region of the spinal cord. Preclinical data previously reported included significant reductions of SOD1 mRNA throughout the spinal cord of the Göttingen mini-pig, which has a spinal cord similar in length and diameter to the human spinal cord. This novel delivery approach with VY-SOD102 yielded well-tolerated and significant reduction of SOD1 mRNA throughout the spinal cord at four weeks post-dosing. In June 2019 in connection with the restructuring of our gene therapy relationship with Sanofi Genzyme, we decided to reallocate resources to our Huntington's Program and new discovery efforts. We intend to seek a partner to advance our preclinical program for SOD1 ALS and no longer expect to file an IND application for VY-SOD102 in 2019.

We are collaborating with AbbVie on the research and development of specified vectorized antibody compounds comprised of an AAV or other viral capsid and a virus vector genome that encodes one or more antibodies that target and bind to a tau protein. In early 2019, we presented on the use of therapeutic antibodies targeting various forms of tau to prevent, reduce, or slow the development of tau pathology as an important potential therapeutic strategy for Alzheimer's disease and other tauopathies. Because of the blood-brain barrier, or BBB, only very low levels of antibody distribute to the brain from the systemic circulation after passive immunization, resulting in modestly reduced tau pathology in animal models. Our vectorized antibody approach aims to circumvent this limitation by delivering, with a potential one-time intravenous, or IV, administration, the genes that encode for the production of therapeutic antibodies utilizing our novel BBB-penetrant AAV capsids. This approach could potentially result in higher levels of therapeutic antibodies in the brain compared with current systemic administration of antibodies.

Additional preclinical studies are underway including steps to optimize a lead clinical candidate for the treatment of Friedreich's ataxia.

In January 2019, we announced the Neurocrine Collaboration focused on the development and commercialization of the VY-AADC gene therapy program for Parkinson's disease and VY-FXN01 gene therapy program for Friedreich's ataxia, as well as rights to two programs to be determined. In February 2019, we announced the AbbVie Alpha-Synuclein Collaboration to develop and commercialize vectorized antibodies directed at pathological species of alpha-synuclein for the potential treatment of Parkinson's disease and other diseases characterized by the abnormal accumulation of misfolded alpha-synuclein protein, or synucleinopathies.

In addition to the programs described above, we continue to evaluate additional severe neurological diseases that could be treated using AAV gene therapy through application of either a gene replacement or a gene knockdown approach and are also actively exploring additional potential treatment methods that can utilize an AAV vector. In early 2019, we presented on our discovery and development of novel AAV capsids that cross the BBB after IV administration with improved transduction of the brain and spinal cord and enhanced cellular specificity using libraries under the control of either the neuron-specific synapsin, or SYN, promoter or the astrocyte-specific glial fibrillary acidic protein, or GFAP, promoter to apply selective pressure for capsid variants that transduce the cell type of interest. As part of that effort, our scientists have developed a proprietary system called TRACER™ (Tropism Redirection of AAV by Cell Type-Specific Expression of RNA) to facilitate the selection of AAV capsids with BBB crossing and cell-specific transduction properties for particular therapeutic applications. The TRACER system is a broadly-applicable, functional RNA-based AAV capsid screening platform that allows for rapid *in vivo* evolution of AAV capsids with cell-specific transduction properties in wild-type animals. Multiple capsid variants have been identified with up to 1,000-fold improvement of central nervous system transduction in mouse models over AAV9 following IV administration after three rounds of selection. We are applying the TRACER system towards selecting AAV capsids with improved BBB-penetrant properties in the non-human primate.

Finally, we are working to develop our own real-time, intra-operative, MRI compatible device, the Variable Trajectory Array Guide, or V-TAG™, that can be used with other neuro-navigational systems for the administration of drugs and other surgical procedures, to avoid blood vessels and reduce the risk of potential hemorrhage during surgery, and to maximize drug coverage of the targeted structures. In July 2018, the Center for Devices and Radiological Health, or the CDRH, of the FDA provided 510(k) clearance for V-TAG. We are currently working with MRI Interventions Inc., or MRIC, on process development and manufacturing of the device, and in March 2019, we transferred our premarket notification (510(k)) clearance for V-TAG to MRIC. Investigators have used an alternative MRI-compatible device called the ClearPoint® System in the Phase 1b clinical trial of VY-AADC and Phase 1 posterior trajectory trial. We expect to use both V-TAG and the ClearPoint System in the RESTORE-1 Phase 2 clinical trial.

We have incurred significant operating losses since our inception. Our net losses were $16.0 million for the six months ended June 30, 2019. As of June 30, 2019, we had an accumulated deficit of $285.1 million. We expect to continue to incur significant expenses and operating losses for the foreseeable future. We anticipate that our expenses will increase significantly in connection with our ongoing activities, if and as we:

- continue investing in our gene therapy platform to optimize capsid engineering and payload development, manufacturing and dosing and delivery techniques;
- work with our collaborative partner, Neurocrine to advance VY-AADC as a treatment for Parkinson’s disease through the Phase 1b clinical trial, the separate Phase 1 clinical trial, and the RESTORE-1 Phase 2 clinical trial;
- initiate additional preclinical studies and clinical trials for, and continue research and development of, our other programs;
- conduct joint research and development under our strategic collaborations for the research, development, and commercialization of certain of our pipeline programs;
- continue our process research and development activities, as well as establish our research-grade and commercial manufacturing capabilities;
- identify additional neurological diseases for treatment with our AAV gene therapies and develop additional programs or product candidates;
- work to identify and optimize novel AAV capsids;
- expand our manufacturing capabilities;

- develop, obtain and maintain regulatory clearances for devices to deliver our AAV gene therapies, and to provide financial and operating support to partners manufacturing and supplying these devices for use in our clinical development program;
- seek marketing and regulatory approvals for VY-AADC or other product candidates or devices that arise from our programs that successfully complete clinical development;
- maintain, expand, protect and enforce our intellectual property portfolio;
- identify, acquire or in-license other product candidates and technologies;
- develop a sales, marketing and distribution infrastructure to commercialize any product candidates for which we may obtain marketing approval;
- expand our operational, financial and management systems and personnel, including personnel to support our clinical development, manufacturing and commercialization efforts and our operations as a public company;
- increase our product liability and clinical trial insurance coverage as we expand our clinical trials and commercialization efforts; and
- continue to operate as a public company.

Financial Operations Overview

Revenue

To date, we have not generated any revenue from product sales and do not expect to generate any revenue from product sales for the foreseeable future. For the six months ended June 30, 2019, we recognized $31.6 million of collaboration revenue from the Sanofi Genzyme Collaboration, $4.9 million of collaboration revenue from the AbbVie Tau Collaboration, $0.4 million of collaboration revenue from the AbbVie Alpha-Synuclein Collaboration, and $14.4 million of collaboration revenue from the Neurocrine Collaboration.

For the foreseeable future, we expect substantially all of our revenue will be generated from our existing collaboration agreements with AbbVie and Neurocrine, and any other strategic relationships we may enter into. If our development efforts are successful, we may also generate revenue from product sales in the future.

Expenses

Research and Development Expenses

Research and development expenses consist primarily of costs incurred for our research activities, including our program discovery efforts, and the development of our programs and gene therapy platform, which include:

- employee-related expenses including salaries, benefits, and stock-based compensation expense;
- costs of funding research performed by third parties that conduct research and development, preclinical activities, manufacturing and production design on our behalf;
- the cost of purchasing lab supplies and non-capital equipment used in designing, developing and manufacturing preclinical study materials;

- consultant fees;
- facility costs including rent, depreciation and maintenance expenses; and
- fees for maintaining licenses under our third-party licensing agreements.

Research and development costs are expensed as incurred. Costs for certain activities, such as manufacturing, preclinical studies, and clinical trials, are generally recognized based on an evaluation of the progress to completion of specific tasks using information and data provided to us by our vendors and collaborators.

At this time, we cannot reasonably estimate or know the nature, timing and estimated costs of the efforts that will be necessary to complete the development of our product candidates. We are also unable to predict when, if ever, material net cash inflows will commence from sales of our product candidates. This is due to the numerous risks and uncertainties associated with developing such product candidates, including the uncertainty of:

- successful enrollment in and completion of clinical trials;
- establishing an appropriate safety profile;
- establishing commercial manufacturing capabilities or making arrangements with third-party manufacturers;
- receipt of marketing approvals from applicable regulatory authorities;
- commercializing the product candidates, if and when approved, whether alone or in collaboration with others;
- obtaining and maintaining patent and trade secret protection and regulatory exclusivity for our product candidates;
- continued acceptable safety profiles of the products following approval; and
- retention of key research and development personnel.

A change in the outcome of any of these variables with respect to the development of any of our product candidates would significantly change the costs, timing and viability associated with the development of that product candidate.

Research and development activities are central to our business model. We expect research and development costs to increase significantly for the foreseeable future as our development programs progress, including as we continue to support the Phase 1b clinical trial and the separate Phase 1 trial exploring a posterior delivery approach and continue to enroll the RESTORE-1 Phase 2 clinical trial of VY-AADC as a treatment for Parkinson’s disease, and move our other product candidates into clinical trials and identify potential new product candidates. Additionally, we expect research and development costs associated with activities under our strategic collaborations to increase. There are numerous factors associated with the successful commercialization of any of our product candidates, including future trial design and various regulatory requirements, many of which cannot be determined with accuracy at this time based on our stage of development. Additionally, future commercial and regulatory factors beyond our control will impact our clinical development programs and plans.

General and Administrative Expenses

General and administrative expenses consist primarily of salaries and other related costs, including stock-based compensation, for personnel in executive, finance, accounting, business development, legal and human resource

functions. Other significant costs include corporate facility costs not otherwise included in research and development expenses, legal fees related to patent and corporate matters and fees for accounting and consulting services.

We anticipate that our general and administrative expenses will increase in the future to support continued research and development activities, including the RESTORE-1 Phase 2 clinical trial of VY-AADC, the expanded efforts in connection with our strategic collaborations, and the ongoing research and development activities and initiation of clinical trials for our other product candidates. These increases will likely include increased costs related to the hiring of additional personnel and fees to outside consultants. We also anticipate increased expenses associated with being a public company, including costs for audit, legal, regulatory, and tax-related services, director and officer insurance premiums, business development activities, and investor relations costs.

Other Income

Other income consists primarily of interest income on our marketable debt securities and the gain on the equity securities investment in MRIC.

Critical Accounting Policies and Estimates

See "*Recently Adopted Accounting Pronouncements*" below for discussion of our adoption of new guidance. All amounts and disclosures set forth in this Management's Discussion and Analysis of Financial Condition and Results of Operations reflect these changes.

Recently Adopted Accounting Pronouncements

In February 2016, the Financial Accounting Standard Board, or FASB, issued ASU No. 2016-02, a comprehensive new lease accounting standard, which provides revised guidance on accounting for lease arrangements by both lessors and lessees and requires lessees to recognize a lease liability and a right-of-use asset for most leases. In July 2018, the FASB issued ASU No. 2018-11, *Leases* (Topic 842), *Targeted Improvements*, or ASC 842, which provides an additional transition method that allowed entities to initially apply the new lease requirements at the adoption date, not the earliest period presented, and recognize a cumulative effect adjustment to the opening balance of retained earnings in the period of adoption. We elected this transition method at the adoption date of January 1, 2019. We elected a package of practical expedients, under which an entity need not reassess whether any expired or existing contracts are or contain leases, the lease classification for any expired or existing leases, or initial direct costs for any existing leases. The impact of adopting ASC 842 was represented as a capitalization of a right-of-use asset of approximately $31.0 million with a corresponding lease liability of approximately $36.7 million to be recognized over the remaining life of our leases.

In June 2018, the FASB issued ASU No. 2018-07, *Compensation-Stock Compensation: Improvements to Nonemployee Share-Based Payment Accounting*, or ASU 2018-07. The new standard largely aligns the accounting for share-based payment awards issued to employees and nonemployees by expanding the scope of ASC 718 to apply to nonemployee share-based transactions, as long as the transaction is not effectively a form of financing. The adoption of ASU 2018-07 on January 1, 2019 did not have a material impact on our consolidated financial statements.

Recent Accounting Pronouncements

In August 2018, the FASB issued ASU No. 2018-13, *Disclosure Framework - Changes to the Disclosure Requirements for Fair Value Measurement*, or ASU 2018-13. This standard eliminates, adds and modifies certain disclosure requirements for fair value measurements as part of its disclosure framework project. ASU 2018-13 is effective for annual reporting periods beginning after December 15, 2019 and interim periods within those annual periods and early adoption is permitted. We are currently evaluating the potential impact that this guidance may have on our consolidated financial statements.

In June 2016, the FASB issued ASU No. 2016-13, Measurement of Credit Losses on Financial Instruments ("ASU 2016-13"). ASU 2016-13 will change how companies account for credit losses for most financial assets and certain other instruments. For trade receivables, loans and held-to-maturity debt securities, companies will be required to

recognize an allowance for credit losses rather than reducing the carrying value of the asset. ASU 2016-13 is effective for fiscal years beginning after December 15, 2019, including interim periods within those fiscal years. Early adoption is permitted. We are currently evaluating the potential impact that this guidance may have on our consolidated financial statements.

Results of Operations

Comparison of the three months ended June 30, 2019 and 2018

The following table summarizes our results of operations for the three months ended June 30, 2019 and 2018, together with the changes in those items in dollars:

	Three Months Ended June 30,		
	2019	2018	Change
	(in thousands)		
Collaboration revenue	$ 46,087	$ 2,575	$ 43,512
Operating expenses:			
Research and development	28,576	16,507	12,069
General and administrative	8,322	11,762	(3,440)
Total operating expenses	36,898	28,269	8,629
Other income, net:			
Interest income	2,097	870	1,227
Other expense	(133)	(717)	584
Total other income, net	1,964	153	1,811
Net Income (loss)	11,153	(25,541)	36,694

Collaboration Revenue

Collaboration revenue was $46.1 million and $2.6 million for the three months ended June 30, 2019 and 2018, respectively. The increase in collaboration revenue in the three months ended June 30, 2019 was primarily a result of the termination of the Sanofi Genzyme Collaboration in June 2019. As a result of the termination, we paid $10.0 million to Sanofi Genzyme and expect to pay an additional $10.0 million within fifteen days of the filing of an IND application for a Post-Termination HD Product. We recognized $30.2 million of revenue related to the Sanofi Genzyme Collaboration in the three months ended June 30, 2019. This amount includes $1.5 million related to research services provided prior to the termination date and $48.7 million of deferred revenue remaining under the agreement at the termination date. These amounts were offset by the $20.0 million to be paid to Sanofi Genzyme.

During the three months ended June 30, 2019, collaboration revenue also included $3.2 million related to research services from the AbbVie Tau Collaboration, $0.2 million related to research services from the AbbVie Alpha-Synuclein Collaboration, and $12.5 million related to research services and cost reimbursement from the Neurocrine Collaboration. During the three months ended June 30, 2018, collaboration revenue included $0.7 million related to the Sanofi Genzyme Collaboration and $1.9 million related to research services on the AbbVie Tau Collaboration. No amounts were recognized related to the Neurocrine Collaboration Agreement or the AbbVie Alpha-Synuclein Collaboration Agreement in the three months ended June 30, 2018.

Research and Development Expense

Research and development expense increased by $12.1 million from $16.5 million for the three months ended June 30, 2018, to $28.6 million for the three months ended June 30, 2019. The following table summarizes our research and development expenses for the three months ended June 30, 2019 and 2018, together with the change in those items in dollars:

	Three Months Ended June 30,		
	2019	2018	Change
	(in thousands)		
External research and development expenses	$ 14,094	$ 7,768	$ 6,326
Employee and consultant related expenses	10,007	6,318	3,689
Facility and other expenses	4,308	2,207	2,101
License fees	167	214	(47)
Total research and development expenses	$ 28,576	$ 16,507	$ 12,069

The increase in research and development expense for the three months ended June 30, 2019 was primarily attributable to the following:

- approximately $6.5 million for increased external research and development costs, offset by approximately $0.2 million for increased in-kind research and development services incurred by Sanofi Genzyme and provided to us under the Sanofi Genzyme Collaboration;
- approximately $3.7 million for increased research and development employee-related and consultant compensation costs as we continue to increase research and development headcount to support our program pipeline, in addition to the one-time recognition of $2.2 million of stock-based compensation related to Dr. Sah's retirement agreement; and
- approximately $2.1 million for increased facility and other costs including rent, depreciation, maintenance and other expenses due to the additional space leased at 64 Sidney Street and 75 Sidney Street.

General and Administrative Expense

General and administrative expense decreased by $3.5 million from $11.8 million for the three months ended June 30, 2018 to $8.3 million for the three months ended June 30, 2019. The decrease in general and administrative expense was primarily attributable to:

- a $3.4 million reduction for decreased compensation costs associated with the one-time recognition of $5.4 million of stock-based compensation related to the retirement agreement of our former President and Chief Executive Officer, Dr. Steven M. Paul, during the three months ended June 30, 2018, offset by an increase in administrative function headcount.

Other Income, net

Interest and other income of approximately $2.0 million and $0.2 million was recognized during the three months ended June 30, 2019 and 2018, respectively, related to interest income on marketable securities balances in addition to gains on our common stock investment in and warrants to purchase shares of common stock of MRIC.

Comparison of the six months ended June 30, 2019 and 2018

The following table summarizes our results of operations for the six months ended June 30, 2019 and 2018, together with the changes in those items in dollars:

	Six Months Ended June 30,		
	2019	2018	Change
	(in thousands)		
Collaboration revenue	$ 51,284	$ 3,517	$ 47,767
Operating expenses:			
Research and development	53,407	31,360	22,047
General and administrative	17,981	18,945	(964)
Total operating expenses	71,388	50,305	21,083
Other income, net:			
Interest income	3,242	1,458	1,784
Other income (expense)	845	(318)	1,163
Total other income, net	4,087	1,140	2,947
Loss before income taxes	(16,017)	(45,648)	29,631
Income tax benefit	—	180	(180)
Net loss	$ (16,017)	$ (45,468)	$ 29,451

Collaboration Revenue

Collaboration revenue was $51.3 million and $3.5 million for the six months ended June 30, 2019 and 2018, respectively. The increase in collaboration revenue in the six months ended June 30, 2019 was primarily a result of the termination of the Sanofi Genzyme Collaboration in June 2019. As a result of the termination, we paid $10.0 million to Sanofi Genzyme and expect to pay an additional $10.0 million within fifteen days of the filing of an IND application for a Post-Termination HD Product. We recognized $31.6 million of revenue related to the Sanofi Genzyme Collaboration in the six months ended June 30, 2019. This amount includes $2.9 million related to research services provided prior to the termination date and $48.7 million of deferred revenue remaining under the agreement at the termination date. These amounts were offset by the $20.0 million to be paid to Sanofi Genzyme.

During the six months ended June 30, 2019, collaboration revenue also included $4.9 million related to research services from the AbbVie Tau Collaboration, $0.4 million related to research services from the AbbVie Alpha-Synuclein Collaboration, and $14.4 million related to research services and cost reimbursement from the Neurocrine Collaboration. During the six months ended June 30, 2018, collaboration revenue included $1.2 million related to the Sanofi Genzyme Collaboration and $2.3 million related to research services on the AbbVie Tau Collaboration. No amounts were recognized related to the Neurocrine Collaboration Agreement or the AbbVie Alpha-Synuclein Collaboration Agreement in the six months ended June 30, 2018.

Research and Development Expense

Research and development expense increased by $22.0 million from $31.4 million for the six months ended June 30, 2018, to $53.4 million for the six months ended June 30, 2019. The following table summarizes our research and development expenses, for the six months ended June 30, 2019 and 2018:

	Six Months Ended June 30,		
	2019	2018	Change
	(in thousands)		
External research and development expenses	$ 27,542	$ 14,790	$ 12,752
Employee and consultant related expenses	17,931	12,110	5,821
Facility and other expenses	7,616	4,088	3,528
License fees	318	372	(54)
Total research and development expenses	$ 53,407	$ 31,360	$ 22,047

The increase in research and development expense for the six months ended June 30, 2019 was primarily attributable to the following:

- approximately $13.2 million for increased external research and development costs, offset by approximately $0.4 million for increased in-kind research and development services incurred by Sanofi Genzyme and provided to us under the Sanofi Genzyme Collaboration;

- approximately $5.8 million for increased research and development employee-related and consultant compensation costs as we continue to increase research and development headcount to support our program pipeline, in addition to the one-time recognition of $2.2 million of stock-based compensation related to Dr. Sah's retirement agreement; and

- approximately $3.5 million for increased facility and other costs including rent, depreciation, maintenance and other expenses due to the additional space leased at 64 Sidney Street and 75 Sidney Street.

General and Administrative Expense

General and administrative expense decreased by $0.9 million from $18.9 million for the six months ended June 30, 2018 to $18.0 million for the six months ended June 30, 2019. The decrease in general and administrative expense was primarily attributable to the following:

- approximately $2.3 million for decreased compensation costs associated with the one-time recognition of $5.4 million of stock-based compensation related to the retirement agreement of our former President and Chief Executive Officer, Dr. Steven M. Paul, during the six months ended June 30, 2018, offset by the increase in administrative function headcount; offset by

- approximately $1.3 million for legal costs including amounts incurred in connection with our strategic collaborations and intellectual property related expenses.

Other Income, net

Interest and other income of approximately $4.1 million and $1.1 million was recognized during the six months ended June 30, 2019 and 2018, respectively, related to interest income on marketable securities balances in addition to gains on our common stock investment in and warrants to purchase shares of common stock of MRIC.

Liquidity and Capital Resources

Sources of Liquidity

We have funded our operations primarily through private placements of redeemable convertible preferred stock, public offerings of our common stock, the Sanofi Genzyme Collaboration which commenced in February 2015 and was terminated in June 2019, the AbbVie Tau Collaboration which commenced in February 2018, the AbbVie Alpha-Synuclein Collaboration which commenced in February 2019, and the Neurocrine Collaboration, which commenced in March 2019.

On November 16, 2015, we closed our initial public offering whereby we sold 5,750,000 shares of common stock, at a public offering price of $14.00 per share, including 750,000 shares of common stock issued upon the full exercise by the underwriters of their option to purchase additional shares, resulting in net proceeds to us of $72.9 million after deducting underwriting discounts and commissions and offering expenses payable by us. On November 7, 2017, we sold 5,175,000 shares of common stock to the public at an offering price of $12.00 per share, including 675,000 shares of common stock issued upon the full exercise by the underwriters of their option to purchase additional shares, resulting in net proceeds to us of $58.0 million after deducting underwriting discounts, commissions, and offering expenses payable by us.

As of June 30, 2019, we had cash, cash equivalents, and marketable debt securities of $327.5 million.

Cash Flows

The following table provides information regarding our cash flows for the six months ended June 30, 2019 and 2018:

	Six Months Ended June 30,	
	2019	2018
	(in thousands)	
Net cash provided by (used in):		
Operating activities	$ 93,605	$ 26,108
Investing activities	(139,549)	(970)
Financing activities	78,970	2,946
Net increase in cash, cash equivalents, and restricted cash	$ 33,026	$ 28,084

Net Cash Provided by Operating Activities

Net cash provided by operating activities was $93.6 million during the six months ended June 30, 2019 compared to $26.1 million of cash provided by operating activities during the six months ended June 30, 2018. Cash provided by operating activities during the six months ended June 30, 2019 was primarily due to an increase in deferred revenue of $106.1 million from the upfront payments related to the AbbVie Alpha-Synuclein Collaboration and the Neurocrine Collaboration, offset by $16.0 million of net loss adjusted for non-cash items. Cash provided by operating activities during the six months ended June 30, 2018 was primarily due to an increase in deferred revenue of $65.5 million from the upfront payment related to the AbbVie Tau Collaboration, offset by $45.5 million of net loss adjusted for non-cash items.

Net Cash Used in Investing Activities

Net cash used in investing activities was $139.5 million during the six months ended June 30, 2019 compared to $1.0 million of cash used in investing activities during the six months ended June 30, 2018. The increase in cash used in investing activities for the six months ended June 30, 2019 was primarily due to purchases of $314.4 million of marketable securities and $3.2 million for purchases of property and equipment, offset by $177.8 million of proceeds from maturities of marketable securities. The cash used in investing activities for the six months ended June 30, 2018

was primarily due to $205.0 million for purchases of marketable securities and $3.0 million for purchases of property and equipment, offset by $207.0 million of proceeds from maturities of marketable securities.

Net Cash Provided by Financing Activities

Net cash provided by financing activities was $79.0 million during the six months ended June 30, 2019, primarily from the issuance of 4,179,728 shares to Neurocrine pursuant to a stock purchase agreement in connection with the Neurocrine Collaboration as well as proceeds from exercises of stock options. Net cash provided by financing activities was $2.9 million during the six months ended June 30, 2018, primarily from proceeds of exercises of stock options.

Funding Requirements

We expect our expenses to increase in connection with our ongoing activities, particularly as we continue the research and development of, continue or initiate clinical trials of, and seek marketing approval for, our product candidates and as we continue to enter into or expand efforts on our collaboration agreements. In addition, if we obtain marketing approval for any of our product candidates, we expect to incur significant expenses related to program sales, marketing, manufacturing and distribution to the extent that such sales, marketing and distribution are not the responsibility of potential collaborators. Furthermore, we expect 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 or enter into business development transactions when needed or on acceptable terms, we could be forced to delay, reduce or eliminate our research and development programs or any future commercialization efforts.

Based upon our current operating plan, we expect that our existing cash, cash equivalents, and marketable debt securities as well as amounts expected to be received for reimbursement of development costs from the Neurocrine Collaboration will enable us to fund our operating expenses and capital expenditure requirements into mid-2022. Our future capital requirements will depend on many factors, including:

- the scope, progress, results, and costs of product discovery, preclinical studies and clinical trials for our product candidates and any required companion devices;
- the scope, progress, results, costs, prioritization, and number of our research and development programs;
- the progress and status of our strategic collaborations, including any research and development costs for which we are responsible, the potential exercise by our collaboration partners of options to develop or license certain products and product candidates, and our potential receipt of future milestone payments and royalties from our collaboration partners;
- the extent to which we are obligated to reimburse, or entitled to reimbursement of, preclinical development and clinical trial costs, or the achievement of milestones or occurrence of other developments that trigger payments, under any other collaboration agreement to which we might become a party;
- the costs, timing and outcome of regulatory review of our product candidates;
- our ability to establish and maintain collaboration, distribution, or other marketing arrangements for our product candidates on favorable terms, if at all;
- the costs and timing of preparing, filing and prosecuting patent applications, maintaining and enforcing our intellectual property rights and defending intellectual property-related claims;

- the extent to which we acquire or in-license other product candidates and technologies, including any intellectual property associated with such candidates or technologies, or acquire or invest in other businesses, such as our investment in MRIC;
- the costs related to evaluating possible alternative devices that may be useful in the delivery of our product candidates, including our potential delivery devices, such as V-TAG;
- the costs of advancing our manufacturing capabilities and securing manufacturing arrangements for pre-commercial and commercial production;
- the level of product sales by us or our collaborators from any product candidates for which we obtain marketing approval in the future; and
- the costs of establishing or contracting for sales, manufacturing, marketing, distribution, and other commercialization capabilities if we obtain regulatory approvals to market our product candidates.

Identifying potential product candidates and conducting preclinical studies and clinical trials is a time-consuming, expensive and uncertain process that takes years to complete. 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, and any commercial milestones or royalty payments under our collaboration agreements, will be derived from 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 and business development transactions to achieve our business objectives. Adequate additional financing may not be available to us on acceptable terms, or at all.

Until such time, if ever, as we can generate product revenues sufficient to achieve profitability, we expect to finance our cash needs through a combination of equity offerings, debt financings, collaborations, strategic alliances and licensing arrangements. To the extent that we raise additional capital through the sale of equity or equity-linked securities, including convertible debt, our stockholders' ownership interests will be diluted, and the terms of these securities may include liquidation or other preferences that adversely affect our existing stockholders' rights as holders of our common stock. 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, obtaining additional capital, acquiring or divesting businesses, making capital expenditures or declaring dividends.

If we raise additional funds through collaborations, strategic alliances or licensing arrangements with third parties, we may have to relinquish valuable rights to our technologies, future revenue streams, research programs or product candidates or to 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 product candidates that we would otherwise prefer to develop and market ourselves.

AbbVie Alpha-Synuclein Collaboration

In February 2019, we entered into an exclusive collaboration and option agreement with AbbVie for the research, development and commercialization of vectorized antibodies directed against pathological species of alpha-synuclein for the potential treatment of Parkinson's disease and other synucleinopathies. Under the terms of this agreement, we received an upfront payment of $65.0 million and may receive future option fees, development, regulatory, and commercial milestone payments, and royalties. Under the terms of the agreement, we and AbbVie have agreed to collaborate on the research and development of specified vectorized antibody compounds, or Research Compounds, comprised of an AAV or other viral capsid and a virus vector genome that encodes one or more antibodies that target and bind to the alpha-synuclein protein. The collaboration is comprised of a research period and a development period. We are obligated to conduct research activities directed to constructing one or more virus vectors that encode antibodies designated by AbbVie. We are obligated to use diligent efforts to conduct antibody engineering

and other research activities to create the Research Compounds and to develop product candidates containing or comprised of such Research Compounds, which we refer to as Product Candidates. We are solely responsible for the costs and expenses during the research period.

During a specified portion of the research period, AbbVie may exercise one or more of its exclusive development options to select up to a total of four Research Compounds and their corresponding Product Candidates to proceed to the development period, after which AbbVie may exercise its option to license such Product Candidates following Phase 1 results, for which we may earn up to $245.0 million in option exercise payments in aggregate. In addition to the upfront payment and the potential option exercise payments, we are eligible to receive up to $727.5 million in development and regulatory milestones for each licensed compound. We are also eligible to receive tiered, escalating royalties, in the mid-single-digit percentage range on aggregate net sales of licensed products on a licensed compound by licensed compound basis, as well as up to $500.0 million in commercial milestones based on aggregate annual net sales thresholds of licensed products. The royalties are subject to potential reductions for biosimilar market penetration, patent claim expiration, and other provisions, subject to specified limits. Subject to certain exceptions, we and AbbVie agreed to be financially responsible for all payments owed to a third party with which we or it has contracted for any use of in-licensed intellectual property under the agreement.

Neurocrine Collaboration

In January 2019, we entered into a collaboration agreement with Neurocrine, or the Neurocrine Collaboration Agreement, for the research, development and commercialization of four programs including our Parkinson’s disease program, or AADC Program, our Friedreich’s ataxia program, or FA Program, and two programs, or the Discovery Programs. The Neurocrine Collaboration Agreement became effective on March 11, 2019 following expiration of the applicable waiting period under the Hart-Scott-Rodino Antitrust Improvements Act of 1976, as amended, and satisfaction of customary closing conditions. Under the terms of the agreement, we received an upfront payment of $165.0 million, inclusive of $50.0 million for the sale of 4,179,728 shares of our common stock to Neurocrine, and we may receive future development and regulatory milestone payments and royalties. In June 2019, in conjunction with the termination of the Sanofi Genzyme Collaboration Agreement, we gained worldwide rights to the VY-HTT01 Huntington's disease program and ex-U.S. rights to the VY-FXN01 Friedreich's ataxia program. The ex-U.S. rights to VY-FXN01 were subsequently transferred from us to Neurocrine Biosciences pursuant to the Neurocrine Collaboration Agreement. To facilitate the transfer of the ex-U.S. rights to VY-FXN01 from us to Neurocrine, we and Neurocrine amended the Neurocrine Collaboration Agreement and we received a $5.0 million payment from Neurocrine. We will use commercially reasonable efforts to develop the products in each of these programs. Neurocrine will be responsible for all costs incurred by us in conducting these activities for each program, in accordance with an agreed budget.

Under the terms of the agreement for the AADC Program, Neurocrine will fund the clinical development of the RESTORE-1 Phase 2 clinical trials for VY-AADC. After the data readout of the RESTORE-1 Phase 2 trial, we have the option to either: (1) co-commercialize VY-AADC with Neurocrine in the U.S. under a 50/50 cost- and profit-sharing arrangement and receive milestones and royalties based on ex-U.S. sales, or (2) retain the right to receive milestone payments and royalties based on global sales pursuant to the full global commercial rights granted to Neurocrine. Under the terms of the agreement for the FA Program, Neurocrine will fund the development through the Phase 1 clinical trial of VY-FXN01. After the data readout of the Phase 1 trial, we have the option to either: (1) co-commercialize VY-FXN01 with Neurocrine in the U.S. under a 60/40 cost- and profit-sharing arrangement, or (2) retain the right to receive milestone payments and royalties based on global sales pursuant to the full global commercial rights granted to Neurocrine. Under the terms of the agreement for the two Discovery Programs, Neurocrine will fund the development of those programs and we have the right to earn milestone payments and royalties based on global sales.

In addition to the upfront payment, we are eligible to receive aggregate development milestone payments under (i) the AADC Program of up to $170.0 million, (ii) the FA Program of up to $195.0 million, and (iii) each of the Discovery Programs of up to $130.0 million each. We may also be entitled to receive aggregate commercial milestone payments for each collaboration product of up to $275.0 million, subject to an aggregate cap on commercial milestone payments across all programs of $1.1 billion. We are also eligible to receive royalties, based on future net sales of the collaboration products. Such royalty percentages, for net sales in and outside the United States, as applicable, range (i) for the AADC Program, from the mid-teens to thirty and the low-teens to twenty, respectively; (ii) for the FA Program,

from the low-teens to high-teens and high-single digits to mid-teens, respectively; and (iii) for each Discovery Program, from the high-single digits to mid-teens and mid-single digits to low-teens, respectively.

Termination of the Sanofi Genzyme Collaboration Agreement

On June 14, 2019, we and Sanofi Genzyme executed the Sanofi Genzyme Termination Agreement to terminate the Sanofi Genzyme Collaboration Agreement. Under the terms of the Sanofi Genzyme Termination Agreement, Sanofi Genzyme has relinquished its rights to its exclusive license options to the Huntington's Program, Friedreich's ataxia Program and the Future Program. We have been relieved of our obligations to perform the research and development services under those programs through completion of the respective POP Studies. As a result, we gained worldwide rights to the Huntington's Program and ex-U.S. rights to the Friedreich's ataxia Program. The ex-U.S. rights to the Friedreich's ataxia Program have been, in turn, transferred from us to Neurocrine Biosciences pursuant to the Neurocrine Collaboration Agreement. Additionally, we and Sanofi Genzyme entered into the Amended Capsid Agreement. Under the Amended Capsid Agreement, Sanofi Genzyme has obtained exclusive option rights to exclusively license select novel AAV capsids owned or controlled by us for exclusive use for up to two non-CNS indications.

Under the Sanofi Genzyme Termination Agreement, we paid Sanofi Genzyme $10.0 million up-front and have agreed to pay Sanofi Genzyme a $10.0 million milestone payment within fifteen days of the filing of an IND application for a Post-Termination HD Product. We have agreed to pay Sanofi Genzyme (i) 50% of any income received from sublicensing arrangements related to Post-Termination HD Products in excess of specified thresholds and entered into prior to (x) the filing of an IND application for a Post-Termination HD Product or (y) the dosing of the first patient in a clinical trial for a Post-Termination HD Product in the United States or certain European countries, respectively and (ii) a low-double digit percentage of any income received from sublicensing arrangements outside the United States related to Post-Termination FA Products that are in excess of a specified threshold and entered into prior to the dosing of the first patient in a clinical trial for a Post-Termination FA Product in the United States or certain European countries, in each case, subject to certain limitations. We have also agreed to pay low-single-digit royalties on net sales of Post-Termination HD Products. Under the Sanofi Genzyme Collaboration Agreement, we had rights to certain in-kind services. As of the termination date, we waived our right to approximately $0.4 million in unused in-kind services, we have relinquished our rights to the spinal muscular atrophy program, and we no longer have the right to receive any option payments, regulatory or commercial milestone payments or royalties from Sanofi Genzyme under the Sanofi Genzyme Collaboration Agreement.

During the capsid evaluation period, we have granted Sanofi Genzyme a non-exclusive license to the capsid intellectual property to conduct evaluation studies. In addition, Sanofi Genzyme is able to evaluate up to two additional capsids for a low six-figure payment per additional capsid. We are not obligated to perform any additional research on the capsids. Sanofi Genzyme shall have the right to obtain an exclusive license for up to two capsids, each in a specified non-CNS indication. At its discretion, Sanofi Genzyme may exercise both its options for the same capsid for different specified non-CNS indications. Upon its exercise of each option, Sanofi Genzyme has agreed to pay us a $1.0 million option exercise fee. Under the Amended Capsid Agreement, we are also entitled to receive potential development and regulatory milestone payments upon the achievement of certain milestone events for products containing licensed capsids, which we refer to as the Licensed Products, of up to an aggregate of $15.0 million per Licensed Product. In addition, for each specified indication, Sanofi Genzyme has agreed to pay us a one-time sales milestone payment of $20.0 million, if aggregate worldwide net sales for all Licensed Products for such specified indication surpass a specified amount, and low-to-mid single-digit tiered royalty payments on worldwide net sales of Licensed Products, on a Licensed Product-by-Licensed Product basis.

Contractual Obligations

The following table summarizes our significant contractual obligations as of payment due date by period at June 30, 2019:

	Total	Less Than 1 Year	1 to 3 Years	3 to 5 Years	More than 5 Years
Operating lease commitments[1]	$ 48,586	$ 2,756	$ 12,098	$ 12,835	$ 20,897

(1) We lease office space at 75 Sidney Street and 64 Sidney Street in Cambridge, Massachusetts under non-cancelable operating leases that expire in November 2026.

In February 2018, we executed a second amendment for additional space located at 75 Sidney Street in Cambridge, Massachusetts, concurrent to the existing leases with terms going through December 2024. In June 2018, we executed a third amendment for additional space located at 75 Sidney Street, including an extension to the term through November 2026. Additionally, we executed an amendment to the lease at 64 Sidney Street to extend the term through November 2026.

We enter into agreements in the normal course of business with clinical research organizations, contract manufacturing organizations, and institutions to license intellectual property. We have not included these future payments in the table of contractual obligations above since the contracts are cancelable at any time by us, generally upon 30 to 90 days prior written notice.

Other than the above, there were no material changes to our contractual obligations and commitments described under Management's Discussion and Analysis of Financial Condition and Results of Operations in our Annual Report on Form 10-K for the fiscal year ended December 31, 2018, as filed with the SEC on February 26, 2019.

Off-Balance Sheet Arrangements

We did not have, during the periods presented, and we do not currently have, any off-balance sheet arrangements, as defined under applicable SEC rules.

JOBS Act; Smaller Reporting Company Status

In April 2012, the Jumpstart Our Business Startups Act of 2012, or the JOBS Act, was enacted. Section 107 of the JOBS Act provides that an "emerging growth company," or EGC, can take advantage of the extended transition period provided in Section 7(a)(2)(B) of the Securities Act of 1933, as amended, or the Securities Act, for complying with new or revised accounting standards. Thus, an EGC can delay the adoption of certain accounting standards until those standards would otherwise apply to private companies.

EGCs are also permitted to rely on exemptions from certain disclosure requirements that are applicable to other public companies that are not EGCs. Subject to certain conditions, as an EGC, we intend to rely on certain of these exemptions, including without limitation, (i) not being required to provide an auditor's attestation report on our system of internal controls over financial reporting pursuant to Section 404(b) of the Sarbanes-Oxley Act; (ii) 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, known as the auditor discussion and analysis; (iii) reduced disclosure obligations regarding executive compensation; and (iv) exemptions from the requirements of holding a nonbinding advisory vote on executive compensation and shareholder approval of any golden parachute payments not previously approved. We will remain an EGC until the earlier of (i) the last day of the fiscal year in which we have total annual gross revenues of $1.07 billion or more; (ii) December 31, 2020; (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.

We are also a "smaller reporting company," as defined in Rule 12b-2 under the Exchange Act. We would cease to be a smaller reporting company if we have a non-affiliate public float in excess of $250 million and annual revenues

in excess of $100 million, or a non-affiliate public float in excess of $700 million, determined on an annual basis. Even after we no longer qualify as an EGC, we may still qualify as a smaller reporting company, which would allow us to take advantage of many of the same exemptions from disclosure requirements. In addition to the above reduced disclosure requirements applicable to EGCs, as a smaller reporting company, we are permitted and intend to rely on certain exemptions from disclosure requirements that are applicable to other public companies that are not smaller reporting companies. These permitted exemptions include (i) being permitted to provide only two years of audited consolidated financial statements in our Annual Report on Form 10-K, with correspondingly reduced "Management's Discussion and Analysis of Financial Condition and Results of Operations" disclosure; (ii) not being required to furnish a contractual obligations table in "Management's Discussion and Analysis of Financial Condition and Results of Operations"; and (iii) not being required to furnish a stock performance graph in our annual report to stockholders.

ITEM 3. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

We are exposed to market risk related to changes in interest rates. We have policies requiring us to invest in high-quality issuers, limit our exposure to any individual issuer, and ensure adequate liquidity. 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 investments, including cash equivalents, are in the form of money market funds and marketable securities and are invested in U.S. Treasury notes. Due to the 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.

We are not currently exposed to market risk related to changes in foreign currency exchange rates; however, we may contract with vendors that are located in Asia and Europe in the future and may be subject to fluctuations in foreign currency rates at that time.

Inflation generally affects us by increasing our cost of labor and clinical trial costs. We do not believe that inflation had a material effect on our business, financial condition, or results of operations during the three and six months ended June 30, 2019.

ITEM 4. CONTROLS AND PROCEDURES

Management's Evaluation of Disclosure Controls and Procedures

We maintain disclosure controls and procedures (as defined in Rules 13a-15(e) and 15d-15(e) under the Securities Exchange Act of 1934, or the Exchange Act) that are designed to ensure that information required to be disclosed in the reports that we file or submit under the Exchange Act is (1) recorded, processed, summarized, and reported within the time periods specified in the SEC's rules and forms and (2) accumulated and communicated to our management, including our principal executive officer and principal financial officer, to allow timely decisions regarding required disclosure.

As of June 30, 2019, our management, with the participation of our principal executive officer and principal financial and accounting officer, evaluated the effectiveness of our disclosure controls and procedures. Our 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. Our principal executive officer and principal financial and accounting officer have concluded based upon the evaluation described above that, as of June 30, 2019, our disclosure controls and procedures were effective at the reasonable assurance level.

We continue to review and document our disclosure controls and procedures and may from time to time make changes aimed at enhancing their effectiveness and to ensure that our systems evolve with our business.

Changes in Internal Control over Financial Reporting

During the three months ended June 30, 2019, there have been no changes in our internal control over financial reporting, as such term is defined in Rules 13a-15(f) and 15d-15(f) under the Exchange Act, that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

PART II. OTHER INFORMATION

ITEM 1. LEGAL PROCEEDINGS

As of the date of this Quarterly Report on Form 10-Q, we were not party to any material legal matters or claims. In the future, we may become party to legal matters and claims arising in the ordinary course of business, the resolution of which we do not anticipate would have a material adverse impact on our financial position, results of operations, or cash flows.

ITEM 1A. RISK FACTORS

The following risk factors and other information in this Quarterly Report on Form 10-Q, including our condensed consolidated financial statements and related notes thereto, should be carefully considered. The risks and uncertainties described below are not the only ones we face. Additional risks and uncertainties not presently known to us or that we presently deem less significant may also impair our business operations. Please see page 1 of this Quarterly Report on Form 10-Q for a discussion of some of the forward-looking statements that are qualified by these risk factors. If any of the following risks occur, our business, financial condition, results of operations and future growth prospects could be materially and adversely affected.

Risks Related to Our Financial Position and Need for Capital

We have incurred significant losses since inception and anticipate that we will continue to incur losses for the foreseeable future and may never achieve or maintain profitability.

We are a clinical-stage gene therapy company with a limited operating history and have not yet generated revenues from the sales of our product candidates. Investment in biotechnology companies is highly speculative because it entails substantial upfront capital expenditures and significant risk that any product candidates will fail to be safe and efficacious, obtain regulatory approval or become commercially viable. We have not yet demonstrated the ability to complete any clinical trials of our product candidates, obtain marketing approvals, manufacture a commercial-scale product or conduct sales and marketing activities necessary for successful commercialization. We continue to incur significant expenses related to research and development, and other operations in order to commercialize our product candidates. As a result, we are not and have never been profitable and have incurred losses since our inception. Our net losses were $16.0 million and $45.5 million for the six months ended June 30, 2019 and 2018, respectively. As of June 30, 2019, we had an accumulated deficit of $285.1 million.

We historically have financed our operations primarily through private placements of our redeemable convertible preferred stock, public offerings of our common stock, and strategic collaborations, including those with Sanofi Genzyme, AbbVie, Inc., or AbbVie, and Neurocrine Biosciences, Inc., or Neurocrine. On November 16, 2015 we closed our initial public offering whereby we sold 5,750,000 shares of common stock at a public offering price of $14.00 per share, including 750,000 shares of common stock issued upon the full exercise by the underwriters of their option to purchase additional shares, resulting in net proceeds to us of $72.9 million after deducting underwriting discounts, commissions and offering expenses payable by us. On November 7, 2017, we sold 5,175,000 shares of common stock to the public at an offering price of $12.00 per share, including 675,000 shares of common stock issued upon the full exercise by the underwriters of their option to purchase additional shares, resulting in net proceeds to us of $58.0 million after deducting underwriting discounts, commissions, and offering expenses payable by us. On March 11, 2019, in

connection with our collaboration with Neurocrine, we sold 4,179,728 shares of common stock to Neurocrine at a price of $11.9625 per share, resulting in net proceeds to us of $50.0 million.

To date, we have devoted substantially all of our financial resources to building our gene therapy platform, selecting product programs, conducting research and development, including preclinical development of our product candidates, building our intellectual property portfolio, building our team, and establishing strategic collaborations. We expect that it could be several years, if ever, before we have a commercialized product. We expect to continue to incur significant expenses and increasing operating losses for the foreseeable future. The net losses we incur may fluctuate significantly from quarter to quarter. We anticipate that our expenses will increase substantially if, and as, we:

- continue investing in our gene therapy platform to optimize capsid engineering and payload development, manufacturing and dosing and delivery techniques;
- work with our collaborative partner Neurocrine to advance VY-AADC as a treatment for Parkinson's disease through the Phase 1b clinical trial, the separate Phase 1 clinical trial, and the RESTORE-1 Phase 2 clinical trial;
- initiate additional preclinical studies and clinical trials for, and continue research and development of, our other programs;
- conduct joint research and development under our strategic collaborations for the research, development, and commercialization of certain of our pipeline programs;
- continue our process research and development activities, as well as establish our research-grade and commercial manufacturing capabilities;
- identify additional neurological diseases for treatment with our AAV gene therapies and develop additional programs or product candidates;
- work to identify and optimize novel AAV capsids;
- expand our manufacturing capabilities;
- develop, obtain and maintain regulatory clearances for devices to deliver our AAV gene therapies, and to provide financial and operating support to partners manufacturing and supplying these devices for use in our clinical development program;
- seek marketing and regulatory approvals for VY-AADC or other product candidates or devices that arise from our programs that successfully complete clinical development;
- maintain, expand, protect and enforce our intellectual property portfolio;
- identify, acquire or in-license other product candidates and technologies;
- develop a sales, marketing and distribution infrastructure to commercialize any product candidates for which we may obtain marketing approval;
- expand our operational, financial and management systems and personnel, including personnel to support our clinical development, manufacturing and commercialization efforts and our operations as a public company;

- increase our product liability and clinical trial insurance coverage as we expand our clinical trials and commercialization efforts; and
- continue to operate as a public company.

Because of the numerous risks and uncertainties associated with pharmaceutical product development, we are unable to accurately predict the timing or amount of increased expenses or when, or if, we will be able to achieve profitability. Our expenses will increase if:

- we are required by the U.S. Food and Drug Administration, or FDA, or the European Medicines Agency, or EMA, or other regulatory agencies to redesign or modify trials or studies or to perform trials or studies in addition to those currently expected;
- there are any delays in the receipt of regulatory clearance to begin our planned clinical programs or to use companion devices required in such clinical programs; or
- there are any delays in enrollment of patients in or completing our clinical trials or the development of our product candidates.

To become and remain profitable, we must develop and eventually commercialize, alone or with our collaborators, product candidates with significant market potential, which will require us to be successful in a range of challenging activities. These activities can include completing preclinical studies and clinical trials of our product candidates; obtaining marketing approval for these product candidates; developing and obtaining marketing approval of any required companion devices; manufacturing at clinical and commercial scale; marketing and selling those products that are approved; satisfying any post-marketing requirements and achieving an adequate level of market acceptance of and obtaining and maintaining adequate coverage and reimbursement from third-party payors for such products; and protecting our rights to our intellectual property portfolio. 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 our stockholders to lose all or part of their investment.

We may not be able to generate sufficient revenue from the commercialization of our product candidates and may never be profitable.

Our ability to generate revenue and achieve profitability depends on our ability, alone or with our collaborative partners, to successfully complete the development of, and obtain the regulatory approvals necessary to commercialize, our current and future product candidates. Our lead product candidate VY-AADC, which we have the option to co-commercialize with Neurocrine in the United States, is being evaluated in the Phase 1b clinical trial, the separate Phase 1 clinical trial, and the RESTORE-1 Phase 2 clinical trial. We do not anticipate generating revenues from product sales for the next several years, and we may never succeed in doing so. Our ability to generate future revenues from product sales depends heavily on our and our collaborators' success in:

- completing preclinical and clinical development of our product candidates and any required companion devices and identifying new 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, marketing and distribution infrastructure or, alternatively, collaborating with a commercialization partner;

- obtaining and maintaining adequate coverage and reimbursement by government and third-party payors for our product candidates if and when approved;
- maintaining and enhancing a sustainable, scalable, reproducible and transferable manufacturing process for our vectors and product candidates;
- establishing and maintaining supply and manufacturing relationships with third parties that have the financial, operating and technical capabilities to provide adequate products and services, in both amount and quality, to support clinical development and the market demand for our product candidates, if and when approved;
- obtaining an adequate level of market acceptance of our product candidates as a viable treatment option;
- addressing any competing technological and market developments;
- implementing additional internal systems and infrastructure, as needed;
- negotiating favorable terms in any collaboration, licensing or other arrangements into which we may enter and performing our obligations in such collaborations;
- obtaining, maintaining, protecting, enforcing and expanding our portfolio of intellectual property rights, including patents, trade secrets and know-how;
- avoiding and defending against third-party claims of interference or infringement; 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, EMA, or other regulatory authorities to redesign or modify preclinical studies or clinical trials or to perform preclinical studies or clinical trials 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 to raise 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 certain of our product development efforts or other operations.

We expect our expenses to increase in connection with our ongoing and planned activities, particularly as we continue the research and development of, continue or initiate clinical trials of, and seek marketing approval for, our product 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. Since the completion of our IPO on November 16, 2015, we have also incurred 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 or enter into business development transactions when needed or on acceptable terms, we could be forced to delay, reduce or eliminate certain of our research and development programs or any future commercialization efforts.

Our operations have consumed significant amounts of cash since inception. As of June 30, 2019, our cash, cash equivalents, and marketable debt securities were $327.5 million. Based upon our current operating plan, we expect that our existing cash, cash equivalents, and marketable debt securities, as well as ongoing reimbursement amounts expected

from development costs related to the Neurocrine Collaboration Agreement, will enable us to fund our operating expenses and capital expenditure requirements into mid-2022.

Our future capital requirements will depend on many factors, including:

- the scope, progress, results, and costs of product discovery, preclinical studies and clinical trials for our product candidates and any required companion devices;
- the scope, progress, results, costs, prioritization, and number of our research and development programs;
- the progress and status of our strategic collaborations including any research and development costs for which we are responsible, the potential exercise by our collaboration partners of options to develop or license certain products and product candidates, and our potential receipt of future milestone payments and royalties from our collaboration partners;
- the extent to which we are obligated to reimburse, or entitled to reimbursement of, preclinical development and clinical trial costs, or the achievement of milestones or occurrence of other developments that trigger payments, under any other collaboration agreement to which we might become a party;
- the costs, timing and outcome of regulatory review of our product candidates;
- our ability to establish and maintain collaboration, distribution, or other marketing arrangements for our product candidates on favorable terms, if at all;
- the costs and timing of preparing, filing and prosecuting patent applications, maintaining and enforcing our intellectual property rights and defending intellectual property-related claims;
- the extent to which we acquire or in-license other product candidates and technologies, including any intellectual property associated with such candidates or technologies, or acquire or invest in other businesses, such as our investment in MRI Interventions, Inc., or MRIC;
- the costs related to evaluating possible alternative devices that may be useful in the delivery of our product candidates, including our potential delivery devices, such as V-TAG;
- the costs of advancing our manufacturing capabilities and of securing manufacturing arrangements for pre-commercial and commercial production;
- the level of product sales by us or our collaborators from any product candidates for which we obtain marketing approval in the future; and
- the costs of establishing or contracting for sales, manufacturing, marketing, distribution, and other commercialization capabilities if we obtain regulatory approvals to market our product candidates.

Identifying potential product candidates and conducting preclinical studies and clinical trials is a time-consuming, expensive, and uncertain process that takes years to complete. 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, and any commercial milestones or royalty payments under our collaboration agreements will be derived from 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 and business development to achieve our business objectives. Adequate additional financing or business development transactions may not be available to us on acceptable terms, or at all.

Raising additional capital may cause dilution to our stockholders, restrict our operations or require us to relinquish rights to our technologies or product candidates.

Until such time, if ever, as we can generate product revenues sufficient to achieve profitability, we expect to finance our cash needs through a combination of equity offerings, debt financings, collaborations, strategic alliances, and licensing arrangements. We do not have any committed external source of funds other than the amounts we are entitled to receive from our collaboration partners for potential option exercises, the achievement of specified regulatory and commercial milestones, and royalty payments under our collaboration agreements. To the extent that we raise additional capital through the sale of equity or equity-linked securities, including convertible debt, our stockholders' ownership interests will be diluted, and the terms of these securities may include liquidation or other preferences that adversely affect our existing stockholders' rights as holders of our common stock. 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, obtaining additional capital, acquiring or divesting businesses, making capital expenditures or declaring dividends. In addition, we may seek additional capital due to favorable market conditions or strategic considerations, even if we believe we have sufficient funds for our current or future operating plans. Our issuance of additional securities, whether equity or debt, or the possibility of such issuance, may cause the market price of our common stock to decline. Further, our existing stockholders may not agree with the terms of such financings.

If we raise additional funds through collaborations, strategic alliances, or licensing arrangements with third parties, we may have to relinquish valuable rights to our technologies, future revenue streams, research programs or product candidates or to 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. Such collaborations, alliances, or licensing arrangements could therefore cause the market price of common stock to decline.

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

We are a clinical stage company. Our operating history is short, and to date has been limited to building our team, business planning, raising capital, establishing our intellectual property portfolio, determining which neurological diseases to pursue, advancing our product candidates including delivery and manufacturing and conducting preclinical studies and clinical trials. Consequently, any predictions 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 a new business, we may encounter unforeseen expenses, difficulties, complications, delays and other known and unknown factors. To achieve our current goals, we will need to transition in the future from a company with a research and development focus to a company capable of supporting commercial activities. We may not be successful in such a transition.

We expect our financial condition and operating results to continue to fluctuate significantly from quarter-to-quarter and year-to-year due to a variety of factors, many of which are beyond our control. Accordingly, our stockholders should not rely upon the results of any quarterly or annual periods as indications of future operating performance.

Risks Related to the Development and Regulatory Approval of Our Product Candidates

Our AAV gene therapy product candidates are based on a relatively novel technology, which makes it difficult to predict the time and cost of development and of subsequently obtaining regulatory approval, if at all. Only two AAV gene therapy products have been approved in the United States. In Europe, only two AAV gene therapy products have been approved.

We have concentrated our research and development efforts to date on our gene therapy platform, identifying our initial targeted disease indications, and our initial product candidates. Our future success depends on our successful

development of viable AAV gene therapy product candidates. Currently, only one of our product candidates, VY-AADC, is in clinical development, and the remainder of our product candidates are in preclinical development. AAV gene therapies are a relatively new technology. We cannot accurately predict when or if any of our product candidates will prove effective or safe in humans or whether these product candidates will receive marketing approval. There can be no assurance that we will not experience problems or delays in the preclinical testing or development of our product candidates and that such problems or delays will not cause unanticipated costs, or that any such problems or delays can be solved in a timely or profitable basis, if at all. We also may experience unanticipated problems or delays in expanding our manufacturing capacity.

The clinical trial requirements of the FDA, the EMA and other 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 the product candidate. The regulatory approval process for novel product candidates such as gene therapies can be more expensive and take longer than for other, better known or more extensively studied product candidates. Until August 2017, the FDA had never approved a gene therapy product. Since that time, it has approved Luxturna, an AAV gene therapy product by Spark Therapeutics, or Spark, for patients with an inherited form of vision loss, and Zolgensma, an AAV gene therapy product by Avexis, a Novartis company, for pediatric patients with spinal muscular atrophy. The FDA has also approved two non-AAV gene therapy products, Kymriah by Novartis International AG, for pediatric and young adult patients with a form of acute lymphoblastic leukemia and Yescarta by Kite Pharma, Inc., for adult patients with certain forms of non-Hodgkin lymphoma. In Europe, two AAV gene therapy products, Glybera by uniQure N.V., or uniQure, and Luxturna by Spark, have been granted marketing authorization; however, uniQure decided not to pursue renewal of such authorization in 2017 and has since withdrawn Glybera from the European market. The European Commission also has approved four non-AAV gene therapy products, Strimvelis by Orchard Therapeutics (Netherlands) BV, Kymriah, Yescarta, and ZYNTEGLO by bluebird bio for a form of transfusion-dependent β-thalassemia.

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 either the United States or the European Union or how long it will take to commercialize our product candidates. The few regulatory approvals to date may not be indicative of what the FDA, European Commission, or other regulatory authorities may require for approval or whether different or additional preclinical studies or clinical trials may be required to support regulatory approval in a particular jurisdiction. Delay or failure to obtain, or unexpected costs in obtaining, the regulatory approval necessary to bring a potential product candidate to market could decrease our ability to generate sufficient product revenue, and our business, financial condition, results of operations and prospects may be harmed.

Regulatory requirements governing gene and cell therapy products have changed frequently and may continue to change in the future. Such requirements may lengthen the regulatory review process, require us to modify current studies or perform additional studies or increase our development costs, which in turn may force us to delay, limit, or terminate certain of our programs.

The Center for Biologics Evaluation and Research, or CBER, of the FDA regulates biological products for human use. The Office of Tissues and Advanced Therapies, or OTAT, formerly known as the Office of Cellular, Tissue and Gene Therapies, within CBER reviews gene therapy and related products and has established the Cellular, Tissue and Gene Therapies Advisory Committee to advise CBER in its review.

NIH-funded institutions need to have their institutional biosafety committee, or IBC, as well as their institutional review board, or IRB, review proposed clinical trials to assess the safety of the trial. The Phase 1b clinical trial of VY-AADC and the separate Phase 1 trial exploring the delivery of VY-AADC using a posterior trajectory are being conducted at multiple sites, and therefore are subject to oversight by these authorities. Such trials will need to be re-reviewed by the respective institutional IRBs if the protocols for the trials are amended. For any new clinical trial protocols, including the RESTORE-1 Phase 2 clinical trial protocol, the same processes and issues apply.

Adverse developments in clinical trials of gene therapy products conducted by us or others may cause the FDA or other oversight bodies to change the requirements for approval of any of our product candidates. Similarly, EMA and local health authorities of individual countries within the European Union may issue new guidelines concerning the

clinical development and marketing authorization for gene therapy medicinal products and require that we comply with these new guidelines. The EMA and agencies at both the federal and state level in the United States have expressed an interest in further regulating new biotechnologies, including gene therapy. In addition, gene therapy products are considered genetically-modified organism, or GMO, products and are regulated as such in each country. Designation of the type of GMO product and subsequent handling and disposal requirements can vary across countries and is variable throughout the EU. Addressing each specific country requirement and obtaining approval to commence a clinical trial in these countries could result in delays in starting, conducting, or completing a clinical trial. Similar issues could be faced in other regions of the world including the Asia-Pacific region.

These regulatory review committees and advisory groups and the 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. We have requested feedback from the FDA on, among other matters, the regulatory pathway for VY-AADC and the design of our proposed pivotal program. We had multiple interactions with the FDA throughout 2018 and received certain written feedback requiring additional clarification. In December 2018, we held a Type B meeting with the FDA to discuss the overall development and pivotal program for VY-AADC. In connection with our Neurocrine Collaboration Agreement, we have agreed to transfer sponsorship of the VY-AADC clinical program to Neurocrine, which required the related investigational new drug, or IND, application to be transferred to Neurocrine. The transition process will require additional regulatory filings with and review by the FDA and may lead to modification of the clinical VY-AADC protocol and to additional costs or delays in the VY-AADC clinical program. We and Neurocrine are currently evaluating the written feedback received from the FDA, including FDA guidance received during the Type B meeting that in a disease such as Parkinson's two adequate and well-controlled clinical trials is suggested. Finalization of our clinical plans using this FDA guidance may lead to further modification of the clinical VY-AADC protocol and to additional costs or delays in the VY-AADC clinical program.

We plan to continue to seek and incorporate FDA guidance in our ongoing development plans for each of our potential clinical candidates, including VY-AADC on which we collaborate with Neurocrine. If we fail to consult or solicit guidance from regulators, 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. Delays as a result of increased or lengthier regulatory approval process and further restrictions on development of our product candidates can be costly and could negatively impact our or our collaborators' ability to complete clinical trials and commercialize our current and future product candidates in a timely manner, if at all.

Results from preclinical studies and early-stage clinical trials may not be indicative of efficacy in late-stage clinical trials.

All of our product candidates are in early stages of development. Clinical testing is expensive, is difficult to design and implement, can take many years to complete and is uncertain as to outcome. A failure of one or more clinical trials can occur at any stage of testing. Our product candidates may fail to show the desired safety and efficacy in preclinical testing or clinical development despite demonstrating promising results in earlier preclinical studies or clinical trials. In addition, the outcome of preclinical testing and early clinical trials may not be predictive of the success of later stage clinical trials. Similarly, interim results generated from clinical trials do not necessarily predict final results, and results from one completed clinical trial may not be replicated in a subsequent clinical trial with a similar study design. Some of our clinical trials, including the Phase 1b clinical trial and the separate Phase 1 clinical trial exploring the delivery of VY-AADC using a posterior trajectory (PD-1101 and PD-1102, respectively), were conducted with small patient populations and were not blinded or placebo-controlled, making it difficult to predict whether the favorable results that we observed in such trials will be sustained or repeated in larger and more advanced clinical trials. Moreover, preclinical and clinical data are often susceptible to varying interpretations and analyses, and many companies that have believed their product candidates performed satisfactorily in preclinical studies and clinical trials have nonetheless failed to obtain marketing approval of their products.

There is a high failure rate for product candidates proceeding through preclinical studies and clinical trials. A number of companies in the pharmaceutical and biotechnology industries have suffered significant setbacks in late-stage clinical trials even after achieving promising results in early-stage clinical trials. If a larger population of patients does not experience positive results, if these results are not reproducible, or if our products show diminishing activity over time, our products may not receive approval from the EMA or the FDA. Data obtained from preclinical and clinical activities are subject to varying interpretations, which may delay, limit or prevent regulatory approval. In addition, we may encounter regulatory delays or rejections as a result of many factors, including changes in regulatory policy during the period of product development. Failure to confirm favorable results from earlier trials by demonstrating the safety and effectiveness of our products in late-stage clinical trials with larger patient populations could harm our business and we may never succeed in commercialization or generating product revenue.

The dosing and coverage of the putamen in the VY-AADC Phase 1b clinical trial, separate Phase 1 clinical trial, and as planned in the RESTORE-1 Phase 2 clinical trial, are different than the dosing and coverage of the putamen in prior clinical trials conducted by other parties. The up to total vector genome dose chosen in the RESTORE-1 Phase 2 clinical trial may not demonstrate the safety and effectiveness of VY-AADC in the RESTORE-1 Phase 2 clinical trial, or in the planned RESTORE-2 Phase 3 trial. Any failure to demonstrate safety or effectiveness could result in a decision to modify dosing and/or coverage of the putamen in any subsequent clinical trials, and such decisions could cause a delay in achieving market authorization, or may result in limiting or terminating the program entirely.

The clinical trial results of some of our collaborators have been negatively affected by factors that had not been fully anticipated prior to the design of the clinical trials. For example, the magnitude of some of the clinical responses seen in the Phase 1 clinical trial of AAV2-AADC were similar to the placebo effects observed in previous surgical therapies for Parkinson's disease. As a result, we are unable to rely on the results of this prior Phase 1 trial as an indicator of the efficacy of treatment with VY-AADC. We and Neurocrine believe that to increase the likelihood of a clinical benefit, the dose and volume of infusion of VY-AADC should be optimized to substantially increase the coverage of the putamen, the region of the brain targeted by VY-AADC. However, it is not possible at this time to know if we are optimizing these parameters, and as a result, to know if we will be able to achieve sufficient coverage of the putamen and a clinical benefit.

The Phase 1b clinical trial of VY-AADC incorporated several design features in an attempt to increase the coverage area of the putamen, particularly the posterior putamen. We employed larger infusion volumes and higher doses of VY-AADC, and we used the ClearPoint® System to provide real-time, intra-operative, magnetic resonance imaging, or MRI, assistance to the physician surgically administering VY-AADC to the patient.

In a separate Phase 1 clinical trial, we are utilizing posterior, or back of the head, delivery of VY-AADC into the putamen, compared to a transfrontal, or top of the head, delivery approach used in Cohorts 1 through 3 of the Phase 1b clinical trial described above. A posterior approach better aligns the infusion of VY-AADC with the anatomical structure of the putamen to potentially reduce the total procedure time and increase the total coverage of the putamen. Administration of VY-AADC with this posterior approach has been well-tolerated to date with no reported serious adverse events, or SAEs.

Due to the nature of the techniques used in the Phase 1b clinical trial and the numerous variables that can be changed, it is possible that the data generated from this trial may not provide evidence of statistically significant or durable clinical benefit. For example, physicians may use cannulas, which are small tubes, of differing lengths in the infusion procedure, or may use differing infusion speeds or infusion angles. These differences could affect the dose of VY-AADC that ultimately reaches the putamen, leading to highly variable results. Similarly, we have limited experience to date with the posterior delivery approach which we have selected as the preferred surgical route of administration for the RESTORE-1 Phase 2 clinical trial. Further, use of a posterior approach may not generate outcomes that are clinically superior to the outcomes achieved with a transfrontal approach.

For the RESTORE-1 Phase 2 clinical trial, we have selected a dose of up to 2.5 x 10^{12} vector genomes as a maximum total bilateral dose. This dosing level is between the up to maximum total vector genome doses administered in Cohorts 2 and 3 from the Phase 1b trial when considering the higher volume administered with the posterior trajectory and vector produced using the baculovirus system. We have not previously evaluated this dosing level in a clinical trial.

To achieve safety, primary and secondary efficacy endpoints, the dose concentration and volume selected for the RESTORE-1 Phase 2 clinical trial may be modified, and regardless of the dose concentration and volume selected, we may never achieve desired safety and efficacy outcomes.

The RESTORE-1 Phase 2 trial is a randomized, double-blind, placebo-surgery controlled trial with a planned enrollment of 75 to 100 patients who have been diagnosed with Parkinson's disease for at least four years, are not responding adequately to oral medications, and have at least three hours of OFF time during the day as measured by a validated self-reported patient diary. Patients will be randomized 1:1 to either VY-AADC or placebo surgery. Patient eligibility criteria and the protocol design, including the total number of patients in the trial and the number of patients who receive VY-AADC or placebo, may change during the course of the trial in response to recruiting challenges, clinical patient assessments, data collection, statistical analysis modifications, and other factors.

The primary efficacy endpoint of the RESTORE-1 Phase 2 clinical trial is the mean improvement from baseline to 12 months on time without troublesome dyskinesia, or good ON time, as measured by a validated self-reported patient diary at 12 months. Secondary endpoints include diary OFF time, other motor function and quality of life measures from the United Parkinson's Disease Rating Scales (UPDRS-II,-III scores), the Parkinson's Disease Questionnaire (PDQ-39), and patient's global function as measured by the proportion of participants with improvement on the Clinical Global Impression (CGI) score. The trial will also measure non-motor symptoms from the Non-Motor Symptom Scale (NMSS), as well as safety. Primary and secondary endpoints may be adjusted during the trial in response to changes in the protocol design.

Biomarker data collected during the RESTORE-1 Phase 2 clinical trial will include measurements of the coverage of the putamen, the specific region of the brain targeted with VY-AADC, and measurements of AADC enzyme expression and activity in the putamen measured by positron emission tomography (PET) using fluorodopa F-18. Changes in patients' daily doses of oral levodopa and related medications will also be recorded.

We plan to continue to seek and incorporate FDA guidance in our clinical trial plans. We and Neurocrine are currently evaluating the written feedback from the FDA, including guidance from the Type B meeting to conduct two adequate and well-controlled clinical trials for a large patient population such as Parkinson's disease. Additional interaction with the FDA regarding the RESTORE-1 and RESTORE-2 clinical trial plans could result in changes to the current plan.

Additionally, we are using a different manufacturing process for our AAV gene therapy vector in our global RESTORE-1 Phase 2 clinical trial and our planned RESTORE-2 Phase 3 clinical trial. We have begun to manufacture VY-AADC using our baculovirus/Sf9 system as opposed to manufacturing in HEK 293 cells, which were used in the Phase 1 clinical trials. We have conducted studies to demonstrate comparability between the current version and the new version. It is possible, however, that the results of the RESTORE-1 Phase 2 clinical trial and our planned RESTORE-2 Phase 3 clinical trial in Parkinson's disease may differ from the results of the Phase 1b or the separate Phase 1 clinical trial based on the use of VY-AADC manufactured using our baculovirus/Sf9 system as opposed to using HEK 293 cells.

We may in the future conduct, and intend to conduct, clinical trials for product candidates at sites outside the United States, and the FDA may not accept data from trials conducted in such locations.

To date, we have only conducted clinical trials in the United States. However, we may in the future choose to conduct, one or more of our clinical trials or include sites in current or future clinical trials outside the United States. We may include international sites in the RESTORE-1 Phase 2 clinical trial. The transfer of sponsorship of the VY-AADC clinical program to Neurocrine requires Neurocrine to be the sponsor of the RESTORE-1 Phase 2 clinical trial in any international sites. Any sponsorship transition could require additional regulatory filings with and review by regulatory officials, and may lead to additional costs or delays in the initiation of the RESTORE-1 Phase 2 clinical trial and the enrollment of patients in those international sites.

Although the FDA may accept data from sites or clinical trials outside the United States, acceptance of these data is subject to conditions imposed by the FDA. For example, the clinical trial must be well designed and conducted and performed by qualified investigators in accordance with ethical principles. The trial population must also adequately

represent the U.S. population, and the data must be applicable to the U.S. population and U.S. medical practice in ways that the FDA deems clinically meaningful. In addition, while these clinical trials or trial sites are subject to the applicable local laws, FDA acceptance of the data will depend on its determination that the trials or trial sites also complied with all applicable U.S. laws and regulations. If the FDA does not accept the data from any trial or trial site outside the United States, it would likely result in the need for additional trials, which would be costly and time-consuming and would delay or permanently halt our development of the applicable product candidates.

Other risks inherent in conducting international clinical trials or using international trial sites include:

- foreign regulatory requirements that could restrict or limit our ability to conduct our clinical trials;
- administrative burden of complying with a variety of foreign laws, medical standards and regulatory requirements, including the regulation of pharmaceutical and biotechnology products and treatment;
- failure of enrolled patients to adhere to clinical protocols or inadequate collection and assessment of clinical data as a result of differences in healthcare services or cultural customs;
- foreign exchange fluctuations;
- diminished or loss of protection of intellectual property in the relevant jurisdiction; and
- political and economic risks relevant to foreign countries.

We may encounter substantial delays or difficulties in commencement, enrollment or completion of our clinical trials, or may fail to demonstrate safety and efficacy to the satisfaction of applicable regulatory authorities, which could prevent us from commercializing our current and future product candidates on a timely basis, if at all.

Before obtaining marketing approval from regulatory authorities for the sale of our current and future product candidates, we must conduct extensive clinical trials to demonstrate the safety and efficacy of the product candidates. To conduct clinical trials, we must first complete preclinical testing and studies to support IND applications or similar applications in other jurisdictions. We cannot be certain of the timely completion or outcome of our preclinical testing and studies and cannot predict if the FDA or similar regulatory authorities outside the United States will accept our planned clinical programs or if the outcome of our preclinical testing and studies will ultimately support the further development of our preclinical programs.

We have very limited experience with clinical trials. The transfer of sponsorship of the VY-AADC clinical program to Neurocrine requires Neurocrine to be the sponsor of the RESTORE-1 Phase 2 clinical trial in any sites. Any sponsorship transition could require additional regulatory filings with and review by the FDA, EU, or other regulatory officials, and may lead to additional costs or delays in the initiation of the RESTORE-1 Phase 2 clinical trial in those sites.

The RESTORE-1 Phase 2 clinical trial of VY-AADC is being conducted at several locations. We cannot guarantee that any clinical trials will be conducted as planned or completed on schedule, if at all. A clinical trial failure can occur at any stage of testing. Similarly, there may be delays or difficulties in our initiation of future clinical trials. Due to the additional regulatory uncertainties associated with gene therapy products, we did not initiate the RESTORE-1 Phase 2 clinical trial for VY-AADC as a treatment for Parkinson’s disease until we met with OTAT to discuss our proposed trial design and overall development plan. While we have received OTAT’s feedback and incorporated it as appropriate in our plans, the clinical trial as designed may not achieve the prospectively defined primary clinical endpoints or provide a favorable benefit to risk ratio to support a BLA filing or approval.

Identifying and qualifying patients to participate in clinical trials of our product candidates is critical to our success. 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 pursuant to the requirements of the

FDA, EMA, or other regulatory authorities. Patient enrollment and trial completion are affected by many factors including:

- perceived risks and benefits of AAV gene therapy approaches for the treatment of neurological diseases;
- perceived risks of the delivery procedure, such as intracranial infusion for VY-AADC;
- formulation changes to our product candidates, which may require us to conduct additional clinical studies to bridge our modified product candidates to earlier versions;
- size of the patient population and process for identifying patients;
- design of the trial protocol;
- eligibility and exclusion criteria;
- patients with preexisting antibodies to the gene therapy vector that preclude their participation in the trial;
- perceived risks and benefits of the product candidate under study;
- 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;
- lack of adequate compensation of patients;
- ability to obtain and maintain patient consent;
- risk that enrolled patients will drop out before completion of the trial;
- our ability to locate appropriately trained physicians to conduct such clinical trials, which may be particularly difficult for the VY-AADC RESTORE-1 Phase 2 and RESTORE-2 Phase 3 clinical trials as we have historically used, and expect to use, the ClearPoint System, which is only available at a small number of academic medical centers in the United States;
- the ability to commercially launch V-TAG, our real-time, intra-operative, MRI-compatible device, and to train physicians to conduct clinical trials using the device;
- willingness of patients to participate in a placebo-controlled trial;
- patient referral practices of physicians; and
- ability to monitor patients adequately during and after treatment.

Further, we plan to seek marketing approvals in the United States, the European Union and other jurisdictions, which may require that we conduct clinical trials in foreign countries. 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 clinical research organizations, or CROs, and physicians;
- different standards for the conduct of clinical trials;
- absence in some countries of established groups with sufficient regulatory expertise for review of AAV gene therapy protocols;
- our inability to locate qualified local partners or collaborators for such clinical trials; 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 harm our business, financial condition, results of operations and prospects.

Other events that may prevent successful or timely completion of clinical development include:

- delays in reaching a consensus with regulatory authorities or collaborators on trial design;
- delays in reaching agreement on acceptable terms with prospective CROs and clinical trial sites;
- delays in opening clinical trial sites or obtaining required IRB or independent ethics committee approval at each clinical trial site;
- imposition of a clinical hold by regulatory authorities as a result of a serious adverse event or after an inspection of our clinical trial operations or trial sites or our decision or the requirement of regulators or institutional review boards to suspend or terminate clinical research for various reasons, including noncompliance with regulatory requirements or a finding that the participants are being exposed to unacceptable health risks;
- failure by us, our collaborative partners, any CROs we engage, or any other third parties to adhere to clinical trial protocols or regulatory requirements;
- failure by us, our collaborative partners, any CROs we engage, or any other third parties to perform in accordance with the FDA's good clinical practices, or GCPs, or applicable regulatory guidelines in the European Union;
- failure by physicians to adhere to delivery protocols leading to variable results;
- delays in the testing, validation, manufacturing and delivery of our product candidates to the clinical sites, including delays by third parties with whom we have contracted to perform certain of those functions;
- insufficient or inadequate supply or quality of our product candidates or other materials necessary to conduct clinical trials of our product candidates, including potential delays in the RESTORE-1 Phase 2 clinical trial in Parkinson's disease associated with the commercial availability of V-TAG;

- delays in having patients complete participation in a trial or return for post-treatment follow-up;
- clinical trial sites or patients dropping out of a trial at a rate higher than we anticipate;
- selection of clinical endpoints that require prolonged periods of clinical observation or analysis of the resulting data;
- receipt of negative or inconclusive clinical trial results;
- occurrence of serious adverse events associated with the product candidate that are viewed to outweigh its potential benefits;
- occurrence of serious adverse events in trials of the same class of agents conducted by other sponsors;
- changes in regulatory requirements and guidance that require amending or submitting new clinical protocols; or
- the cost of clinical trials of our product candidates may be greater than we anticipate.

Any inability to successfully complete preclinical studies and clinical trials could result in additional costs and potential delays to us or impair our ability to generate revenues from product sales, regulatory and commercialization milestones and royalties. We do not know whether any of our preclinical studies or clinical trials will begin as planned, will need to be restructured, or will be completed on schedule, or at all. In addition, if we make manufacturing or formulation changes to our product candidates, we may need to conduct additional studies to bridge our modified product candidates to earlier versions. Clinical trial delays also could shorten any periods during which we may have the exclusive right to commercialize our product candidates 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, financial condition, results of operations and prospects.

Additionally, if the results of our clinical trials are inconclusive or if there are safety concerns or serious 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 that includes significant use or distribution restrictions or safety warnings;
- be subject to changes in the way the product is administered;
- be required to perform additional clinical trials to support approval or be subject to additional post-marketing testing requirements;
- have regulatory authorities withdraw, or suspend, their approval of the product or impose restrictions on its distribution in the form of a Risk Evaluation and Mitigation Strategy, or REMS;
- be subject to the addition of labeling statements, such as warnings or contraindications;
- be sued; or
- experience damage to our reputation.

Our product candidates or 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.

In past clinical trials that were conducted by others with non-AAV gene therapy vectors, several significant side effects were caused by gene therapy treatments, including reported cases of leukemia and death. Other potential side effects could include an immunologic reaction and insertional oncogenesis, which is the process whereby the insertion of a functional gene near a gene that is important in cell growth or division results in uncontrolled cell division, which could potentially enhance the risk of malignant transformation. If our vectors demonstrate a similar adverse effect, or other adverse effects, we may be required to halt or delay further clinical development of our product candidates or withdraw the product from the market post-approval. For example, in a recently published review of patients with hepatocellular carcinomas, it was shown that a small subset contained an integrated genome sequence of wild-type AAV2 and it was suggested that AAV2 may be associated with insertional oncogenesis.

In addition to side effects caused by the product candidate, the administration process or related procedures also can cause side effects. VY-AADC and VY-HTT01 will be administered directly to the targeted areas and cells in the brain, requiring the patient to undergo brain surgery. In a previous Phase 1 clinical trial conducted by UCSF, three patients experienced hemorrhages caused by the surgical procedure for administering VY-AADC. In the RESTORE-1 Phase 2 clinical trial of VY-AADC, we are using the ClearPoint System to provide accurate placement of the cannula in the putamen and allow for real-time, intra-operative MRI to assist the physician in visualizing the delivery of VY-AADC to the putamen and to avoid specific blood vessels during the duration of the surgical procedure, with the goal of reducing the risk of hemorrhages. The ClearPoint System has only been used in limited gene therapy neurosurgeries to date. One patient in the Phase 1b trial experienced two SAEs, a pulmonary embolism, or blood clot in the lungs, and related heart arrhythmia, or irregular heartbeat, which were determined to be related to the surgical procedure and prolonged immobility, not VY-AADC. In the Phase 2 and future trials, we may use V-TAG, a proprietary real-time, intra-operative, MRI-compatible device that we developed with MRIC. For VY-SOD102 in the treatment for ALS, the product candidate is planned to be injected directly into the spinal cord. Limited clinical data are available for this route of administration. If other side effects were to occur in connection with the surgical procedures described above, or problems were encountered with the use of the ClearPoint System or V-TAG, our clinical trials could be suspended or terminated.

If in the future we are unable to demonstrate that such side effects were caused by the administration process or related procedures or are unable to modify the trial protocol adequately to address such side effects, the FDA, the European Commission, the EMA or other regulatory authorities could order us to cease further development of, or deny approval of, our product candidates for any or all targeted indications. For products that “knock down” or reduce the amount of a gene or its encoded protein, their effects on other parts of the body, or “off target” effects, could result in unforeseen toxicity. Even if we are able to demonstrate that any future SAEs are not product-related, and regulatory authorities do not order us to cease further development of our product candidates, such occurrences could affect patient recruitment or the ability of enrolled patients to complete the trial. Moreover, if we elect, or are required, to delay, suspend or terminate any clinical trial of any of our product candidates, the commercial prospects of such product candidates may be harmed and our ability to generate product revenues from any of these product candidates may be delayed or eliminated. Any of these occurrences may harm our ability to develop other product candidates, and may harm our business, financial condition and prospects significantly.

Additionally, if any of our product candidates receives marketing approval, the FDA could require us to adopt a REMS to ensure that the benefits outweigh its risks. Such REMS may include, among other things, a medication guide outlining the risks of the product for distribution to patients and a communication plan to health care practitioners or the limitation of the use of the product to specifically trained neurosurgeons and/or certain centers. Furthermore, adverse events which were initially considered unrelated to the study treatment of the clinical trial may later be found to be caused by the study treatment. If we or others later identify undesirable side effects caused by our product candidate, several potentially significant negative consequences could result, including:

- regulatory authorities may suspend or withdraw approvals of such product candidate;

- regulatory authorities may require additional warnings on the label;
- we may be required to change the way a product candidate is 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 and could significantly harm our business, prospects, financial condition and results of operations.

We may be unable to obtain orphan drug designation or exclusivity for any of our product candidates for which we seek such designation. If our competitors are able to obtain orphan drug exclusivity for products that constitute the same drug and treat the same indications as our product candidates, we may not be able to have competing products approved by the applicable regulatory authority for a significant period of time. For products for which we may obtain orphan drug designation or exclusivity, we may be unable to prevent the approval or marketing authorization of other similar products based upon regulator decisions regarding product "sameness".

Regulatory authorities in some jurisdictions, including the United States and the European Union, may designate drugs for relatively small patient populations as orphan drugs. Under the Orphan Drug Act of 1983, or the Orphan Drug Act, the FDA may designate a product candidate as an orphan drug or biological product 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 or biological product will be recovered from sales in the United States. We have received feedback from the FDA that VY-AADC for the treatment of Parkinson's disease does not qualify for orphan disease designation because the potential for its use in earlier stages of Parkinson's disease exceeds the 200,000 patient population criterion 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 five 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. We have received feedback from the Committee for Orphan Medicinal Products that orphan designation likely would not be granted for VY-AADC in Parkinson's disease since the Committee does not grant such status for products targeting more severe stages of a disease.

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 the European Commission 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 may 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 United States can be extended by nine months if the BLA sponsor submits pediatric data that adequately respond to a written request from the FDA for such data. The exclusivity period in the European Union can be reduced to six 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.

We believe that all of our current programs may qualify for orphan drug designation except for VY-AADC for Parkinson's disease. On March 15, 2019, we received notification from the FDA that VY-HTT01, an AAV gene therapy

containing a transgene that encodes a microRNA targeting huntingtin messenger RNA, had been granted orphan drug designation for the treatment of Huntington's disease. 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 or biological products 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 or biological product for the same condition if the FDA concludes that the latter drug or biological product is not the same drug or biological product or is clinically superior in that it is shown to be safer or 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.

Even if we seek orphan drug designation from the FDA, the European Commission or other regulatory agencies for a product candidate, there can be no assurances that the regulatory agency or agencies will grant such designation. Additionally, the designation of any of our product candidates as an orphan drug does not guarantee that any regulatory agency will ultimately approve that product candidate or prevent other products from receiving marketing authorization due to decisions of the applicable regulatory agency regarding "sameness" of the products.

On August 3, 2017, the Congress passed the FDA Reauthorization Act of 2017, or FDARA. FDARA, among other things, codified the FDA's pre-existing regulatory interpretation to require that a drug sponsor demonstrate the clinical superiority of an orphan drug that is otherwise the same as a previously approved drug for the same rare disease in order to receive orphan drug exclusivity. The new legislation reverses prior precedent holding that the Orphan Drug Act unambiguously requires that the FDA recognize the orphan exclusivity period regardless of a showing of clinical superiority. The FDA may further reevaluate the Orphan Drug Act and its regulations and policies. We do not know if, when, or how the FDA may change the orphan drug regulations and policies in the future, and it is uncertain how any changes might affect our business. Depending on what changes the FDA may make to its orphan drug regulations and policies, our business could be adversely impacted.

A potential breakthrough therapy designation by the FDA for our product candidates may not lead to a faster development or regulatory review or approval process, and it does not increase the likelihood that our product candidates will receive marketing approval.

We have sought and may in the future seek a breakthrough therapy designation for some of our product candidates. A breakthrough therapy is defined as a drug or biological product that is intended, alone or in combination with one or more other drugs, to treat a serious or life-threatening disease or condition, and preliminary clinical evidence indicates that the drug or biological product 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 drugs or biological products 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. Drugs designated as breakthrough therapies by the FDA may also be 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 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 as breakthrough therapies, the FDA may later decide that the drugs or biological products no longer meet the conditions for qualification.

A potential regenerative medicine advanced therapy designation by the FDA for our product candidates may not lead to a faster development or regulatory review or approval process, and it does not increase the likelihood that our product candidates will receive marketing approval.

We have sought and may in the future seek a regenerative medicine advanced therapy, or RMAT, designation for some of our product candidates. Under the 21st Century Cures Act, or the Cures Act, to be eligible to receive RMAT designation from the FDA, a product candidate must be (i) considered a "regenerative medicine therapy" as defined in the Cures Act; (ii) intended to treat, modify, reverse, or cure one or more serious or life-threatening diseases or conditions; and (iii) indicated, in preliminary clinical evidence, to have the potential to address unmet medical needs for such diseases or conditions. Gene therapies, including genetically modified cells, that lead to a durable modification of cells or tissues may meet the definition in the Cures Act of a regenerative medicine therapy.

The RMAT program is intended to facilitate efficient development and expedite review of such therapies. A new drug application or a BLA for a product candidate that has received an RMAT designation 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 product candidate that has received an RMAT designation 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.

In June 2018, the FDA granted RMAT designation for the VY-AADC gene therapy treatment for Parkinson's disease in patients with motor fluctuations that are refractory to medical management. The designation was based on data from the Phase 1b clinical trial.

RMAT designation is within the discretion of the FDA. Accordingly, even if we believe one of our other product candidates meets the criteria for RMAT designation, 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, the FDA may later decide that a product candidate that received RMAT designation no longer meets the conditions for designation.

Fast track designation by the FDA may not actually lead to a faster development or regulatory review or approval process and does not assure FDA approval of our product candidate.

If a drug is intended for the treatment of a serious or life-threatening condition and the drug demonstrates the potential to address unmet medical need for this condition, the drug sponsor may apply for FDA fast track designation. VY-AADC has been granted fast track designation by the FDA. We may seek such a designation for our other product candidates. A fast track designation does not ensure that the product candidate will receive marketing approval or that approval will be granted within any particular timeframe. Thus, fast track products may not experience a faster development process, review or approval compared to conventional FDA procedures. In addition, the FDA may withdraw fast track designation if it believes that the designation is no longer supported by data from a product candidate's clinical development program. Fast track designation alone does not guarantee qualification for the FDA's priority review procedures.

Priority review designation by the FDA may not lead to a faster regulatory review or approval process and, in any event, does not assure FDA approval of our product candidate.

If the FDA determines that a product candidate offers major advances in treatment or provides a treatment where no adequate therapy exists, the FDA may designate the product candidate for priority review. A priority review designation means that the FDA's goal to review an application is six months, rather than the standard review period of ten months. We may request priority review for our product candidates. The FDA has broad discretion with respect to whether or not to grant priority review status to a product candidate, so even if we believe a particular product candidate is eligible for such designation or status, the FDA may decide not to grant it. Moreover, a priority review designation does not necessarily mean a faster regulatory review process or necessarily confer any advantage with respect to approval compared to conventional FDA procedures. Receiving priority review from the FDA does not guarantee approval within the six-month review cycle or thereafter.

Even if we complete the necessary preclinical studies and clinical trials, the marketing approval process is expensive, time-consuming and uncertain and may prevent us from obtaining approvals for the commercialization of some or all of our product candidates. If we or any current or future collaborators are not able to obtain, or if there are delays in obtaining, required regulatory approvals, we or they may not be able to commercialize our products, and our ability to generate revenue may be materially impaired.

Our product candidates and the activities associated with their development and commercialization, including their design, testing, manufacture, safety, efficacy, recordkeeping, labeling, storage, approval, advertising, promotion, sale and distribution, export and import, are subject to comprehensive regulation by the FDA and other regulatory agencies in the United States and by the EMA and comparable regulatory authorities in other countries. Failure to obtain marketing approval for a product candidate will prevent us from commercializing the product candidate. We have not received approval to market any of our product candidates from regulatory authorities in any jurisdiction. We have only limited experience in filing and supporting the applications necessary to gain marketing approvals and expect to rely on third-party CROs to assist us in this process.

Securing marketing approval requires the submission of extensive preclinical and clinical data and supporting information to the various regulatory authorities for each therapeutic indication to establish the product candidate's safety and efficacy. Securing regulatory approval also requires the submission of information about the product manufacturing process to, and inspection of manufacturing facilities by, the relevant regulatory authority. Our product candidates may not be effective, may be only moderately effective or may prove to have undesirable or unintended side effects, toxicities or other characteristics that may preclude our obtaining marketing approval or prevent or limit commercial use.

The process of obtaining marketing approvals, both in the United States and abroad, is expensive; may take many years if additional clinical trials are required, if approval is obtained at all and can vary substantially based upon a variety of factors, including the type, complexity and novelty of the product candidates involved. In the United States, for example, the submission fee to obtain U.S. marketing approval is more than $2.0 million, and may be higher in the future. Changes in marketing approval policies during the development period, in or the enactment of additional statutes or regulations, or in regulatory review for each submitted product application, may cause delays in the approval or rejection of an application. The FDA and comparable authorities in other countries have substantial discretion in the approval process and may refuse to accept any application or may decide that our data are insufficient for approval and require additional preclinical, clinical or other studies. In addition, varying interpretations of the data obtained from preclinical and clinical testing could delay, limit or prevent marketing approval of a product candidate. Any marketing approval we, or any current or future collaborators, ultimately obtain may be limited or subject to restrictions or post-approval commitments that render the approved product not commercially viable.

Additionally, in July 2018, we received 510(k) regulatory clearance of V-TAG, our potential delivery device, from the Center for Devices and Radiological Health of the FDA, or CDRH. There are additional steps needed in making this device available for use including the manufacture of the product and compliance with state and federal laws and regulations for medical devices. We expect to rely on third parties in the development and manufacture of our potential delivery devices. In May 2018, for example, we entered into a master services and supply agreement with MRIC which provides for MRIC to perform certain manufacturing, supply, development, and services as requested by us, including the supply of the ClearPoint System and cannula devices as well as to collaborate on V-TAG. In March 2019, we

transferred our premarket notification (510(k)) clearance for the V-TAG device to MRIC. MRIC has sole responsibility for regulatory compliance related to V-TAG.

Accordingly, if we or any current or future collaborators experience delays in obtaining approval or if we or they fail to obtain or retain approval of our product candidates and devices, the commercial prospects for our product candidates may be harmed and our ability to generate revenues could be materially impaired.

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, storing, advertising, promoting, sampling, record-keeping and submitting 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 some types of gene therapy undergo follow-up observations 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 cGMP, requirements and adherence to commitments made in the BLA or foreign marketing application. 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 such regulatory authority disagrees with the promotion, marketing or labeling of that product, the 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, FDA 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 harm our business, financial condition, results of operations and prospects.

We face significant competition in an environment of rapid technological change and the possibility that our competitors may achieve regulatory approval before us or develop therapies that are more advanced or effective than ours, which may harm our business and financial condition, and our ability to successfully market or commercialize our product candidates.

The biopharmaceutical industry is characterized by intense and dynamic competition to develop new technologies and proprietary therapies. Any product candidates that we successfully develop into products and commercialize may compete with existing therapies and new therapies that may become available in the future. While we believe that our gene therapy platform, product programs, product candidates and scientific expertise in the fields of gene therapy and neuroscience provide us with competitive advantages, we face potential competition from various sources, including larger and better-funded pharmaceutical, specialty pharmaceutical and biotechnology companies, as well as from academic institutions, governmental agencies and public and private research institutions.

We are aware of several companies focused on developing AAV gene therapies in various indications, including Abeona Therapeutics, Inc., Adverum Biotechnologies, Inc., Aevitas Therapeutics, Inc., Agilis Biotherapeutics, LLC (acquired by PTC Therapeutics, Inc. in 2018), Apic Bio, Applied Genetic Technologies Corporation, Asklepios BioPharmaceutical, Inc., Audentes Therapeutics, Inc., AveXis, Inc. (acquired by Novartis in 2018), Axovant Sciences Ltd., GenSight Biologics SA, Homology Medicines, Inc., LogicBio Therapeutics, Inc., Lysogene SA, MeiraGTx Ltd., Neurogene, Inc., NightstaRx Ltd (acquired by Biogen, Inc., or Biogen in 2019), Passage Bio, Inc., Pfizer, Prevail Therapeutics, Inc., REGENXBio Inc., Sarepta Therapeutics, Inc., Solid Biosciences, Inc., Spark Therapeutics, Inc. (which has agreed to be acquired by F. Hoffmann-La Roche Ltd., or Roche, following completion of shareholder and regulatory approvals), StrideBio, Inc., and uniQure, as well as several companies addressing other methods for modifying genes and regulating gene expression. Any advances in gene therapy technology made by a competitor may be used to develop therapies that could compete against any of our product candidates.

We expect that VY-AADC will compete with a variety of therapies currently marketed and in development for Parkinson's disease, including deep brain stimulation, or DBS, marketed by Medtronic plc, Abbott Laboratories (acquired from St. Jude Medical in 2017), and other medical device companies; DUOPA/Duodopa marketed by AbbVie Inc.; and other novel, non-oral forms of levodopa in development, including Mitsubishi Tanabe Pharma's ND0612 (acquired from NeuroDerm in 2017), Acorda Therapeutics' inhaled levodopa, INBRIJA (CVT-301), and Sunovion Pharmaceuticals' sublingual apomorphine, APL-130277. Gene therapy competition for Parkinson's disease previously included AMT-090 or AAV-GDNF, but this was deprioritized by uniQure in 2016. Axovant is developing a second generation LentiVector gene therapy, AXO-Lenti-PD (previously OXB-102, licensed from Oxford Biomedica in 2018). MeiraGTx is developing AAV-GAD, acquired from Vector Neurosciences, Inc. in 2018.

We expect that our preclinical programs will compete with a variety of therapies in development, including:

- VY-SOD102 for a monogenic form of ALS will potentially compete with BIIB067 (IONIS-SOD1R$_{x)}$ being developed by Biogen, in collaboration with Ionis Pharmaceuticals, Inc., or Ionis, and gene therapies being developed by AveXis (acquired by Novartis in 2018) and Apic Bio;

- VY-FXN01 for Friedreich's ataxia will potentially compete with AAV gene therapies being developed by Pfizer, Agilis Biotherapeutics, LLC (acquired by PTC Therapeutics, Inc. in 2018), StrideBio, Inc. in collaboration with Takeda Pharmaceuticals, and BMN 290 being developed by BioMarin Pharmaceutical Inc.;

- VY-HTT01 for Huntington's disease will potentially compete with RG6042 (IONIS-HTTR$_{x)}$ being developed by Roche in collaboration with Ionis, WVE-120101 and WVE-120102 being developed by WAVE Life Sciences in collaboration with Takeda Pharmaceuticals, a Zinc Finger Protein (ZFP) therapy being developed by Sangamo Therapeutics, Inc. in collaboration with Shire plc, and gene therapies being developed by uniQure and Spark;

- Our Tau program for tauopathies including Alzheimer's disease, progressive supranuclear palsy, and frontotemporal dementia will potentially compete with tau antibodies being developed by Roche Genentech Inc. in collaboration with AC Immune SA, Eli Lilly & Co., AbbVie Inc., Biogen, and several other companies, as well as an antisense oligonucleotide program being developed by Ionis in collaboration with Biogen; and

- Our alpha-synuclein program for synucleinopathies, including Parkinson's disease, Lewy Body Dementia, and multiple system atrophy, will potentially compete with alpha-synuclein antibodies being developed by Roche in collaboration with Prothena Corporation, Biogen in collaboration with Neurimmune AG, AstraZeneca in collaboration with Takeda, and several other companies, as well as an antisense oligonucleotide program being developed by Ionis in collaboration with Biogen.

We are also aware of several companies and institutions who have developed or are developing real-time, intra-operative, MRI-compatible devices that would compete with V-TAG. Investigators in the Phase 1b, the separate Phase 1 posterior trajectory trial, and the RESTORE-1 Phase 2 clinical trial of VY-AADC, have used and are using the ClearPoint System from MRIC.

Many of our potential competitors, alone or with their strategic partners, have substantially greater financial, technical and other resources, such as larger research and development, clinical, marketing and manufacturing organizations. Mergers and acquisitions in the biotechnology and pharmaceutical industries, including recent transactions involving a number of gene therapy companies, may result in even more resources being concentrated among a smaller number of competitors. Smaller and other early stage companies may also prove to be significant competitors, particularly through collaborative agreements with large and established companies. Our commercial opportunity could be reduced or eliminated if competitors develop and commercialize products that are safer, more effective, have fewer or less severe side effects, are more convenient or are less expensive than any products that we may develop. Competitors also may obtain FDA or other regulatory approval for their products more rapidly or earlier than us or may obtain orphan drug or other marketing exclusivity, which could result in our competitors establishing a strong market position before we are able to enter the market or reducing the number of available subjects for enrollment in our clinical trials to support regulatory submissions and approvals of our product. Additionally, technologies developed or acquired by our competitors may render our potential product candidates uneconomical or obsolete, and we may not be successful in marketing our product candidates against competitors. These third parties also compete with us in recruiting and retaining qualified scientific and management personnel, establishing clinical trial sites, and registering patients for clinical trials.

In addition, as a result of the expiration or successful challenge of our patent rights, we could face more litigation with respect to the validity and scope of patents relating to our competitors' products. The availability of our competitors' products could limit the demand, and the price we are able to charge, for any products that we may develop and commercialize. If we are not able to compete effectively against potential competitors, our business will not grow and our financial condition and operations will be harmed.

Even if we obtain and maintain approval for our product candidates from the FDA, we may never obtain approval for our product candidates outside of the United States, which would limit our market opportunities and adversely affect our business.

Approval of a product candidate in the United States by the FDA does not ensure approval of such product candidate by regulatory authorities in other countries or jurisdictions, and approval by one foreign regulatory authority does not ensure approval by regulatory authorities in other foreign countries or by the FDA. Sales of our product candidates outside of the United States will be subject to foreign regulatory requirements governing clinical trials and marketing approval. Even if the FDA grants marketing approval for a product candidate, comparable regulatory authorities of foreign countries also must approve the manufacturing and marketing of the product candidates in those countries. Approval procedures vary among jurisdictions and can involve requirements and administrative review periods different from, and more onerous than, those in the United States, including additional preclinical studies or clinical trials or manufacturing control requirements. In many countries outside the United States, a product candidate must be separately approved for reimbursement before it can be approved for sale in that country. In some cases, the price that we intend to charge for our products, if approved, is also subject to approval. We intend to submit a marketing authorization application to EMA for approval of our product candidates in the European Union but obtaining such approval from the European Commission following the opinion of EMA is a lengthy and expensive process. Even if a product candidate is approved, the FDA or the European Commission may limit the indications for which the product may be marketed, require extensive warnings on the product labeling or require expensive and time-consuming additional clinical trials or reporting as conditions of approval. Regulatory authorities in countries outside of the United States and the European Union also have requirements for approval of product candidates with which we must comply prior to marketing in those countries. Obtaining foreign regulatory approvals and compliance with foreign regulatory requirements could result in significant delays, difficulties and costs for us and could delay or prevent the introduction of our product candidates in certain countries.

Further, clinical trials conducted in one country may not be accepted by regulatory authorities in other countries. Regulatory approval for any of our product candidates may be withdrawn. If we fail to comply with the regulatory requirements, our target market will be reduced and our ability to realize the full market potential of our product candidates will be harmed and our business, financial condition, results of operations and prospects will be harmed.

Additionally, on June 23, 2016, the electorate in the United Kingdom voted in favor of leaving the European Union, commonly referred to as Brexit. On March 29, 2017, the country formally notified the European Union of its intention to withdraw pursuant to Article 50 of the Lisbon Treaty. The United Kingdom had a maximum period of two years from the date of its formal notification to negotiate the terms of its withdrawal from, and future relationship with, the EU. To date, no formal withdrawal agreement has been reached between the United Kingdom and the EU, despite the passage of the date on which it was expected that the United Kingdom's membership in the EU would automatically terminate. The deadline for negotiating a withdrawal agreement has been extended to October 31, 2019, and discussions between the United Kingdom and the EU continue to focus on withdrawal issues and transition agreements. However, limited progress has been made to date, and the disagreement and uncertainty within the government of the United Kingdom sustains the possibility that the United Kingdom may leave the EU without a withdrawal agreement and associated transition period in place, which is likely to cause significant market and economic disruption.

Since a significant proportion of the regulatory framework in the United Kingdom is derived from European Union directives and regulations, Brexit could materially impact the regulatory regime with respect to the approval of our product candidates in the United Kingdom or the European Union. Any delay in obtaining, or an inability to obtain, any marketing approvals, as a result of Brexit or otherwise, would prevent us from commercializing our product candidates in the United Kingdom and/or the European Union and restrict our ability to generate revenue and achieve and sustain profitability. If any of these outcomes occur, we may be forced to restrict or delay efforts to seek regulatory approval in the United Kingdom and/or European Union for our product candidates, which could significantly and materially harm our business.

Risks Related to Third Parties

To date, all of our revenue has been derived from our collaborations with Sanofi Genzyme, AbbVie, and Neurocrine. If any ongoing or future collaboration agreements were to be terminated, our business financial condition, results of operations and prospects could be harmed.

In February 2015, we entered into the Sanofi Genzyme Collaboration Agreement to leverage our combined expertise and assets in gene therapy for neurological diseases. Under the Sanofi Genzyme Collaboration Agreement, we received an upfront commitment of approximately $100.0 million. Pursuant to the agreement, we granted Sanofi Genzyme an exclusive option to license, develop and commercialize (i) ex-U.S. rights to our Parkinson's disease, Friedreich's ataxia and Huntington's disease programs and a future program, or the Split Territory Programs, with an incremental option to co-commercialize the product candidate from our Huntington's disease program in the United States and (ii) worldwide rights to our spinal muscular atrophy program. If Sanofi Genzyme would have exercised an option for a Split Territory Program, except for our Parkinson's disease program, it would have been required to make an option exercise payment to us. At the inception of the agreement, we were eligible to receive up to $745.0 million in the aggregate upon the achievement of specified regulatory and commercial milestones, as well as tiered royalty payments based on a percentage of net sales of product candidates from the programs for which Sanofi Genzyme exercised its option, or the Optioned Programs.

In June 2019, we and Sanofi Genzyme executed a termination agreement to terminate the Sanofi Genzyme Collaboration Agreement, or the Sanofi Genzyme Termination Agreement. Under the terms of the Sanofi Genzyme Termination Agreement, Sanofi Genzyme has relinquished its rights to its exclusive license options to the Huntington's disease program, Friedreich's ataxia program and the unnamed future program described above. We have been relieved of our obligations to perform the research and development services under those programs under the Sanofi Genzyme Collaboration Agreement. As a result, we gained worldwide rights to the Huntington's program and ex-U.S. rights to the Friedreich's ataxia program. The ex-U.S. rights to the Friedreich's ataxia Program were, in turn, transferred from us to Neurocrine Biosciences pursuant to the Neurocrine Collaboration Agreement. In connection with the Sanofi Genzyme Termination Agreement, we have also relinquished our rights to the spinal muscular atrophy program thereunder. As of the termination date, we waived our right to approximately $0.4 million in unused in-kind services, we have relinquished our rights to the spinal muscular atrophy program, and we no longer have the right to receive any option payments, regulatory or commercial milestone payments or royalties from Sanofi Genzyme under the Sanofi Genzyme Collaboration Agreement.

In February 2018, we entered into an exclusive collaboration and option agreement with AbbVie, which we refer to as the AbbVie Tau Collaboration Agreement, for the research, development, and commercialization of AAV gene therapy products for the treatment of diseases of the central nervous system and other neurodegenerative diseases related to defective or excess aggregation of tau protein in the human brain, including Alzheimer's disease. Under the terms of the AbbVie Tau Collaboration Agreement, we received an upfront payment of $69.0 million and may receive option exercise payments, future development and regulatory milestone payments and royalties.

Under the AbbVie Tau Collaboration Agreement, we are obligated to use diligent efforts to conduct research and development activities, including IND-enabling and Phase 1 clinical trial activities, for which we are solely financially responsible. Our research and development activities in connection with this collaboration might not be successful. We cannot accurately predict when or if any of our product candidates will prove effective or safe in humans or whether these product candidates will receive marketing approval. There can be no assurance that we will not experience problems or delays in developing our product candidates and that such problems or delays will not cause unanticipated costs, or that any such development problems can be solved. The AbbVie Tau Collaboration Agreement shall automatically terminate if AbbVie decides not to exercise one or more of its options prior to the expiration of the specified periods of the collaboration. If AbbVie does not exercise one or more of its options, we would have incurred significant research and development expenses but would not receive any future option exercise, milestone, or royalty payments under the collaboration.

Such research and development activities shall be pursuant to plans agreed to by the parties and overseen by a joint governance committee, or JGC. Initially, we will have final decision-making authority within the JGC, subject to specified limitations. If AbbVie exercises its license option, however, AbbVie will assume final decision-making authority within the JGC. If AbbVie exercises its license option, it will also be solely responsible for all development and

commercialization activities relating to compounds and products licensed pursuant to the agreement, and, at AbbVie's request, we could be required to effect a full transfer of the manufacturing process for such compound and products. Even if AbbVie does not exercise any of its options under the AbbVie Tau Collaboration Agreement, we have agreed to grant AbbVie perpetual, exclusive or non-exclusive (as the case may be), worldwide licenses to certain know-how and patent rights developed by us or jointly by us and AbbVie arising from the collaboration.

AbbVie might not be effective in administering the JGC, obtaining approvals for the product candidates arising from our collaboration, or commercializing or manufacturing the resulting products. Further, AbbVie's objectives in connection with the collaboration may not be consistent with our best interests. AbbVie could use its leadership of the JGC or intellectual property it has licensed under the AbbVie Tau Collaboration Agreement in a manner adverse to us, or it could halt, slow, or deprioritize its development and commercialization efforts under the collaboration. In any such instances, our business, financial condition, results of operations and prospects could be materially harmed.

In January 2019, we entered into the Neurocrine Collaboration Agreement for the research, development and commercialization of four programs including our Parkinson's disease program, or AADC Program, our Friedreich's ataxia program, or FA Program, and two programs to be determined by us and Neurocrine at a later date, or the Neurocrine Discovery Programs. Under the terms of the agreement, we received an upfront payment of $165.0 million, inclusive of $50.0 million for 4,179,728 shares of our common stock, and may receive future development and regulatory milestones and royalties. In June 2019, in conjunction with the termination of the Sanofi Genzyme Collaboration Agreement, we and Neurocrine amended the Neurocrine Collaboration Agreement to facilitate the transfer of the ex-U.S. rights to VY-FXN01 which we acquired from Sanofi Genzyme to Neurocrine Biosciences. In connection with the amendment, we received a $5.0 million payment from Neurocrine.

Under the terms of the Neurocrine Collaboration Agreement, subject to the rights retained by us thereunder, we have agreed to collaborate with Neurocrine on, and to grant, exclusive, royalty-bearing, non-transferable, sublicensable licenses to certain of our intellectual property rights for all human and veterinary diagnostic, prophylactic, and therapeutic uses for the research, development, and commercialization of gene therapy Collaboration Products, under (i) the AADC Program, on a worldwide basis; (ii) the FA Program, on a worldwide basis; and (iii) each Neurocrine Discovery Program, on a worldwide basis.

Pursuant to development plans to be agreed by the parties, which will be overseen by a joint steering committee, we have operational responsibility, subject to certain exceptions, for the conduct of each Neurocrine Program (prior to specified transition events for each program), and are required to use commercially reasonable efforts to develop the Collaboration Products. Neurocrine has agreed to be responsible for all costs incurred by us in conducting these activities for each Neurocrine Program in accordance with an agreed budget. If we breach our development responsibilities or in certain circumstances upon a change in control of us, Neurocrine has the right but not the obligation to assume the activities under such Neurocrine Program.

Upon the occurrence of specified events for each program, Neurocrine has agreed to assume responsibility for development, manufacturing and commercialization activities for such program and to pay us milestones and royalties on future net sales. For each Existing Program, we have the option to co-develop and co-commercialize such program upon the occurrence of a specified event. Should we elect to exercise our co-development and co-commercialization option, we and Neurocrine have agreed to enter into a cost- and profit-sharing arrangement whereby we and Neurocrine agree to jointly develop and commercialize Collaboration Products for such program and share in its costs, profits and losses, and we have agreed to forfeit certain milestones and royalties on net sales in the United States during the effective period of the applicable co-development and co-commercialization agreement. As described above, our research and development activities in connection with a collaboration might not be successful. Neurocrine may terminate the Neurocrine Collaboration Agreement in its entirety or on a program-by-program or country-by-country basis by providing at least 180-day advance notice if such notice is provided prior to the first commercial sale of the Collaboration Product to which the termination applies or one-year advance notice if such notice is provided after the first commercial sale of the Collaboration Product to which the termination applies. If Neurocrine were to terminate the agreement, we would become responsible for all research and development expenses relating to the Neurocrine Programs, and would not receive any future milestone payments or royalty payments under the Neurocrine Collaboration Agreement.

Neurocrine might not be successful in obtaining approvals for the product candidates arising from our collaboration, or commercializing or manufacturing the resulting products. Further, Neurocrine's objectives in connection with the collaboration may not be consistent with our best interests. With respect to the rights granted to Neurocrine by us, Neurocrine could take actions that may be adverse to us, or it could halt, slow, or deprioritize its development and commercialization efforts under the collaboration. In any such instances, our business, financial condition, results of operations and prospects could be materially harmed.

In February 2019, we entered into the AbbVie Alpha-Synuclein Collaboration Agreement for the research, development, and commercialization of AAV gene therapy products directed against alpha-synuclein for indications including Parkinson's disease and other synucleinopathies. Under the terms of the AbbVie Alpha-Synuclein Collaboration Agreement, we received an upfront payment of $65.0 million and may receive option exercise payments, future development and regulatory milestone payments and royalties.

Under the terms of the agreement, we and AbbVie have agreed to collaborate on the research and development of the specified vectorized antibody compounds, or the Research Compounds. We are obligated to conduct research activities directed to constructing one or more virus vectors that encode antibodies designated by AbbVie. We are obligated to use diligent efforts to conduct antibody engineering and other research activities to create Research Compounds and to develop product candidates containing or comprised of such Research Compounds, which we refer to as Product Candidates. We are solely responsible for the costs and expenses during the research period. During a specified portion of the Research Period, AbbVie may exercise one or more of its exclusive development options to select up to a total of four Research Compounds and their corresponding product candidates to proceed to the Development Period. As described above, our research and development activities in connection with a collaboration might not be successful. The AbbVie Alpha-Synuclein Collaboration Agreement shall automatically terminate if AbbVie decides not to exercise one or more of its options prior to the expiration of the specified periods of the collaboration. If AbbVie did not exercise one or more of its options, we would have incurred significant research and development expenses but would not receive any future option exercise, milestone payments, or royalty payments under the collaboration.

Such research and development activities shall be pursuant to plans agreed to by the parties and overseen by a JGC. Initially, we will have final decision-making authority within the JGC, subject to specified limitations. If AbbVie exercises its license option, however, AbbVie will assume final decision-making authority within the JGC. If AbbVie exercises its license option, it will also be solely responsible for all development and commercialization activities relating to compounds and products licensed pursuant to the agreement, and, at AbbVie's request, we could be required to effect a full transfer of the manufacturing process for such compound and products. Even if AbbVie does not exercise any of its options under the AbbVie Alpha-Synuclein Collaboration Agreement, we have agreed to grant AbbVie perpetual, exclusive or non-exclusive (as the case may be), worldwide licenses to certain know-how and patent rights developed by us or jointly by us and AbbVie arising from the collaboration.

AbbVie might not be effective in administering the JGC, obtaining approvals for the product candidates arising from our collaboration, or commercializing or manufacturing the resulting products. Further, AbbVie's objectives in connection with the collaboration may not be consistent with our best interests. AbbVie could use its leadership of the JGC or intellectual property it has licensed under the AbbVie Alpha-Synuclein Collaboration Agreement in a manner adverse to us, or it could halt, slow, or deprioritize its development and commercialization efforts under the collaboration. In any such instances, our business, financial condition, results of operations and prospects could be materially harmed.

We have only used the ClearPoint System to deliver our product candidates. While other devices for delivery may be used in the future, any issues with the ClearPoint System or the manufacturer of the ClearPoint System may result in delays in the development and commercialization of certain of our product candidates, which could have an adverse impact on our business.

The surgical approach that we are using for VY-AADC is similar, in some respects, to the stereotactic approach used for DBS. One primary difference with our approach is the ability to assist the physician in visualizing the delivery of VY-AADC to the putamen using real-time, intra-operative, magnetic resonance imaging scans, or MRI imaging, to avoid specific blood vessels to potentially reduce the risk of hemorrhages during the surgical procedure and to maximize the coverage of the putamen.

Investigators in the Phase 1b clinical trial, the separate Phase 1 posterior trajectory trial, and the RESTORE-1 Phase 2 clinical trial for VY-AADC, have used and are using the real-time, intra-operative, MRI imaging system known as the ClearPoint System. The ClearPoint System is manufactured by MRIC. Not all neurosurgical units within the United States utilize the ClearPoint system and may employ other neuro-navigational systems that are not compatible with real-time MRI imaging. We and Neurocrine intend to use the ClearPoint System at certain sites in the RESTORE-1 Phase 2 clinical trial and may choose to use it in future clinical trials of VY-AADC and any other of our product candidates that are injected directly into the brain. Therefore, any issues with the ClearPoint System, such as a finding that use of the ClearPoint System causes adverse events or a product recall, or issues with MRIC, the manufacturer of the ClearPoint System, such as bankruptcy or a decision to stop production of the system due to lack of profitability, could delay the development or commercialization of certain of our product candidates, including VY-AADC, as there currently is no other manufacturer of the ClearPoint System. Outside the United States, the ClearPoint System is not widely available or utilized in neurosurgical units.

We have developed the Variable Trajectory Array Guide, or V-TAG, as our own real-time, intra-operative device that is compatible with MRI imaging and can be used with other neuro-navigational systems to dose VY-AADC and for other surgical procedures. We believe that the experience we have gained from delivering VY-AADC in our clinical trials to date and our work to develop V-TAG may inform AAV gene therapy delivery for our Huntington's disease program and other projects. In July 2018, we received 510(k) regulatory clearance of V-TAG from the CDRH. There are additional steps needed in making this device available for use, including the manufacture of the product and compliance with state and federal laws and regulations for medical devices.

We expect to rely on third parties in the development and manufacture of our potential delivery devices. In May 2018, we entered into a master services and supply agreement with MRIC for the development and manufacture of devices, including V-TAG. This agreement provides for MRIC to perform certain manufacturing, supply, development and other services, including the supply of the ClearPoint System and cannula devices. In March 2019, we transferred our premarket notification (510(k)) clearance for the V-TAG device to MRIC, and will work with MRIC on the manufacturing and clinical supply of the device.

As of March 31, 2019, MRIC reported cash and cash equivalents of $2.5 million and junior secured debt totaling approximately $3.6 million, and also reported a net loss of $1.2 million for the three months ended March 31, 2019. MRIC has disclosed that it is not generating sufficient revenues from its operations to fund its activities, that it is dependent upon external sources for financing its operations, and that there is a risk that MRIC will be unable to obtain necessary financing to continue its operations. In April 2019, MRIC also acknowledged that its auditors in their report on MRIC's consolidated financial statements for the year ended December 31, 2018 expressed substantial doubt regarding MRIC's ability to continue as a going concern. If MRIC, or any potential successor to MRIC, is not able to meet its obligations under our agreement with MRIC, and if we are not able to arrange suitable alternative arrangements for the supply of the ClearPoint System or V-TAG, the use of the ClearPoint System and V-TAG in our clinical trials could be adversely affected, and our clinical trials, including the RESTORE-1 Phase 2 clinical trial, could be delayed. In such circumstance, our business, financial condition, results of operations and prospects could be materially harmed.

We may seek to enter into collaborations in the future with other third parties. If we are unable to enter into such collaborations, or if these collaborations are not successful, our business could be adversely affected.

We may seek to enter into additional collaborations in the future, including sales, marketing, distribution, development, licensing, and/or broader collaboration agreements. Our likely collaborators include large and mid-size pharmaceutical companies, regional and national pharmaceutical companies, biotechnology companies, and medical device manufacturers. However, we may not be able to enter into additional collaborations on favorable terms or at all. Our ability to generate revenues from our collaborations will depend on our and our collaborators' abilities to successfully perform the functions assigned to each of us in these arrangements. In addition, our collaborators might have the ability to abandon research or development projects and terminate applicable agreements. Moreover, an unsuccessful outcome in any clinical trial for which our collaborator is responsible could be harmful to the public perception and prospects of our gene therapy platform.

Our relationship with any future collaborators may pose several risks, including the following:

- collaborators have significant discretion in determining the amount and timing of the efforts and resources that they will apply to these collaborations;
- collaborators may not perform their obligations as expected;
- the preclinical studies and clinical trials conducted as part of these collaborations may not be successful;
- collaborators may not pursue development and commercialization of any product candidates that achieve regulatory approval or may elect not to continue or renew development or commercialization programs based on preclinical study or clinical trial results, changes in the collaborators' strategic focus or available funding or external factors, such as an acquisition, that divert resources or create competing priorities;
- collaborators may delay preclinical studies and clinical trials, provide insufficient funding for preclinical studies and clinical trials, stop a preclinical study or clinical trial or abandon a product candidate, repeat or conduct new preclinical studies or clinical trials or require a new formulation of a product candidate for preclinical studies or clinical trials;
- we may not have access to, or may be restricted from disclosing, certain information regarding product candidates being developed or commercialized under a collaboration and, consequently, may have limited ability to inform our stockholders about the status of such product candidates;
- collaborators could independently develop, or develop with third parties, products that compete directly or indirectly with our product candidates if the collaborators believe that competitive products are more likely to be successfully developed or can be commercialized under terms that are more economically attractive than ours;
- product candidates developed in collaboration with us may be viewed by our collaborators as competitive with their own product candidates or products, which may cause collaborators to cease to devote resources to the commercialization of our product candidates;
- a collaborator with marketing and distribution rights to one or more of our product candidates that achieve regulatory approval may not commit sufficient resources to the marketing and distribution of any such product candidate;
- disagreements with collaborators, including disagreements over proprietary rights, contract interpretation or the preferred course of development of any product candidates, may cause delays or termination of the research, development or commercialization of such product candidates, may lead to additional responsibilities for us with respect to such product candidates or may result in litigation or arbitration, any of which would be time-consuming and expensive;
- collaborators may not properly maintain or defend our intellectual property rights or may use our proprietary information in such a way as to invite litigation that could jeopardize or invalidate our intellectual property or proprietary information or expose us to potential litigation;
- disputes may arise with respect to the ownership or inventorship of intellectual property developed pursuant to our collaborations;
- collaborators may infringe the intellectual property rights of third parties, which may expose us to litigation and potential liability;

- the terms of our collaboration agreement may restrict us from entering into certain relationships with other third parties, thereby limiting our options; and
- collaborations may be terminated for the convenience of the collaborator and, if terminated, we could be required to raise additional capital to pursue further development or commercialization of the applicable product candidates.

Collaboration agreements may not lead to the development or commercialization of product candidates in the most efficient manner, or at all. If our collaborations do not result in the successful development and commercialization of products, or if one of our collaborators terminates its agreement with us, we may not receive any future research funding or milestone or royalty payments under the collaboration. If we do not receive the funding we expect under these agreements, our development of our product candidates could be delayed, and we may need additional resources to develop our product candidates. Additionally, subject to its contractual obligations to us, if a collaborator of ours were to be involved in a business combination, it might deemphasize or terminate the development or commercialization of any product candidate licensed to it by us. If one of our collaborators terminates its agreement with us, we may find it more difficult to attract new collaborators, and the perception of us in the business and financial communities could be adversely affected. All of the risks relating to product development, regulatory approval and commercialization described in this periodic report also apply to the activities of our collaborators.

We will face significant competition in seeking appropriate collaborators, and the negotiation process is time-consuming and complex. Our ability to reach a definitive collaboration agreement with any future collaborators will depend, among other things, upon our assessment of the collaborator's resources and expertise, the terms and conditions of the proposed collaboration and the proposed collaborator's evaluation of several factors. Those factors may include the design or results of clinical trials, the likelihood of approval by the FDA or similar regulatory authorities outside the United States, the potential market for the subject product candidate, the costs and complexities of manufacturing and delivering such product candidate to patients, the potential of competing products, the existence of uncertainty with respect to our ownership of technology, which can exist if there is a challenge to such ownership without regard to the merits of the challenge, and industry and market conditions generally. The collaborator may also consider alternative product candidates or technologies for similar indications that may be available to collaborate on and whether such a collaboration could be more attractive than the one with us for our product candidate. We may also be restricted under future license agreements from entering into agreements on certain terms with potential collaborators. In addition, there have been a significant number of recent business combinations among large pharmaceutical companies that have resulted in a reduced number of potential future collaborators.

If we are unable to reach agreements with suitable collaborators on a timely basis, on acceptable terms, or at all, we may have to curtail the development of a product candidate, reduce or delay its development program or one or more of our other development programs, delay its potential commercialization or reduce the scope of any sales or marketing activities, or increase our expenditures and undertake development or commercialization activities at our own expense. If we elect to fund and undertake development or commercialization activities on our own, we may need to obtain additional expertise and additional capital, which may not be available to us on acceptable terms or at all. If we fail to enter into collaborations and do not have sufficient funds or expertise to undertake the necessary development and commercialization activities, we may not be able to further develop our product candidates or bring them to market or continue to develop our gene therapy platform. If we license rights to product candidates, we may not be able to realize the benefit of such transactions if we are unable to successfully integrate them with our existing operations and company culture.

We have relied, and we expect to continue to rely, on third parties to conduct, supervise and monitor our clinical trials, and if these third parties perform in an unsatisfactory manner, our business could be harmed.

We expect to rely on CROs and clinical trial sites to ensure our clinical trials are conducted properly and on time. We may also engage third parties such as clinical data management organizations, medical institutions and clinical investigators to conduct or assist in our clinical trials or other clinical development work. While we will have agreements governing their activities, we will have limited influence over their actual performance. We will control only certain aspects of our third-party service providers' activities. Nevertheless, we will be responsible for ensuring that each of our clinical studies is conducted in accordance with the applicable protocol, legal, regulatory and scientific standards. Our reliance on these third-parties does not relieve us of our regulatory responsibilities. For example, the Phase 1b clinical

trial of VY-AADC and the separate Phase 1 trial exploring the delivery of VY-AADC using a posterior trajectory were conducted at several locations. We expect to conduct the RESTORE-1 Phase 2 clinical trial at over twenty clinical trial sites, including neurosurgical and neurology patient referral sites in the United States and Europe. If any locations terminate the clinical trial, we would be required to find another party to conduct any new trials. We may be unable to find a new party to conduct new trials of our product candidates or obtain clinical supply of our product candidates or AAV vectors for such trials.

We and our third-party service providers are required to comply with the FDA's GCPs for conducting, recording and reporting the results of IND-enabling studies and clinical studies to assure that the data and reported results are credible and accurate and that the rights, integrity and confidentiality of clinical trial participants are protected. We are also required to register ongoing clinical trials and post the results of completed clinical trials on a government-sponsored database, ClinicalTrials.gov, within specified timeframes. The FDA enforces these GCPs through periodic inspections of trial sponsors, principal investigators and clinical trial sites at which the FDA may determine that our clinical trials did not comply with GCPs. If we, our collaborators, or our third-party service providers fail to comply with applicable GCPs, the clinical data generated in our future clinical trials may be deemed unreliable and the FDA may require us to perform additional clinical trials before approving any marketing applications. In addition, our future clinical trials will require a sufficient number of patients to evaluate the safety and effectiveness of our product candidates. Accordingly, if we, our collaborators, or our third-party service providers fail to comply with these regulations or fail to recruit a sufficient number of patients, we may be required to repeat such clinical trials, which would delay the regulatory approval process. Failure to comply can also result in fines, adverse publicity, and civil and criminal sanctions.

Our third-party service providers are not our employees, and we are therefore unable to directly monitor whether or not they devote sufficient time and resources to our clinical and nonclinical programs. These third-party service providers may also have relationships with other commercial entities, including our competitors, for whom they may also be conducting clinical trials or other drug development activities that could harm our competitive position. If our third-party service providers do not successfully carry out their contractual duties or obligations, fail to meet expected deadlines, or if the quality or accuracy of the clinical data they obtain is compromised due to the failure to adhere to our clinical protocols or regulatory requirements, or for any other reasons, our clinical trials may be extended, delayed or terminated, and we may not be able to obtain regulatory approval for, or successfully commercialize our product candidates. As a result, our financial results and the commercial prospects for our product candidates could be harmed, our costs could increase, and our ability to generate revenues could be delayed.

Risks Related to Manufacturing

Gene therapies and their companion diagnostics are novel, complex and difficult to manufacture. We could experience manufacturing problems that result in delays in the development or commercialization of our product candidates or otherwise harm our business.

The manufacture of gene therapy products is technically complex and necessitates substantial expertise and capital investment. Production difficulties caused by unforeseen events may delay the availability of material for our clinical studies. To meet the requirements of our current and planned future trials we have developed a proprietary manufacturing platform that provides a robust and scalable process for AAV production. We are using the baculovirus/Sf9 AAV production system, a technology for producing AAV gene therapy vectors at scale in insect-derived cells. The process has been successfully transferred to our contract manufacturing organizations where it is used in manufacturing clinical materials in accordance with the FDA's current good manufacturing practices, or cGMPs. We have also built an onsite, state-of-the-art process research and development facility to enable the manufacturing of high quality AAV gene therapy vectors at laboratory scale.

We presently contract with third parties for the manufacturing of our program materials. We are currently assessing our manufacturing capabilities and although we do not currently have our own clinical or commercial scale manufacturing, we may choose to build those capabilities. The use of contracted manufacturing and reliance on collaboration partners is relatively cost efficient and has eliminated the need for our direct investment in manufacturing facilities and additional staff early in development. Although we rely on contract manufacturers, we have personnel with manufacturing and quality experience to oversee our contract manufacturers.

To date, our third-party manufacturers have met our manufacturing requirements for our program materials. We expect third-party manufacturers to be capable of providing sufficient quantities of our program materials to meet anticipated clinical trial scale demands. To meet our projected needs for commercial manufacturing, third parties with whom we currently work might need to increase their scale of production or we will need to secure alternate suppliers. We believe that there are alternate sources of supply for our program materials that can satisfy our clinical and commercial requirements, although we cannot be certain that identifying and establishing relationships with such sources, if necessary, would not result in significant delay or material additional costs.

To date, our third-party manufacturers have met our quality standards for our program materials. The manufacturers of pharmaceutical products must comply with strictly enforced cGMP requirements, state and federal regulations, as well as foreign requirements when applicable. Any failure by us or our contract manufacturing organizations to adhere to or document compliance to such regulatory requirements could lead to a delay or interruption in the availability of our program materials for clinical study. If we or our manufacturers were to fail to comply with the FDA, EMA, or other regulatory authority, it could result in sanctions being imposed on us, including clinical holds, fines, injunctions, civil penalties, delays, suspension or withdrawal of approvals, license revocation, seizures or recalls of product candidates or products, operating restrictions and criminal prosecutions, any of which could significantly and adversely affect supplies of our product candidates. Our potential future dependence upon others for the manufacture of our product candidates may also adversely affect our future profit margins and our ability to commercialize any product candidates that receive regulatory approval on a timely and competitive basis.

Biological products are inherently difficult to manufacture. Our program materials are manufactured using technically complex processes requiring specialized equipment and facilities, highly specific raw materials, cells, and reagents, and other production constraints. Several of these raw materials, cells, and reagents are provided by a limited number of suppliers. Even though we aim to have backup supplies and suppliers of raw materials, cells, and reagents whenever possible, we cannot be certain they will be sufficient if our primary sources are unavailable. A shortage of a critical raw material, cell line, or reagent, or a technical issue during manufacturing may lead to delays in clinical development or commercialization plans. Any changes in the manufacturing of components of the raw materials we use could result in unanticipated or unfavorable effects in our manufacturing processes, resulting in delays.

Companion diagnostic devices may be required to diagnose a genetic disease or to determine patient antibody levels to certain components in a product, and could also require a sophisticated, technically complex manufacturing processes. If we or our contract manufacturing organizations fail to manufacture such diagnostics or comply with relevant regulatory requirements or approvals, we might seek to transition such manufacturing processes to another contract manufacturing organization. We might not be able to transition such processes in a timely manner or at all, and our commercialization and development efforts could be delayed.

Delays in obtaining regulatory approval of our or our collaborators' manufacturing processes and facilities or disruptions in such manufacturing processes may delay or disrupt our commercialization efforts. Until recently, no cGMP gene therapy manufacturing facility in the United States had received approval from the FDA for the manufacture of an approved gene therapy product.

Before we can begin to commercially manufacture a product candidate in our own facility, or the facility of a collaborator, we must obtain regulatory approval from the FDA for our manufacturing process and our collaborator's facility. A manufacturing authorization must also be obtained from the appropriate European Union regulatory authorities. Until recently, no cGMP gene therapy manufacturing facility in the United States had received approval from the FDA for the manufacture of an approved gene therapy product and, therefore, the timeframe required for us to obtain such approval is uncertain. In addition, we must pass a pre-approval inspection of our or our collaborator's manufacturing facility by the FDA and other relevant regulatory authorities before any of our product candidates can obtain marketing approval. In order to obtain approval, we will need to ensure that all of our processes, methods and equipment are compliant with cGMP, and perform extensive audits of vendors, contract laboratories and suppliers. If any of our vendors, contract laboratories or suppliers is found to be out of compliance with cGMP, we may experience delays or disruptions in manufacturing while we work with these third parties to remedy the violation or while we work to identify suitable replacement vendors. The cGMP requirements govern quality control of the manufacturing process and documentation policies and procedures. In complying with cGMP, we will be obligated to expend time, money and effort

in production, record keeping and quality control to assure that the product meets applicable specifications and other requirements. If we fail to comply with these requirements, we would be subject to possible regulatory action and may not be permitted to sell any products that we may develop.

Failure to comply with ongoing regulatory requirements could cause us to suspend production or put in place costly or time-consuming remedial measures.

The regulatory authorities may, at any time, following approval of a product for sale, audit the manufacturing facilities for such product or institute biennial inspections. If any such inspection or audit identifies a failure to comply with applicable regulations, or if a violation of product specifications or applicable regulations occurs independent of such an inspection or audit, the relevant regulatory authority may require remedial measures that may be costly or time-consuming to implement and that may include the temporary or permanent suspension of a clinical trial or commercial sales or the temporary or permanent closure of a manufacturing facility. Any such remedial measures imposed upon our third-party manufacturers, our collaborators, or us could harm our business, financial condition, results of operations and prospects.

If our third-party manufacturers, our collaborators, or we fail to comply with applicable cGMP regulations, FDA and foreign regulatory authorities can impose regulatory sanctions including, among other things, refusal to approve a pending application for a new product candidate or suspension or revocation of a pre-existing approval. Such an occurrence may cause our business, financial condition, results of operations and prospects to be harmed.

Additionally, if supply from any third-party manufacturers is delayed or interrupted, there could be a significant disruption in the supply of our clinical or commercial material. We have agreements in place with our contract manufacturers pursuant to which we are collaborating on cGMP manufacturing processes and analytical methods for the manufacture of our AAV product candidates. Therefore, if we are unable to enter into an agreement with our contract manufacturers to manufacture clinical or commercial material for our product programs, or if our agreement with our contract manufacturers were terminated, we would have to find suitable alternative manufacturers. This could delay our or our collaborators' ability to conduct clinical trials or commercialize our current and future product candidates. The regulatory authorities also may require additional trials if a new manufacturer is relied upon for commercial production. Switching manufacturers may involve substantial costs and could result in a delay in our desired clinical and commercial timelines.

Any contamination in the manufacturing process for our products or product candidates, shortages of raw materials, cells or reagents, or failure of any of our key suppliers to deliver necessary components could result in delays in our clinical development or marketing schedules.

Given the nature of biologics manufacturing, there is a risk of contamination. Any contamination could 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 raw materials required in our manufacturing process are derived from biologic sources. Such raw 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 adversely affect our development timelines and our business, financial condition, results of operations and prospects.

Interruptions in the supply of product candidates or inventory loss may harm our operating results and financial condition.

Our product candidates and our product delivery devices are manufactured using technically complex processes requiring specialized facilities, highly specific raw materials and other production constraints. The complexity of these processes, as well as strict government standards for the manufacture and storage of our product candidates and delivery devices, subjects us to manufacturing risks. While product candidate batches released for use in clinical trials or for commercialization undergo sample testing, some defects may only be identified following product release. In addition, process deviations or unanticipated effects of approved process changes may result in these intermediate products not complying with stability requirements or specifications. Our product candidates and delivery devices must be stored and transported at temperatures within a certain range and in sterile environments. If these temperature and environmental

conditions deviate, the remaining shelf-life of a product candidate and utility of a device could be impaired or their efficacy and safety could be negatively impacted, making them no longer suitable for use.

The occurrence, or suspected occurrence, of manufacturing and distribution difficulties can lead to lost inventories and, in some cases, product recalls, with consequential reputational damage and the risk of product liability. The investigation and remediation of any identified problems can cause production delays, substantial expense, lost sales and delays of new product launches. Any interruption in the supply of finished products or the loss thereof could hinder our ability to timely distribute our products and satisfy customer demand. Any unforeseen failure in the storage of the product or loss in supply could delay our clinical trials and, if our product candidates are approved, result in a loss of our market share and negatively affect our business, financial condition, results of operations and prospects.

Failure to obtain access to or to protect intellectual property related to the manufacturing of our products or product candidates may result in changes, delays and/or inability to manufacture such products or product candidates.

The intellectual property related to the manufacture of biological products is complex. If we are unable to maintain control of manufacturing technology such as our trade secrets, or we are unable to protect ongoing improvements comprehensively and in a sufficient number of jurisdictions, it would impact our ability to produce products for commercial sale or product candidates for preclinical testing or clinical trials and our development timelines and operations timelines could be adversely affected.

Risks Related to Our Business Operations

We may not be successful in our efforts to identify or discover additional product candidates and may fail to capitalize on programs or product candidates that may be a greater commercial opportunity, or for which there is a greater likelihood of success.

The success of our business depends upon our ability to identify, develop and commercialize product candidates generated through our gene therapy platform. Research programs to identify new product candidates require substantial technical, financial and human resources. Although VY-AADC is currently in clinical development and our other product candidates are in preclinical development, we may fail to identify other potential product candidates for clinical development for several reasons. For example, our research may be unsuccessful in identifying potential product candidates or our potential product candidates may be shown to have harmful side effects, may be commercially impracticable to manufacture or may have other characteristics that may make the products unmarketable or unlikely to receive marketing approval.

Additionally, 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. Our spending on current and future research and development programs may not yield any commercially viable products. 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 collaboration, 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. Alternatively, we may allocate internal resources to a product candidate in a therapeutic area in which it would have been more advantageous to enter into a partnering arrangement.

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, which could harm our business, financial condition, results of operations and prospects.

Our future success depends on our ability to retain key members of our management team, and to attract, retain and motivate qualified personnel.

We are highly dependent on the management, technical, and scientific expertise of principal members of our management, scientific, and clinical teams including Steven M. Paul, M.D., our former President and Chief Executive Officer, who now serves as a senior advisor, director, and member of our Science and Technology Committee, and G. Andre Turenne, our President and Chief Executive Officer. While we have entered into employment agreements or offer

letters 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 currently do not have "key person" insurance on any of our employees. The loss of the services of one or more of our current 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 is also critical to our success. There currently is a shortage of skilled individuals with substantial gene therapy experience, 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, if at all, given the competition among numerous pharmaceutical and biotechnology companies and academic institutions for individuals with similar skill sets. Our consultants and advisors may be employed by employers other than us and may have commitments under consulting or advisory contracts with other entities that may limit their availability to us. In addition, failure to succeed in preclinical or clinical trials or applications for marketing approval may make it more challenging to recruit and retain qualified personnel. The inability to recruit, or loss of services of certain executives, key employees, consultants or advisors, may impede the progress of our research, development and commercialization objectives and could harm our business, financial condition, results of operations and prospects.

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. We can provide no assurances that we will have sufficient resources in the future to manage all of our planned programs. Future growth would impose significant added responsibilities on members of management, may lead to significant added costs, and may divert our management and business development resources. 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, collaborators, and commercial partners. Misconduct by these parties could include intentional failures to comply with FDA regulations or the regulations applicable in the European Union and other jurisdictions, provide accurate information to the FDA, the European Commission and other 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 restrict or prohibit a wide range of pricing, discounting, marketing and promotion, sales commission, customer incentive programs and other business arrangements. Such misconduct also could involve the improper use of information obtained in the course of clinical trials or interactions with the FDA or other regulatory authorities, 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 government 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, financial condition, results of operations and prospects, including the imposition of significant fines or other sanctions.

Current and future legislation may increase the difficulty and cost for us and any collaborators to obtain marketing approval of and commercialize our product candidates and affect the prices we, or they, may obtain.

In the United States and some foreign jurisdictions, there have been and continue to be a number of legislative and regulatory changes and proposed changes regarding the healthcare system that could, among other things, prevent or delay marketing approval of our product candidates, restrict or regulate post-approval activities and affect our ability, or the ability of any collaborators, to profitably sell any products for which we, or they, obtain marketing approval. We expect that current laws, as well as other healthcare reform measures that may be adopted in the future, may result in more rigorous coverage criteria and in additional downward pressure on the price that we, or any collaborators, may receive for any approved products.

In March 2010, President Obama signed into law the Patient Protection and Affordable Care Act, as amended by the Health Care and Education Reconciliation Act, which we refer to, collectively, as the ACA. Among the provisions of the ACA of potential importance to our business and our product candidates are the following:

- an annual, non-deductible fee on any entity that manufactures or imports specified branded prescription drugs and biologic agents;
- an increase in the statutory minimum rebates a manufacturer must pay under the Medicaid Drug Rebate Program;
- expansion of healthcare fraud and abuse laws, including the civil False Claims Act and the federal Anti-Kickback Statute, new government investigative powers and enhanced penalties for noncompliance;
- a new Medicare Part D coverage gap discount program, in which manufacturers must agree to offer 50% point-of-sale discounts off negotiated prices;
- extension of manufacturers' Medicaid rebate liability;
- expansion of eligibility criteria for Medicaid programs;
- expansion of the entities eligible for discounts under the Public Health Service pharmaceutical pricing program;
- new requirements to report certain financial arrangements with physicians and teaching hospitals;
- a new requirement to annually report drug samples that manufacturers and distributors provide to physicians; and
- a new Patient-Centered Outcomes Research Institute to oversee, identify priorities in, and conduct comparative clinical effectiveness research, along with funding for such research.

In addition, other legislative changes have been proposed and adopted since the ACA was enacted. These changes include the Budget Control Act of 2011, which, among other things, led to aggregate reductions to Medicare payments to providers of up to 2% per fiscal year that started in 2013 and, due to subsequent legislative amendments to the statute, will stay in effect through 2025 unless additional congressional action is taken, and the American Taxpayer Relief Act of 2012, which, among other things, reduced Medicare payments to several types of providers and increased the statute of limitations period for the government to recover overpayments to providers from three to five years. These new laws may result in additional reductions in Medicare and other healthcare funding and otherwise affect the prices we may obtain for any of our product candidates for which we may obtain regulatory approval or the frequency with which any such product candidate is prescribed or used. Further, there have been several recent U.S. congressional inquiries and proposed state and federal legislation designed to, among other things, bring more transparency to drug pricing,

review the relationship between pricing and manufacturer patient programs, reduce the costs of drugs under Medicare and reform government program reimbursement methodologies for drug products.

We expect that these healthcare reforms, as well as other healthcare reform measures that may be adopted in the future, may result in additional reductions in Medicare and other healthcare funding, more rigorous coverage criteria, new payment methodologies and additional downward pressure on the price that we receive for any approved product and/or the level of reimbursement physicians receive for administering any approved product we might bring to market. Reductions in reimbursement levels may negatively impact the prices we receive or the frequency with which our products are prescribed or administered. Any reduction in reimbursement from Medicare or other government programs may result in a similar reduction in payments from private payors.

With enactment of the TJCA, which was signed by the President on December 22, 2017, Congress repealed the "individual mandate." The repeal of this provision, which requires most Americans to carry a minimal level of health insurance, became effective January 1, 2019. According to the Congressional Budget Office, the repeal of the individual mandate will cause 13 million fewer Americans to be insured in 2027 and premiums in insurance markets may rise. Further, each chamber of the Congress has put forth multiple bills designed to repeal or repeal and replace portions of the ACA. Although none of these measures has been enacted by Congress to date, Congress may consider other legislation to repeal and replace elements of the ACA in the future.

The Trump administration has also taken executive actions to undermine or delay implementation of the ACA. Since January 2017, President Trump has signed two Executive Orders designed to delay the implementation of certain provisions of the ACA or otherwise circumvent some of the requirements for health insurance mandated by the ACA. One Executive Order directs federal agencies with authorities and responsibilities under the ACA to waive, defer, grant exemptions from, or delay the implementation of any provision of the ACA that would impose a fiscal or regulatory burden on states, individuals, healthcare providers, health insurers, or manufacturers of pharmaceuticals or medical devices. The second Executive Order terminates the cost-sharing subsidies that reimburse insurers under the ACA. Several state Attorneys General filed suit to stop the Trump administration from terminating the subsidies, but their request for a restraining order was denied by a federal judge in California on October 25, 2017.

In addition, CMS has proposed regulations that would give states greater flexibility in setting benchmarks for insurers in the individual and small group marketplaces, which may have the effect of relaxing the essential health benefits required under the ACA for plans sold through such marketplaces. On November 30, 2018, CMS announced a proposed rule that would amend the Medicare Advantage and Medicare Part D prescription drug benefit regulations to reduce out of pocket costs for plan enrollees and allow Medicare plans to negotiate lower rates for certain drugs. Among other things, the proposed rule changes would allow Medicare Advantage plans to use pre-authorization, or PA, and step therapy, or ST, for six protected classes of drugs, with certain exceptions, permit plans to implement PA and ST in Medicare Part B drugs; and change the definition of "negotiated prices" while adding a definition of "price concession" into the regulations. It is unclear whether these proposed changes we be accepted, and if so, what effect such changes will have on our business. Litigation and legislation over the ACA are likely to continue, with unpredictable and uncertain results.

Further, on June 14, 2018, U.S. Court of Appeals for the Federal Circuit ruled that the federal government was not required to pay more than $12 billion in ACA risk corridor payments to third-party payors who argued were owed to them. The effects of this gap in reimbursement on third-party payors, the viability of the ACA marketplace, providers, and potentially our business, are not yet known. Further, on December 14, 2018, a U.S. District Court judge in the Northern District of Texas ruled that the individual mandate portion of the ACA is an essential and inseverable feature of the ACA, and therefore because the mandate was repealed as part of the TCJA, the remaining provisions of the ACA are invalid as well. The Trump administration and CMS have both stated that the ruling will have no immediate effect, and on December 30, 2018 the same judge issued an order staying the judgment pending appeal. The Trump Administration has recently represented to the Court of Appeals considering this judgment that it does not oppose the lower court's ruling. It is unclear how this decision and any subsequent appeals and other efforts to repeal and replace the ACA will impact the ACA and our business. Litigation and legislation over the ACA are likely to continue, with unpredictable and uncertain results.

Further, there have been several recent U.S. congressional inquiries and proposed federal and proposed and enacted state legislation designed to, among other things, bring more transparency to drug pricing, review the relationship between pricing and manufacturer patient programs, reduce the costs of drugs under Medicare and reform government program reimbursement methodologies for drug products. For example, there have been several recent U.S. congressional inquiries and proposed federal and proposed and enacted state legislation designed to, among other things, bring more transparency to drug pricing, review the relationship between pricing and manufacturer patient programs, reduce the costs of drugs under Medicare and reform government program reimbursement methodologies for drug products. At the federal level, Congress and the Trump administration have each indicated that it will continue to seek new legislative and/or administrative measures to control drug costs. For example, on May 11, 2018, the Trump administration issued a plan to lower drug prices. Under this blueprint for action, the Trump administration indicated that the Department of Health and Human Services will: take steps to end the gaming of regulatory and patent processes by drug makers to unfairly protect monopolies; advance biosimilars and generics to boost price competition; evaluate the inclusion of prices in drug makers' ads to enhance price competition; speed access to and lower the cost of new drugs by clarifying policies for sharing information between insurers and drug makers; avoid excessive pricing by relying more on value-based pricing by expanding outcome-based payments in Medicare and Medicaid; work to give Part D plan sponsors more negotiation power with drug makers; examine which Medicare Part B drugs could be negotiated for a lower price by Part D plans, and improving the design of the Part B Competitive Acquisition Program; update Medicare's drug-pricing dashboard to increase transparency; prohibit Part D contracts that include "gag rules" that prevent pharmacists from informing patients when they could pay less out-of-pocket by not using insurance; and require that Part D plan members be provided with an annual statement of plan payments, out-of-pocket spending, and drug price increases.

At the state level, individual states are increasingly aggressive in passing legislation and implementing regulations designed to control pharmaceutical and biological product pricing, including price or patient reimbursement constraints, discounts, restrictions on certain product access and marketing cost disclosure and transparency measures, and, in some cases, designed to encourage importation from other countries and bulk purchasing. In addition, regional health care authorities and individual hospitals are increasingly using bidding procedures to determine what pharmaceutical products and which suppliers will be included in their prescription drug and other health care programs. These measures could reduce the ultimate demand for our products, once approved, or put pressure on our product pricing. We expect that additional state and federal healthcare reform measures will be adopted in the future, any of which could limit the amounts that federal and state governments will pay for healthcare products and services, which could result in reduced demand for our product candidates or additional pricing pressures.

Finally, legislative and regulatory proposals have also been made to expand post-approval requirements and restrict sales and promotional activities for pharmaceutical products. We cannot be sure whether additional legislative changes will be enacted, or whether the 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 the U.S. Congress of the FDA's approval process may significantly delay or prevent marketing approval, as well as subject us and any collaborators to more stringent product labeling and post-marketing testing and other requirements.

Under the Cures Act and the Trump Administration's regulatory reform initiatives, the FDA's policies, regulations and guidance may be revised or revoked and that could prevent, limit or delay regulatory approval of our product candidates, which would impact our ability to generate revenue.

In December 2016, the Cures Act was signed into law. The Cures Act, among other things, is intended to modernize the regulation of drugs and spur innovation, but its ultimate implementation is unclear. 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 adversely affect our business, prospects, financial condition and results of operations.

We also cannot predict the likelihood, nature or extent of government regulation that may arise from future legislation or administrative or executive action, either in the United States or abroad. For example, certain policies of the Trump administration may impact our business and industry. Namely, the Trump administration has taken several executive actions, including the issuance of a number of Executive Orders, that could impose significant burdens on, or

otherwise materially delay, the FDA's ability to engage in routine regulatory and oversight activities such as the implementation of statutes through rulemaking, issuance of guidance, and review and approval of marketing applications. An under-staffed FDA could result in delays in the FDA's responsiveness or in its ability to review submissions or applications, issue regulations or guidance, or implement or enforce regulatory requirements in a timely fashion or at all. Moreover, on January 30, 2017, President Trump issued an Executive Order, applicable to all executive agencies, including the FDA, which requires that for each notice of proposed rulemaking or final regulation to be issued in fiscal year 2017, the agency shall identify at least two existing regulations to be repealed, unless prohibited by law. These requirements are referred to as the "two-for-one" provisions. This Executive Order includes a budget neutrality provision that requires the total incremental cost of all new regulations in the 2017 fiscal year, including repealed regulations, to be no greater than zero, except in limited circumstances. For fiscal years 2018 and beyond, the Executive Order requires agencies to identify regulations to offset any incremental cost of a new regulation and approximate the total costs or savings associated with each new regulation or repealed regulation. In interim guidance issued by the Office of Information and Regulatory Affairs within OMB on February 2, 2017, the Trump administration indicates that the "two-for-one" provisions may apply not only to agency regulations, but also to significant agency guidance documents. In addition, on February 24, 2017, President Trump issued an executive order directing each affected agency to designate an agency official as a "Regulatory Reform Officer" and establish a "Regulatory Reform Task Force" to implement the two-for-one provisions and other previously issued executive orders relating to the review of federal regulations, however it is difficult to predict how these requirements will be implemented, and the extent to which they will impact the FDA's ability to exercise its regulatory authority. If these executive actions impose constraints on the FDA's ability to engage in oversight and implementation activities in the normal course, our business may be negatively impacted.

We may be subject, directly or indirectly, to federal, state, and foreign healthcare laws and regulations, including fraud and abuse laws, false claims laws and health information privacy and security laws. 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 laws and regulations, including, without limitation, the federal Anti-Kickback Statute, the federal civil and criminal false claims act, and the 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 data privacy laws by both the federal government and the states in which we conduct our business. Such laws that may constrain the business or financial arrangements and relationships through which we conduct our operations include, but are not limited to:

- the federal Anti-Kickback Statute, which prohibits, among other things, persons and entities from knowingly and willfully soliciting, receiving, offering or paying any remuneration (including any kickback, bribe or rebate), directly or indirectly, overtly or covertly, in cash or in kind, to induce or in return for either the referral of an individual for, or the purchase, recommendation, leasing or furnishing of, an item or service reimbursable under a federal healthcare program, such as the Medicare and Medicaid programs. This statute has been interpreted to apply to arrangements between pharmaceutical manufacturers on the one hand, and prescribers, purchasers and formulary managers on the other. Further, the ACA amended the intent requirement of the federal Anti-Kickback Statute. A person or entity no longer needs to have actual knowledge of this statute or specific intent to violate it;
- the federal civil and criminal false claims laws and civil monetary penalty laws, including the civil False Claims Act, which prohibit, among other things, individuals or entities from knowingly presenting, or causing to be presented, claims for payment or approval from Medicare, Medicaid or other government payors that are false or fraudulent, or making a false statement to avoid, decrease, or conceal an obligation to pay money to the federal government. The ACA provided and recent government cases against pharmaceutical and medical device manufacturers support the view that federal Anti-Kickback Statute violations and certain marketing practices, including off-label promotion, may implicate the civil False Claims Act;

- the federal Health Insurance Portability and Accountability Act of 1996, or HIPAA, which created additional federal criminal statutes that prohibit a person from knowingly and willfully executing or attempting to execute a scheme or from making false or fraudulent statements to defraud any healthcare benefit program, regardless of the payor (e.g., public or private);
- HIPAA, as amended by the Health Information Technology for Economic and Clinical Health Act, or HITECH, and its implementing regulations, and as amended again by the final HIPAA omnibus rule, Modifications to the HIPAA Privacy, Security, Enforcement, and Breach Notification Rules Under HITECH and the Genetic Information Nondiscrimination Act; Other Modifications to HIPAA, published in January 2013, which imposes certain requirements relating to the privacy, security and transmission of individually identifiable health information without appropriate authorization by entities subject to the rule, such as health plans, health care clearinghouses and health care providers;
- federal transparency laws, including the federal Physician Payments Sunshine Act, which is part of the ACA, that requires certain manufacturers of drugs, devices, biologics and medical supplies for which payment is available under Medicare, Medicaid, or the Children's Health Insurance Program, with specific exceptions, to report annually to Center for Medicare & Medicaid Services, or CMS, information related to payments and other transfers of value provided to physicians and teaching hospitals, and ownership and investment interests held by physicians and their immediate family members, by the 90th day of each subsequent calendar year, and disclosure of such information is made by CMS on a publicly available website; and
- state and/or foreign law equivalents of each of the above federal laws, such as state anti-kickback and false claims laws that may apply to arrangements and claims involving health care items or services reimbursed by non-governmental third-party payors; state laws that require drug manufacturers to report information related to payments and other transfers of value to physicians and other healthcare providers or marketing expenditures; state laws that require pharmaceutical companies to comply with the pharmaceutical industry's voluntary compliance guidelines and the relevant compliance guidance promulgated by the federal government; and state and foreign laws governing the privacy and security of health information in certain circumstances, many of which differ from each other in significant ways and may not have the same effect, thus complicating compliance efforts in certain circumstances, such as specific disease states.

Because of the breadth of these laws and the narrowness of the statutory exceptions and safe harbors available, it is possible that some of our business activities could be subject to challenge under one or more of such laws. If our operations are found to be in violation of any of the laws described above or any other government regulations that apply to us, we may be subject to penalties, including civil and criminal penalties, damages, fines, exclusion from participation in government health care programs, such as Medicare and Medicaid, disgorgement, contractual damages, reputational harm, diminished profits and future earnings, imprisonment and the curtailment or restructuring of our operations, any of which could adversely affect our ability to operate our business and our results of operations.

The provision of benefits or advantages to physicians to induce or encourage the prescription, recommendation, endorsement, purchase, supply, order or use of medicinal products is prohibited in the European Union. The provision of benefits or advantages to physicians is also governed by the national anti-bribery laws of European Union Member States, such as the UK Bribery Act 2010. Infringement of these laws could result in substantial fines and imprisonment.

Payments made to physicians in certain European Union Member States must be publicly disclosed. Moreover, agreements with physicians often must be the subject of prior notification and approval by the physician's employer, his or her competent professional organization and/or the regulatory authorities of the individual European Union Member States. These requirements are provided in the national laws, industry codes or professional codes of conduct, applicable in the European Union Member States. Failure to comply with these requirements could result in reputational risk, public reprimands, administrative penalties, fines or imprisonment.

The collection, use, disclosure, transfer, or other processing of personal data regarding individuals in the EU, including personal health data, is subject to the EU General Data Protection Regulation, or the GDPR, which became

effective on May 25, 2018. 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, obtaining consent of the individuals to whom the personal data relates, providing information to individuals regarding data processing activities, implementing safeguards to protect the security and confidentiality of personal data, providing notification of data breaches, and taking certain measures when engaging third-party processors. The GDPR also imposes strict rules on the transfer of personal data to countries outside the EU, including the U.S., and permits data protection authorities to impose large penalties for violations of the GDPR, including potential fines of up to €20 million or 4% of annual global revenues, whichever is greater. The GDPR also 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. Compliance with the GDPR has been and will continue to be a rigorous and time-intensive process that has increased and will continue to increase our cost of doing business or require us to change our business practices, and despite those efforts, there is a risk that we or our collaborators may be subject to fines and penalties, litigation, and reputational harm in connection with any European activities, which could adversely affect our business, prospects, financial condition and results of operations.

Product liability lawsuits against us could cause us to incur substantial liabilities and could limit commercialization of any product candidates that we may develop.

We face an inherent risk of product liability exposure related to the testing of our product candidates in clinical trials and may face an even greater risk if we commercialize any products that we may develop. If we cannot successfully defend ourselves against claims that our product candidates caused injuries, we could incur substantial liabilities. Regardless of merit or eventual outcome, liability claims may result in:

- decreased demand for any product candidates that we may develop;
- loss of revenue;
- substantial monetary awards to trial participants or patients;
- significant time and costs to defend the related litigation;
- withdrawal of clinical trial participants;
- the inability to commercialize any product candidates that we may develop; and
- injury to our reputation and significant negative media attention.

Although we maintain product liability insurance coverage in the amount of $5.0 million per occurrence and $5.0 million in the aggregate, and clinical testing liability insurance in the amount of $10.0 million per occurrence and $10.0 million in the aggregate, this insurance may not be adequate to cover all liabilities that we may incur. We anticipate that we will need to increase our insurance coverage each time we commence a clinical trial and if we successfully commercialize any product candidate. Insurance coverage is increasingly expensive. We may not be able to maintain insurance coverage at a reasonable cost or in an amount adequate to satisfy any liability that may arise.

If we, our collaborators, or any third-party manufacturers engaged by us or our collaborators fail to comply with environmental, health and safety laws and regulations, we could become subject to fines or penalties or incur costs that could harm our business.

We, our collaborators, and any third-party manufacturers we engage are subject to numerous environmental, health and safety laws and regulations, including those governing laboratory procedures and the generation, handling, use, storage, treatment, manufacture, transportation and disposal of, and exposure to, hazardous materials and wastes, as well as laws and regulations relating to occupational health and safety. Our operations involve the use of hazardous and flammable materials, including chemicals and biologic and radioactive 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.

Although we maintain general liability insurance and workers' compensation insurance for certain 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. We do not maintain insurance for environmental liability or toxic tort claims that may be asserted against us in connection with our storage or disposal of biologic, hazardous or radioactive materials.

In addition, we may incur substantial costs in order to comply with current or future environmental, health and safety laws and regulations, which have tended to become more stringent over time. 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 harm our business, financial condition, results of operations and prospects.

Further, with respect to the operations of any current or future collaborators or third-party contract manufacturers, it is possible that if they fail to operate in compliance with applicable environmental, health and safety laws and regulations or properly dispose of wastes associated with our products, we could be held liable for any resulting damages, suffer reputational harm or experience a disruption in the manufacture and supply of our product candidates or products.

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. The most recent global financial crisis caused extreme volatility and disruptions in the capital and credit markets. A severe or prolonged economic downturn, such as the most recent global financial crisis, 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. This is particularly true in the European Union, which is recovering from a severe economic crisis. A weak or declining economy could strain our suppliers, possibly resulting in supply disruption, or cause delays in payments for our services by third-party payors or our collaborators. 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.

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.

Our internal computer systems and those of our current and any future collaborators and other contractors or consultants are vulnerable to damage from cyber-attacks, computer viruses, unauthorized access, sabotage, natural disasters, terrorism, war and telecommunication and electrical failures. While we have not experienced any such material system failure, accident or security breach to date, if such an event were to occur and cause interruptions in our operations or the operations of those third parties with which we contract, it could result in a material disruption of our development programs and our business operations, whether due to a loss of our trade secrets or other proprietary information or other similar disruptions, and could require a substantial expenditure of resources to remedy. For example, the loss of clinical trial data from completed or ongoing clinical trials could result in delays in our regulatory approval efforts and significantly increase our costs to recover or reproduce the data. We could also be subject to risks caused by misappropriation, misuse, leakage, falsification or intentional or accidental release or loss of information maintained in our information systems and networks, including personal information of our employees. Outside parties may attempt to penetrate our systems or those of the third parties with which we contract or to fraudulently induce our employees or employees of such third parties to disclose sensitive information to gain access to our data.

The number and complexity of these threats continue to increase over time. Although we develop and maintain systems and controls designed to prevent these events from occurring, and we have a process to identify and mitigate threats, the development and maintenance of these systems, controls and processes is costly and requires ongoing monitoring and updating as technologies change and efforts to overcome security measures become more sophisticated. Despite our efforts, the possibility of these events occurring cannot be eliminated entirely. Although we maintain cyber risk insurance for certain costs we may incur due to a cyber-related event, this insurance may not provide adequate coverage against potential liabilities. 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 and the market perception of the effectiveness of our security measures could be harmed, our credibility could be damaged, and the further development and commercialization of our product candidates could be delayed.

The Tax Cuts and Jobs Act of 2017 could adversely affect our business and financial condition.

On December 22, 2017, President Trump signed into law the Tax Cuts and Jobs Act of 2017, known as the TCJA, which significantly revised the Internal Revenue Code of 1986, as amended. The TCJA, among other things, contains significant changes to corporate taxation, including reduction of the corporate tax rate from a top marginal rate of 35% to a flat rate of 21%, limitation of the tax deduction for net interest expense to 30% of adjusted earnings (except for certain small businesses), limitation of the deduction for net operating losses to 80% of current year taxable income and elimination of net operating loss carrybacks, in each case, for losses arising in taxable years beginning after December 31, 2017 (though any such net operating losses may be carried forward indefinitely), one-time taxation of offshore earnings at reduced rates regardless of whether they are repatriated, elimination of U.S. tax on foreign earnings (subject to certain important exceptions), immediate deductions for certain new investments instead of deductions for depreciation expense over time, and modifying or repealing many business deductions and credits. Notwithstanding the reduction in the corporate income tax rate, the overall impact of the TCJA is uncertain and our business and financial condition could be adversely affected. In addition, it is uncertain how various states will respond to the TCJA. The impact of this tax reform on holders of our common stock is also uncertain and could be adverse. We urge our stockholders to consult with their legal and tax advisors with respect to this legislation and the potential tax consequences of investing in or holding our common stock.

We might not be able to utilize a significant portion of our net operating loss carryforwards.

As of December 31, 2018, we had both federal and state net operating loss carryforwards of $162.9 million and $163.8 million, respectively, which expire beginning in 2033. These net operating loss carryforwards could expire unused and be unavailable to offset our future income tax liabilities. Under the TCJA, federal net operating losses incurred in 2018 and in subsequent years may be carried forward indefinitely, but the deductibility of such federal net operating losses is limited. It is uncertain how various states will respond to the TCJA tax law. If our ability to use our historical net operating loss carryforwards is materially limited, it would harm our future operating results by effectively increasing our future tax obligations.

Risks Related to the Commercialization of Our Product Candidates

The affected populations for our product candidates may be smaller than we or third parties currently project, which may affect the addressable markets for our product candidates.

Our projections of the number of people who have the diseases we are seeking to treat, as well as the subset of people with these diseases who have the potential to benefit from treatment with our product candidates, are estimates based on our knowledge and understanding of these diseases. The total addressable market opportunity for our product candidates will ultimately depend upon a number of factors including the diagnosis and treatment criteria included in the final label, if approved for sale in specified indications, acceptance by the medical community, patient access and product pricing and reimbursement. Prevalence estimates are frequently based on information and assumptions that are not exact and may not be appropriate, and the methodology is forward-looking and speculative. The process we have used in developing an estimated prevalence range for the indications we are targeting has involved collating limited data from multiple sources. While we believe these sources are reliable, we have not independently verified the data.

Accordingly, the prevalence estimates included in our periodic reports and other reports filed with or furnished to the SEC should be viewed with caution. Further, the data and statistical information used in such reports, including estimates derived from them, may differ from information and estimates made by our competitors or from current or future studies conducted by independent sources.

The use of such data involves risks and uncertainties, and such data is subject to change based on various factors. Our estimates may prove to be incorrect and new studies may change the estimated incidence or prevalence of the diseases we seek to address. The number of patients with the diseases we are targeting in the United States, the European Union and elsewhere may turn out to be lower than expected or may not be otherwise amenable to treatment with our products, or new patients may become increasingly difficult to identify or access, all of which would harm our results of operations and our business.

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

To successfully commercialize any products that may result from our clinical development programs, we will need to further develop these 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 products 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.

Under our collaboration and option agreement with AbbVie related to defective or excess aggregation of tau protein in the human brain, AbbVie has options to advance certain compounds into further development and to obtain an exclusive, worldwide license, with the right to sublicense, under certain of our intellectual property rights to develop and commercialize such compounds and corresponding products for all human diagnostic, prophylactic and therapeutic uses. If AbbVie exercises any of these options, we would be eligible to receive specified option fees. In addition, we would be eligible to receive specified development and regulatory milestone payments and tiered royalties on the global commercial net sales of products developed under our tau collaboration.

Under our collaboration agreement with Neurocrine, Neurocrine will fund the clinical development through the readout of the RESTORE-1 Phase 2 clinical trial for VY-AADC. After the data readout of the RESTORE-1 Phase 2 trial, we have the option to either: (1) co-commercialize VY-AADC with Neurocrine in the U.S. under a 50/50 cost- and profit-sharing arrangement and receive milestones and royalties based on ex-U.S. sales, or (2) retain the right to receive milestone payments and royalties based on global sales pursuant to the full global commercial rights granted to Neurocrine. Under the terms of the agreement for the FA Program, Neurocrine will fund the development through the Phase 1 clinical trial of VY-FXN01. After the data readout of the Phase 1 trial, we have the option to either: (1) co-commercialize VY-FXN01 with Neurocrine in the U.S. under a 60/40 cost- and profit-sharing arrangement, or (2) retain the right to receive milestone payments and royalties based on global sales pursuant to the full global commercial rights granted to Neurocrine.

Under our collaboration and option agreement with AbbVie directed against pathological species of alpha-synuclein for the potential treatment of Parkinson’s disease and other synucleinopathies, AbbVie has options to advance certain compounds into further development and to obtain an exclusive, worldwide license, with the right to sublicense, under certain of our intellectual property rights to develop and commercialize such compounds and corresponding products for all human diagnostic, prophylactic and therapeutic uses. If AbbVie exercises any of these options, we would be eligible to receive specified option fees. In addition, we would be eligible to receive specified regulatory and commercial milestone payments and tiered royalties on the global commercial net sales of products developed under our alpha-synuclein collaboration.

In the future, we may seek to enter into collaborations regarding other of our 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 current or future collaborators do not commit sufficient resources to commercialize our products, 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 medical affairs, marketing and sales 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. We might face unforeseen costs and expenses associated with creating an independent sales and marketing organization. Our sales personnel might also face difficulties obtaining access to physicians or being able to persuade adequate numbers of physicians to use or prescribe our products or selling our products if we lack complementary products, which could disadvantage us compared to companies with more extensive product lines. 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.

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 may require more resources than are typically required due to the complexity and uniqueness of our potential products. If any of our product candidates is approved but fails to achieve market acceptance among physicians, patients, or third-party payors, we will not be able to generate significant revenues from such product, which could harm our business, financial condition, results of operations and prospects.

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

We expect the cost of a single administration of gene therapy products, such as those we are developing, to be substantial, when and if they receive regulatory approval. We expect that coverage and reimbursement by government and private payors will be essential for most patients to be able to afford these treatments. Accordingly, 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 will be reimbursed by government authorities, private health coverage insurers and other third-party payors. Coverage and reimbursement by a third-party payor may depend upon several factors, including the third-party payor's determination that use of a product is:

- a covered benefit under its health plan;
- safe, effective and medically necessary;
- appropriate for the specific patient and the indication;
- convenient and easy-to-administer compared to alternative treatments;
- cost-effective compared to alternative treatments; and
- neither experimental nor investigational.

No uniform policy requirement for coverage and reimbursement for biopharmaceutical products exists among third-party payors. Therefore, coverage and reimbursement for such products can differ significantly from payor to payor. As a result, obtaining coverage and reimbursement for a product from third-party payors is a time-consuming and costly process that could require us to provide to each different payor supporting scientific, clinical and cost-effectiveness data, and to receive the support of medical associations and technology assessment committees. We may not be able to provide data sufficient to gain acceptance with respect to coverage and reimbursement. If coverage and reimbursement are not available, or are available only at limited levels, we may not be able to successfully commercialize our product candidates. Even if coverage is provided, the approved reimbursement amount may not be adequate to realize a sufficient return on our investment including our research, development, manufacture, sales, and distribution expenses. Interim reimbursement levels for new drugs, if applicable, may also not be sufficient to cover our costs and may not be made permanent. Reimbursement rates may vary according to the use of the drug and the clinical setting in which it is used, may be based on reimbursement levels already set for lower cost drugs and may be incorporated into existing payments for other services. Assuming we obtain coverage for a given product by a third-party payor, the resulting reimbursement payment rates may not be adequate or may require co-payments that patients find unacceptably high. Patients who are prescribed medications for the treatment of their conditions, and their prescribing

physicians, generally rely on third-party payors to reimburse all or part of the costs associated with their prescription drugs. Patients are unlikely to use our products unless coverage is provided and reimbursement is adequate to cover all or a significant portion of the cost of our products. Therefore, coverage and adequate reimbursement are critical to new product acceptance. Additionally, there may be significant delays in obtaining coverage and reimbursement for newly approved drugs and biologics, and coverage may be more limited than the purposes for which the drug is approved by the FDA or comparable foreign regulatory authorities.

There is significant uncertainty related to third-party coverage and reimbursement of newly approved products. In the United States, third-party payors, including government payors such as the Medicare and Medicaid programs, play an important role in determining the extent to which new drugs and biologics will be covered and reimbursed. The Medicare and Medicaid programs increasingly are used as models for how private payors and government payors develop their coverage and reimbursement policies. A primary trend in the U.S. healthcare industry and elsewhere is cost containment. Government authorities and third-party payors have attempted to control costs by limiting coverage and the amount of reimbursement for particular medications. Increasingly, third-party payors are requiring that drug companies provide them with predetermined discounts from list prices and are challenging the prices charged for medical products.

The CMS is responsible for determining whether a product should be approved for coverage and reimbursement under the Medicare program. It is difficult to predict what CMS will decide with respect to coverage and reimbursement for novel products such as ours, as there is no body of established practices and precedents for these types of products. Currently, no gene therapy product has been approved for coverage and reimbursement by the CMS. Moreover, reimbursement agencies in the European Union may be more conservative than CMS. For example, several cancer drugs have been approved for reimbursement in the United States and have not been approved for reimbursement in certain European Union Member States. It is difficult to predict what third-party payors will decide with respect to the coverage and reimbursement for our product candidates, especially given that the cost of our product candidates is likely to be very high and pricing of such products is highly uncertain.

Outside the United States, international operations generally are subject to extensive government price controls and other market regulations, and increasing emphasis on cost-containment initiatives in the European Union, Canada and other countries may put pricing pressure on us. In many countries, the prices of medical products are subject to varying price control mechanisms as part of national health systems. 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 medical products, 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 product revenues.

Moreover, increasing efforts by government 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 new products approved and, as a result, they may not cover or provide adequate payment for our product candidates. Payors increasingly are considering new metrics as the basis for reimbursement rates, such as average sales price, or ASP, average manufacturer price, or AMP, and Actual Acquisition Cost. The existing data for reimbursement based on some of these metrics is relatively limited, although certain states have begun to survey acquisition cost data for the purpose of setting Medicaid reimbursement rates, and CMS has begun making pharmacy National Average Drug Acquisition Cost and National Average Retail Price data publicly available on at least a monthly basis. The regulations that govern marketing approvals, pricing, coverage and reimbursement for new drug and device products vary widely from country to country. Current and future 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 commercial launch of the product, possibly for lengthy time periods, and negatively impact the revenues we are able to generate from the sale of the product in that country. 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 candidate to other available therapies. Adverse pricing limitations

may hinder our ability to recoup our investment in one or more product candidates, even if our product candidates obtain marketing approval.

Therefore, it is difficult to project the impact of these evolving reimbursement metrics on the willingness of payors to cover candidate products that we or our partners are able to commercialize. 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 intense. As a result, increasingly high barriers are being erected to the entry of new products such as ours.

The commercial success of any of our product candidates will depend upon its degree of market acceptance by physicians, patients, third-party payors and others in the medical community.

Ethical, social and legal concerns about gene therapy could result in additional regulations restricting or prohibiting our products. Even with the requisite approvals from the FDA in the United States, EMA in the European Union and other regulatory authorities internationally, the commercial success of our product candidates will depend, in part, on the support and acceptance of medical associations and technology assessment committees, physicians, patients and health care payors of gene therapy products in general, and our product candidates in particular, as medically necessary, cost-effective and safe. Any product that we commercialize may not gain acceptance by physicians, patients, health care payors and others in the medical community. If these products do not achieve an adequate level of acceptance, we may not generate significant product revenue and may not become profitable. The degree of market acceptance of gene therapy products and, in particular, our product candidates, if approved for commercial sale, will depend on several factors, including:

- the efficacy and safety of such product candidates as demonstrated in clinical trials;
- the potential and perceived advantages of product candidates over alternative treatments;
- the cost of treatment relative to alternative treatments;
- the clinical indications for which the product candidate is approved by the FDA or the European Commission, or other regulatory authorities;
- patient awareness of, and willingness to seek, genotyping;
- the willingness of physicians to prescribe new therapies;
- the willingness of physicians to undergo specialized training with respect to administration of our product candidates;
- the willingness of the target patient population to try new therapies;
- the prevalence and severity of any side effects;
- product labeling or product insert requirements of the FDA, EMA or other regulatory authorities, including any limitations or warnings contained in a product's approved labeling or restrictions on the use of our products together with other medications;
- relative convenience and ease of administration;
- the strength of marketing and distribution support;

- the timing of market introduction of competitive products;
- publicity concerning our products or competing products and treatments; and
- sufficient third-party payor coverage and reimbursement.

Even if a potential product displays a favorable efficacy and safety profile in preclinical studies and clinical trials, market acceptance of the product will not be fully known until after it is launched.

Our gene therapy approach utilizes 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 may damage public perception of the safety of our product candidates and adversely affect our ability to conduct our business or obtain regulatory approvals for our product candidates.

Gene therapy remains a novel technology, with few gene therapy products approved to date in the United States and the European Union. 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 who specialize in the treatment of genetic diseases targeted by our product candidates, prescribing treatments that involve the use of our product candidates in lieu of, or in addition to, existing treatments with which they are familiar and for which greater clinical data may be available. More restrictive government regulations or negative public opinion would have an adverse effect on our business, financial condition, results of operations and prospects 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 and death seen in other trials using non-AAV gene therapy vectors. Serious adverse events in our clinical trials, or other clinical trials involving gene therapy products or our competitors' products, even if not ultimately attributable to the relevant product candidates, and the resulting publicity, could result in increased government regulation, unfavorable public perception, potential regulatory delays in the testing or approval of our product candidates, stricter labeling requirements for those product candidates that are approved and a decrease in demand for any such product candidates.

If we obtain approval to commercialize our product candidates outside of the United States, in particular in the European Union, a variety of risks associated with international operations could harm our business.

We expect that we will be subject to additional risks in commercializing our product candidates outside the United States, including:

- different regulatory requirements for approval of drugs and biologics in foreign countries;
- reduced or loss of protection under our 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;
- shortages resulting from any events affecting raw material supply or manufacturing capabilities abroad;

- business interruptions resulting from geopolitical actions, including war and terrorism or natural disasters including earthquakes, typhoons, floods and fires, or from economic or political instability; and

- greater difficulty with enforcing our contracts in jurisdictions outside of the United States.

We must dedicate additional resources to comply with numerous laws and regulations in each jurisdiction in which we plan to operate. The Foreign Corrupt Practices Act, or FCPA, prohibits any U.S. individual or business from paying, offering, authorizing payment or offering anything of value, directly or indirectly, to any foreign official, political party or candidate for the purpose of influencing any act or decision of the foreign entity in order to assist the individual or business in obtaining or retaining business. The FCPA also obligates companies whose securities are listed in the United States to comply with certain accounting provisions requiring the company to maintain books and records that accurately and fairly reflect all transactions of the corporation, including international subsidiaries, and to devise and maintain an adequate system of internal accounting controls for international operations.

Compliance with the FCPA is expensive and difficult, particularly in countries in which corruption is a recognized problem. In many foreign countries, it is common for others to engage in business practices that are prohibited by U.S. laws and regulations applicable to us, including the FCPA. In addition, the FCPA presents particular challenges in the pharmaceutical industry because, in many countries, hospitals are operated by the government, and doctors and other hospital employees are considered foreign officials. Certain payments to hospitals in connection with clinical trials and other work have been deemed to be improper payments to government officials and have led to FCPA enforcement actions.

Various laws, regulations and executive orders also restrict the use and dissemination outside of the United States, or the sharing with certain non-U.S. nationals, of information classified for national security purposes, as well as certain products and technical data relating to those products. If we expand our presence outside of the United States, it will require us to dedicate additional resources to comply with these laws, and these laws may preclude us from developing, manufacturing, or selling certain products and product candidates outside of the United States, which could limit our growth potential and increase our development costs.

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 Securities and Exchange Commission also may suspend or bar issuers from trading securities on U.S. exchanges for violations of the FCPA's accounting provisions. Although we expect to implement policies and procedures designed to comply with these laws and policies, there can be no assurance that our employees, contractors and agents will comply with these laws and policies. If we are unable to successfully manage the challenges of international expansion and operations, our business and operating results could be harmed.

Risks Related to Our Intellectual Property

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

We are reliant upon licenses to certain patent rights and proprietary technology 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 product candidates. These and other licenses 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. These licenses may also require us to grant back certain rights to licensors and to pay certain amounts relating to sublicensing patent and other rights under the agreement.

In some circumstances, particularly in-licenses with academic institutions, we may not have the right to control the preparation, filing and prosecution of patent applications, or to maintain, enforce or defend the patents, covering technology that we license from third parties. 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. In certain circumstances, we have or may license technology from third parties on a non-exclusive basis. In such instances, other licensees may have the right to enforce our licensed patents in their respective fields, without our oversight or control. Those other licensees may choose to enforce our licensed patents in a way that harms our interest, for example, by advocating for claim interpretations or agreeing on invalidity positions that conflict with our positions or our interest. In addition to the foregoing, the risks associated with patent rights that we license from third parties will also apply to patent rights we own or may own in the future.

Further, in many of our license agreements we are responsible for bringing any actions against any third party for infringing on the patents we have licensed. Certain of our license agreements also require us to meet development thresholds to maintain the license, including establishing a set timeline for developing and commercializing products and minimum yearly diligence obligations in developing and commercializing the product. Certain of our license agreements contain “no challenge” clauses which preclude and prevent us from taking any action to limit or narrow the intellectual property of a licensor. In some cases, these limitations extend to any intellectual property of our licensor and not just that which is licensed to us. Such constraints may limit our ability to develop or commercialize products or to expand such efforts beyond the scope of any license. Disputes may arise regarding intellectual property subject to a licensing agreement, including:

- the scope of rights granted under the license agreement and other interpretation-related issues;
- the extent to which our technology and processes infringe on intellectual property of the licensor that is not subject to the licensing agreement;
- the sublicensing of patent and other rights under our collaborative development relationships;
- our diligence obligations under the license agreement and what activities satisfy those diligence obligations;
- the inventorship or ownership of inventions and know-how resulting from the creation or use of intellectual property by our licensors and us and our partners; and
- the priority of invention of patented technology.

If disputes over intellectual property that we have licensed prevent or impair our ability to maintain our current licensing arrangements on acceptable terms, we may be unable to successfully develop and commercialize the affected product candidates.

If we fail to comply with our obligations under these license agreements, or we are subject to a bankruptcy, the licensor may have the right to terminate the license, in which event we would not be able to develop, manufacture, or market products covered by the license or may face other penalties under the agreements. Termination of any of our agreements involving intellectual property or reduction or elimination of our rights under these agreements may result in our having to negotiate new or reinstated agreements with less favorable terms or cause us to lose our rights under these agreements, including our rights to important intellectual property or technology. Termination may also result in unfavorable terms associated with such termination or may result in obligations on our part to license or grant back intellectual property rights to prior licensors.

Furthermore, the research resulting in certain of our licensed patent rights and technology was funded by the U.S. government. As a result, the government may have certain rights, or march-in rights, to such patent rights and technology. When new technologies are developed with U.S. government funding, the U.S. government generally obtains certain rights in any resulting patents, including a non-exclusive, royalty-free license authorizing the U.S. government, or a third party on its behalf, to use the invention for non-commercial purposes. These rights may permit the

government to disclose our confidential information to third parties and to exercise march-in rights to use or allow third parties to use our licensed technology. The U.S. government can exercise its march-in rights if it determines that action is necessary because we fail to achieve practical application of the government-funded technology, because action is necessary to alleviate health or safety needs, to meet requirements of federal regulations or to give preference to U.S. industry. In addition, our rights in such inventions may be subject to certain requirements to manufacture products embodying such inventions in the United States. Any exercise by the government, or a third party on its behalf, of such rights could harm our competitive position, business, financial condition, results of operations and prospects.

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

Our success depends, in large part, on our and our licensors' ability to obtain and maintain patent protection in the United States and other countries with respect to our product candidates and manufacturing technology. We and our licensors have sought, and we intend to seek in the future, to protect our proprietary position by filing patent applications in the United States and abroad related to many of our technologies and product candidates that are important to our business.

The patent prosecution process is expensive, time-consuming and complex, and we may not have and may not in the future be able to file, prosecute, maintain, enforce, defend or license all necessary or desirable patent applications at a reasonable cost or in a timely manner. For example, in some cases, the work of certain academic researchers in the gene therapy field has entered the public domain, which may compromise our ability to obtain patent protection for certain inventions related to or building upon such prior work. Consequently, we may not be able to obtain any such patents to prevent others from using our technology for, and developing and marketing competing products to treat, these indications. It is also possible that we will fail to identify patentable aspects of our research and development output before it is too late to obtain patent protection. In some cases, we may be able to obtain patent protection, but such protections may expire before we commercialize the product protected by those rights, leaving us no meaningful protection for our products. In other cases, where our intellectual property is being managed by a third-party collaborator, licensee or partner, that third party may fail to act diligently in prosecuting, maintaining, defending or enforcing our patents. Such conduct may result in the failure to maintain or obtain protections, loss of rights, loss of patent term or, in cases where a third party has acted negligently or inequitably, patents being found unenforceable.

The patent position of biotechnology and pharmaceutical companies generally is highly uncertain, involves complex legal and factual questions and has, in recent years, been the subject of much litigation. As a result, the issuance, scope, validity, enforceability and commercial value of our and our licensors' patent rights are highly uncertain. Our pending and future patent applications may not result in patents being issued which protect our technology or product candidates or which effectively prevent others from commercializing competitive technologies and product candidates. In particular, during prosecution of any patent application, the issuance of any patents based on the application may depend upon our ability to generate additional preclinical or clinical data that support the patentability of our proposed claims. We may not be able to generate sufficient additional data on a timely basis, or at all. Changes in either the patent laws or interpretation of the patent laws in the United States and other countries may diminish the value, narrow the scope, or eliminate the enforceability of our and our licensors' patent protection.

We may not be aware of all third-party intellectual property rights potentially relating to our product candidates. Publications of discoveries in the scientific literature often lag behind the actual discoveries, and patent applications in the United States and other jurisdictions are typically not published until 18 months after filing or, in some cases, only upon issuance or not at all. Therefore, we cannot be certain that we, or a licensor, were the first to make the inventions claimed in any owned or any licensed patents or pending patent applications, respectively, or which entity was the first to file for patent protection until such patent application publishes or issues as a patent. Databases for patents and publications, and methods for searching them, are inherently limited, so it is not practical to review and know the full scope of all issued and pending patent applications. As a result, the issuance, scope, validity, enforceability, and commercial value of our and our licensed patent rights are uncertain.

Even if the patent applications we license or may own in the future do issue as patents, they may not issue in a form that will provide us with any meaningful protection, prevent competitors or other third parties from competing with us or otherwise provide us with any competitive advantage. Our competitors or other third parties may be able to circumvent our patents by developing similar or alternative technologies or products in a non-infringing manner.

In spite of a legal presumption of validity, the issuance of a patent is not conclusive as to its inventorship, ownership, scope, validity, or enforceability which may be challenged in the courts and patent offices in the United States and abroad. Such challenges may result in loss of exclusivity or in patent claims being narrowed, invalidated or held unenforceable, which could limit our ability to stop others from using or commercializing similar or identical technology and products, or limit the duration of the patent protection of our technology and product candidates. Given the amount of time required for the development, testing and regulatory review of new product candidates, patents protecting such candidates might expire before or shortly after such candidates are commercialized. As a result, our intellectual property may not provide us with sufficient rights to exclude others from commercializing products similar or identical to ours.

Our intellectual property licenses with third parties may be subject to disagreements over contract interpretation, which could narrow the scope of our rights to the relevant intellectual property or technology, resulting in termination of our access to such intellectual property, or increase our financial or other obligations to our licensors.

The agreements under which we currently license intellectual property or technology from third parties are complex, and certain provisions in such agreements may be susceptible to multiple interpretations. The resolution of any contract interpretation disagreement that may arise could narrow what we believe to be the scope of our rights to the relevant intellectual property or technology, result in loss of access, or increase what we believe to be our financial or other obligations under the relevant agreement, any of which could harm our business, financial condition, results of operations and prospects.

We may not be successful in obtaining necessary rights to our product candidates through acquisitions and in-licenses.

We currently have rights to certain intellectual property, through licenses from third parties, to develop our product candidates. Because our programs may require the use of proprietary rights held by third parties, the growth of our business likely will depend, in part, on our ability to acquire, in-license or use these proprietary rights. We may be unable to acquire or in-license any compositions, methods of use, processes or other intellectual property rights from third parties that we identify as necessary for our product candidates. The licensing or acquisition of third-party intellectual property rights is a competitive area, and several more established companies may pursue strategies to license or acquire third-party intellectual property rights that we may consider attractive. These established companies may have a competitive advantage over us due to their size, capital resources and greater clinical or technical development and commercialization capabilities. In addition, companies that perceive us to be a competitor may be unwilling to assign or license rights to us. We also may be unable to license or acquire third-party intellectual property rights on terms that would allow us to make an appropriate return on our investment.

We sometimes collaborate with non-profit and academic institutions to accelerate our preclinical research or development under written agreements with these institutions. Typically, these institutions provide us with an option to negotiate a license to any of the institution’s rights in technology resulting from the collaboration. Regardless of such option, we may be unable to negotiate a license within the specified timeframe or under terms that are acceptable to us. If we are unable to do so, the institution may offer the intellectual property rights to other parties, potentially blocking our ability to develop our program.

If we are unable to successfully obtain rights to required third-party intellectual property rights or maintain the existing intellectual property rights we have, we may be required to expend significant time and resources to redesign our product candidates or the methods for manufacturing them or to develop or license replacement technology, all of which may not be feasible on a technical or commercial basis. If we are unable to do so, we may be unable to develop or commercialize the affected product candidates, which could harm our business significantly.

Obtaining and maintaining our patent protection depends on compliance with various procedural, document submission, fee payment and other requirements imposed by government patent agencies, and our patent protection could be reduced or eliminated for non-compliance with these requirements.

Periodic maintenance fees, renewal fees, annuity fees and various other government fees on patents and/or applications will be due to be paid to the United States Patent and Trademark Office, or USPTO, and various government patent agencies outside of the United States over the lifetime of our licensed patents and/or applications and any patent rights we may own in the future. We rely on our outside counsel or our licensing partners to pay these fees due to patent agencies. The USPTO and various non-U.S. government patent agencies require compliance with several procedural, documentary, fee payment and other similar provisions during the patent application process. We employ reputable law firms and other professionals to help us comply and we are also dependent on our licensors to take the necessary action to comply with these requirements with respect to our licensed intellectual property. In many cases, an inadvertent lapse can be cured by payment of a late fee or by other means in accordance with the applicable rules. There are situations, however, in which non-compliance can result in abandonment or lapse of the patent or patent application, resulting in partial or complete loss of patent rights in the relevant jurisdiction, and may compromise the strength of other intellectual property in our portfolio. In such an event, potential competitors might be able to enter the market and this circumstance could harm our business.

On February 1, 2019 the government of Venezuela, in response to certain U.S. sanctions, began to require that foreign entities pay all official fees, including patent fees (either for pending matters or new petitions), in PETRO, a "cryptocurrency" created by the Nicolás Maduro administration in February 2018 as a way to collect U.S. dollars while avoiding American financial sanctions issued under an Executive Order of President Trump on March 19, 2018. The Executive Order banned transactions involving "any digital currency, digital coin, or digital token, that was issued by, for, or on behalf of the Government of Venezuela on or after January 9, 2018." The prohibition is applicable to any U.S. entity unless exempted by license. We do not hold such a license and therefore may not be able to secure patents in Venezuela.

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. Our intellectual property rights may vary from country to country and foreign protections could be less extensive than those in the United States. 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. Consequently, we may not be able to prevent third parties from practicing our inventions in all countries outside the United States, 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 have not 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 products 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 or methods of treatment, 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. For example, an April 2014 report from the Office of the United States Trade Representative identified a number of countries, including India and China, where challenges to the procurement and enforcement of patent rights have been reported. Several countries, including India and China, have been listed in the report every year since 1989. With Brexit, there is uncertainty associated with obtaining, defending, and enforcing intellectual property rights in the United Kingdom. International treaties and regulations promulgated as a result of this transition could impede or eliminate our ability to obtain or maintain meaningful intellectual property rights in the United Kingdom. Proceedings to enforce our patent rights 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 technology or 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 our technology or one of our product candidates, the defendant could counterclaim that the patent covering such technology or 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, lack of written description or non-enablement. Grounds for an unenforceability assertion could be an allegation that an individual connected with prosecution of the patent, including an inventor, an employee of the company, a collaborator or advisor, 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 pre-issuance submissions, *ex parte* re-examination, post-grant review, *inter partes* review and equivalent proceedings in foreign jurisdictions. Some of these mechanisms may even be exploited anonymously by third parties. 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 technology or 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 part or, all of the patent protection on one or more of our product candidates or our supporting technology. Such a loss of patent protection could harm our business.

In addition to the protection afforded by patents, we rely on trade secret protection, nondisclosure, 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. 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, collaborators, contractors, and other third parties. 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.

Third parties may initiate legal proceedings alleging that we are infringing their intellectual property rights, the outcome of which would be uncertain and could harm our business.

Our commercial success depends upon our ability and the ability of our collaborators to develop, manufacture, market and sell our product candidates and use our proprietary technologies without infringing the proprietary rights and intellectual property of third parties. The biotechnology and pharmaceutical industries are characterized by extensive and complex litigation regarding patents and other intellectual property rights. We may become party to, or threatened with, infringement litigation claims regarding our products and technology, including claims from competitors or from non-practicing entities that have no relevant product revenue and against whom our own patent portfolio may have no deterrent effect. Moreover, we may become party to, or be threatened with, adversarial proceedings or litigation regarding intellectual property rights with respect to our product candidates and technology, including *ex parte* re-examination, post grant review and *inter partes* review before the USPTO or foreign patent offices. Third parties may assert infringement claims against us based on existing patents or patents that may be granted in the future, regardless of the merit of the claim. There is a risk that third parties may choose to engage in litigation with us to enforce or to

otherwise assert their patent rights against us. Even if we believe such claims are without merit, a court of competent jurisdiction could hold that these third-party patents are valid, enforceable and infringed, which could adversely affect our ability to commercialize our product candidates or any other of our product candidates or technologies covered by the asserted third-party patents. In order to successfully challenge the validity of any such asserted third-party U.S. patent in federal court, we would need to overcome a presumption of validity. As this burden is a high one requiring us to present clear and convincing evidence as to the invalidity of any such U.S. patent claim, there is no assurance that a court of competent jurisdiction would invalidate the claims of any such U.S. patent. Similar challenges exist in other jurisdictions. If we are found to infringe a third-party's valid and enforceable intellectual property rights, we could be required to obtain a license from such third-party to continue developing, manufacturing and marketing our product candidates and technology. However, we may not be able to obtain any required license on commercially reasonable terms or at all. Even if we were able to obtain a license, it could be non-exclusive, thereby giving our competitors and other third parties access to the same technologies licensed to us, and it could require us to make substantial licensing and royalty payments. We could be forced, including by court order, to cease developing, manufacturing and commercializing the infringing technology or product candidates. In addition, we could be found liable for monetary damages, including treble damages and attorneys' fees, if we are found to have willfully infringed a patent or other intellectual property right. A finding of infringement could prevent us from manufacturing and commercializing our product candidates or force us to cease some of our business operations, which could harm our business. In addition, we may be forced to redesign our product candidates, seek new regulatory approvals, and indemnify third parties pursuant to contractual agreements. Claims that we have misappropriated the confidential information or trade secrets of third parties could have a similar negative impact on our business, reputation, financial condition, results of operations and prospects.

Intellectual property litigation could cause us to spend substantial resources and distract our personnel from their normal responsibilities.

Competitors may infringe our intellectual property rights or the intellectual property rights of our licensing partners, or we may be required to defend against claims of infringement. To counter infringement or unauthorized use claims or to defend against claims of infringement can be expensive and time consuming. Even if resolved in our favor, litigation or other legal proceedings relating to intellectual property claims may cause us to incur significant expenses and could distract our technical and management personnel from their normal responsibilities. In addition, there could be public announcements of the results of hearings, motions or other interim proceedings or developments. If securities analysts or investors perceive these results to be negative, it could have a substantial adverse effect on the price of our common stock. Such litigation or proceedings could substantially increase our operating losses and reduce the resources available for development activities or any future sales, marketing or distribution activities. We may not have sufficient financial or other resources to conduct such litigation or proceedings adequately. Some of our competitors may be able to sustain the costs of such litigation or proceedings more effectively than we can because of their greater financial resources and more mature and developed intellectual property portfolios. Uncertainties resulting from the initiation and continuation of patent litigation or other proceedings could adversely affect our ability to compete in the marketplace.

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.

Many of our directors, employees, consultants, and 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 these individuals 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.

In addition, while it is our policy to require our employees, consultants, advisors 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.

If we fail in prosecuting or 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 prosecuting or defending against such claims, litigation could result in substantial costs and be a distraction to management.

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

Patent reform legislation 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-inventor-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-inventor-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 has promulgated 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-inventor-to-file provisions, became effective on March 16, 2013. The Leahy-Smith Act has resulted in an increased investment in filing applications earlier, and consequently has increased the uncertainties and costs surrounding the prosecution of our patent applications, and may increase the enforcement or defense of our issued patents, all of which could harm our business, financial condition, results of operations and prospects.

The administrative tribunal created by the Leahy-Smith Act, known as the Patent Trial and Appeals Board, or PTAB, may have an impact on the operation of our business in the future. For example, the initial results of patent challenge proceedings before the PTAB since its inception in 2013 have resulted in the invalidation of many U.S. patent claims. The availability of the PTAB as a lower-cost, faster and potentially more potent tribunal for challenging patents could therefore increase the likelihood that our own licensed patents will be challenged, thereby increasing the uncertainties and costs of maintaining and enforcing them. Moreover, if such challenges occur, we may not have the right to control the defense. In certain situations, we may be required to rely on our licensor to consider our suggestions and to defend such challenges, with the possibility that it may not do so in a way that best protects our interests.

We also may be subject to a third-party pre-issuance submission of prior art to the USPTO or become involved in other contested proceedings such as opposition, derivation, reexamination, *inter partes* review, or post-grant review proceedings challenging our patent rights or the patent rights of others. An adverse determination in any such submission, proceeding or litigation could reduce the scope of, or invalidate, our patent rights, allow third parties to commercialize our technology or products and compete directly with us, without payment to us, or result in our inability to manufacture or commercialize products without infringing third-party patent rights. In addition, if the breadth or strength of protection provided by our patents and patent applications is threatened, it could dissuade companies from collaborating with us to license, develop or commercialize current or future products.

The patent positions of companies engaged in the development and commercialization of biologics and pharmaceuticals are particularly uncertain as the courts address issues such as patenting genes or gene products. The most recent guidance provided under *Berkheimer v HP, Inc*. (April 19, 2018) and *Vanda Pharmaceuticals, Inc. v West-Ward Pharmaceuticals* (June 7, 2018) instruct USPTO examiners on the ramifications of the court rulings as applied to natural products and principles including all naturally occurring nucleic acids. Patents for certain of our product candidates contain claims related to specific DNA sequences that are naturally occurring and, therefore, could be the subject of future challenges made by third parties. In addition, the recent USPTO guidance could make it impossible for us 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 technology and products will not be negatively impacted by the court decisions referenced above, rulings in other cases or changes in guidance or procedures issued by the USPTO. We cannot fully predict what impact decisions from the Supreme Court's decisions in *Mayo Collaborative Services v. Prometheus Laboratories* and *Molecular Pathology v. Myriad Genetics, Inc.* or other applicable court decisions may have on the ability of life science companies to obtain or enforce patents relating to their products and technologies 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 an adverse effect on our existing patent portfolio and our ability to protect and enforce our intellectual property in the future.

Moreover, although the Supreme Court has held 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.

Outside the United States, other courts have also begun to address the patenting of genetic material. In August 2015, the Australian High Court ruled that isolated genes cannot be patented in Australia. The decision did not address methods of using genetic material. Any ruling of a similar scope in other countries could affect the scope of our intellectual property rights. The ambiguities and changing law in all countries as to patenting genetic material may directly affect our ability to secure and/or maintain patent protection for our products.

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

Depending upon the timing, duration and specifics of any FDA marketing approval of our product candidates, one or more of our U.S. patents, which may cover non-gene therapy compounds, may be eligible for limited patent term extension under the Drug Price Competition and Patent Term Restoration Act of 1984, or the Hatch-Waxman Act. The Hatch-Waxman Act permits 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 per FDA-approved product, and only those claims covering the approved drug, a method for using it or a method for manufacturing it may be extended. Further, certain of our licenses currently or in the future may not provide us with the right to control decisions the licensor or its other licensees on Orange Book listings or patent term extension decisions under the Hatch-Waxman Act. Thus, if one of our important licensed patents is eligible for a patent term extension under the Hatch-Waxman Act, and it covers a product of another licensee in addition to our own product candidate, we may not be able to obtain that extension if the other licensee seeks and obtains that extension first. 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.

The Biologics Price Competition and Innovation Act of 2009 provides up to 12 years of market exclusivity for a reference biological product. We may not be able to obtain such exclusivity for our products. Moreover, the applicable time-period or the scope of patent protection afforded during any such extension could be less than we request. If we are unable to obtain patent term extension or the scope of term of any such extension is less than we request, the period during which we will have the right to exclusively market our product may be shortened and our competitors may obtain approval of competing products following our patent expiration, and our revenue could be materially reduced.

If our trademarks and trade name 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 own service mark registrations in the USPTO for the marks "VOYAGER THERAPEUTICS" and "VOYAGER THERAPEUTICS Logo" and European Community trademark registrations for the marks "V-TAG" and "VOYAGER TRAJECTORY ARRAY GUIDE." We also own pending trademark applications in the USPTO for the marks "V-TAG", V-TAG Logo, and "TRACER". Our trademarks or our trade name may be challenged, infringed, circumvented or declared generic or found to infringe prior third-party marks. We may not be able to protect our rights in our trademarks or in our trade name, which we need in order to build name recognition among potential partners or customers in our markets of interest. It is possible that 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 prior registered trademarks or trademarks that incorporate variations of our registered or unregistered trademarks or trade name. Over the long term, if we are unable to establish name recognition based on our trademarks and trade name, then we may not be able to compete effectively, and our business may be adversely affected. Our efforts to enforce and protect our proprietary rights related to trademarks, trade secrets, domain names, copyrights and 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 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 such rights 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 own, license or may access in the future;
- we, or our license partners or current or future collaborators, might not have been the first to make the inventions covered by the issued patent or pending patent application that we license or may own in the future;
- we, or 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 patent applications or those that we may own in the future will not lead to issued patents;
- issued patents that we hold rights to may be held invalid or unenforceable, including as a result of legal challenges by our competitors;
- 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 for certain inventions, trade secrets or know-how, and a third party may subsequently file 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.

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 currently rely on certain third parties to manufacture all or part of our product candidates and to perform quality testing, and because we collaborate with various organizations and academic institutions for the advancement of our gene therapy platform and pipeline, we must, at times, share our proprietary technology and confidential information, including 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. 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 proprietary technology and confidential information or other unauthorized use or disclosure would impair our competitive position and may harm our business, financial condition, results of operations and prospects.

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 by third parties. A competitor's discovery of our trade secrets would impair our competitive position and have an adverse impact on our business, financial condition, results of operations and prospects.

Risks Related to Ownership of Our Common Stock

Our executive officers, directors, principal stockholders and their affiliates exercise significant influence over our company.

The holdings of our executive officers, directors, principal stockholders and their affiliates, including investment funds affiliated with Third Rock Ventures, LLC, Neurocrine Biosciences, Inc., Bellevue Asset Management AG, and Partner Fund Management, LLC, represent beneficial ownership, in the aggregate, of approximately 49% of our outstanding common stock as of June 30, 2019. As a result, these stockholders, if they act together, will be able to influence our management and affairs and the outcome of matters submitted to our stockholders for approval, including the election of directors and any sale, merger, consolidation, or sale of all or substantially all of our assets. In addition, this concentration of ownership might adversely affect the market price of our common stock by:

- delaying, deferring or preventing a change of control of us;
- impeding a merger, consolidation, takeover or other business combination involving us; or
- discouraging a potential acquirer from making a tender offer or otherwise attempting to obtain control of us.

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

Our shares of common stock began trading on the Nasdaq Global Select Market on November 11, 2015. Given the limited trading history of our common stock, there is a risk that an active trading market for our shares will not be sustained, which could put downward pressure on the market price of our common stock and thereby affect the ability of our stockholders to sell their shares.

If securities analysts do not publish research or reports about our business or if they publish negative evaluations of our stock, the price of our stock could decline.

The trading market for our common stock will rely in part on the research and reports that industry or financial analysts publish about us or our business. If no or few analysts maintain coverage of us, the trading price of our stock would likely decrease. If one or more of the analysts covering our business downgrade their evaluations of our stock, the price of our stock could decline. If one or more of these analysts cease to cover our stock, we could lose visibility in the market for our stock, which in turn could cause our stock price to decline.

Sales of a substantial number of shares of our common stock in the public market could cause our stock price to fall.

Persons who were our stockholders prior to our initial public offering continue to hold a substantial number of shares of our common stock. If such persons sell, or indicate an intention to sell, substantial amounts of our common stock in the public market, the trading price of our common stock could decline.

In addition, shares of common stock that are either subject to outstanding options or restricted stock units, or RSUs, or reserved for future issuance under our stock incentive plans will become eligible for sale in the public market to the extent permitted by the provisions of various vesting schedules and Rule 144 and Rule 701 under the Securities Act of 1933, as amended. We have also filed a registration statement on Form S-8 permitting shares of common stock issued on exercise of options or the settlement of RSUs to be freely sold in the public market. If these additional shares of common stock are sold, or if it is perceived that they will be sold, in the public market, the trading price of our common stock could decline. In addition, we have registered on a registration statement on Form S-3 that has been declared effective, the sale of up to $250.0 million in aggregate of an indeterminate number of shares of common stock and preferred stock, an indeterminate principal amount of debt securities, and an indeterminate number of warrants. In November 2017, under such shelf registration statement, we issued and sold 5,175,000 shares of common stock to the public at an offering price of $12.00 per share, including 675,000 shares of common stock issued upon the full exercise by the underwriters of their option to purchase additional shares, resulting in net proceeds of $58.0 million after deducting underwriting discounts, commissions, and offering expenses payable by us. The registration statement also registers the offering, issuance, and sale of common stock having up to a maximum aggregate offering price of $75.0 million that we may issue and sell in at-the-market offerings or negotiated transactions under a sales agreement we entered into with Cowen and Company, LLC on December 1, 2016 pursuant to a sales agreement prospectus that forms a part of the registration statement. As of August 9, 2019, $75.0 million in shares of common stock remained eligible for sale under the sales agreement. In January 2019, we executed a stock purchase agreement to sell common stock to Neurocrine for an aggregate purchase price of approximately $50.0 million.

Certain holders of our common stock have rights, subject to specified 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. Any sales of securities by these stockholders could have a material adverse effect on the trading price of our common stock.

The price of our common stock may be volatile and fluctuate substantially, which could result in substantial losses for purchasers of our common stock.

The price of our common stock is likely to be volatile and may fluctuate substantially. From April 1, 2019 through June 30, 2019, the sales price of our common stock ranged from a high of $28.79 to a low of $18.73 on the Nasdaq Global Select Market. As a result of this volatility, our stockholders may not be able to sell their common stock at or above the price at which they purchased it. The market price for our common stock may be influenced by many factors, including:

- our success in commercializing any product candidates for which we obtain marketing approval;
- regulatory action and results of clinical trials of our product candidates or those of our competitors;
- the success of competitive products or technologies;

- the results of clinical trials of our product candidates;
- the results of clinical trials of product candidates of our competitors;
- the commencement, termination, and success of our collaborations, including the ability or willingness of our collaboration partners to fulfill their obligations to us;
- regulatory or legal developments in the United States and other countries;
- developments or disputes concerning patent applications, issued patents or other proprietary rights;
- the recruitment or departure of key personnel;
- the level of expenses related to any of our product candidates or clinical development programs;
- the results of our efforts to discover, develop, acquire or in-license additional product candidates or technologies, the cost of commercializing such product candidates, and the cost of development of any such product candidates or technologies;
- actual or anticipated changes in estimates as to financial results, development timelines or recommendations by securities analysts;
- variations in our financial results or those of companies that are perceived to be similar to us;
- the ability to secure third-party reimbursement for our product candidates;
- changes in the structure of healthcare payment systems;
- market conditions in the pharmaceutical and biotechnology sectors;
- general economic, industry and market conditions; and
- the other factors described in this “Risk Factors” section and elsewhere in this Quarterly Report on Form 10-Q.

If our operating results fall below the expectations of investors or securities analysts for a given period, the price of our common stock could decline substantially. Furthermore, any fluctuations in our operating results from period to period may, in turn, cause the price of our stock to fluctuate substantially. We believe that such comparisons of our financial results are not necessarily meaningful and should not be relied upon as an indication of our future performance.

In the past, following periods of volatility in the market price of a company’s securities, securities class-action litigation often has been instituted against that company. We also may face securities class-action litigation if we cannot obtain regulatory approvals for or if we otherwise fail to commercialize our product candidates. Such litigation, if instituted against us, could cause us to incur substantial costs to defend such claims and divert management’s attention and resources, which could seriously harm our business, financial condition, results of operations and prospects.

We have broad discretion in how we apply our available funds, and we may not use these funds effectively, which could affect our results of operations and cause our stock price to decline.

Our management will have broad discretion in the application of our existing cash, cash equivalents and marketable securities and could spend these funds in ways that do not improve our results of operations or enhance the value of our common stock. The failure by our management to apply our available funds effectively could result in financial losses that could cause the price of our common stock to decline and delay the development of our product candidates and preclinical programs. Pending their use, we may invest our available funds in a manner that does not produce income or that loses value.

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

For so long as we remain an "emerging growth company," or EGC, as defined in the JOBS Act, we are permitted and intend to rely on exemptions from certain disclosure requirements that are applicable to other public companies that are not EGCs. These exemptions include:

- not being required to comply with the auditor attestation requirements in the assessment of our internal control over financial reporting pursuant to Section 404 of the Sarbanes-Oxley Act of 2002;
- 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;
- reduced disclosure obligations regarding executive compensation; and
- exemptions from the requirements of holding a nonbinding advisory vote on executive compensation and stockholder approval of any golden parachute payments not previously approved.

We may take advantage of these exemptions until we are no longer an EGC. We would cease to be an EGC upon the earlier of: (i) the last day of the fiscal year in which we have total annual gross revenue 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, which is December 31, 2020; (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 $700.0 million as of June 30th.

We expect to continue to take advantage of some, but not all, of the available exemptions. Even after we no longer qualify as an emerging growth company, we might still qualify as a smaller reporting company, or SRC, which would allow us to take advantage of many of the same exemptions from disclosure requirements, including reduced disclosure obligations regarding executive compensation. 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 and may decline.

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 irrevocably elected not to avail ourselves of this exemption from new or revised accounting standards and, therefore, we will be subject to the same new or revised accounting standards as other public companies that are not emerging growth companies.

We 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 or SRC, we incur significant legal, accounting and other expenses that we did not incur as a private company. In addition, the Sarbanes-Oxley Act of 2002, the Dodd-Frank Wall Street Reform and Consumer Protection Act, and rules subsequently implemented by the SEC and The Nasdaq Stock Market 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 devote a substantial amount of time to these compliance initiatives. Moreover, these rules and regulations have increased our legal and financial compliance costs and have made some activities more time-consuming and costly. For example, these rules and regulations have made it more difficult and more expensive for us to obtain director and officer liability insurance, and we have been required to accept reduced policy limits and coverage or incur

substantially higher costs to obtain the same or similar coverage. As a result, it may be more difficult for us to attract and retain qualified people to serve on our board of directors, our board committees or as executive officers.

Pursuant to Section 404 of the Sarbanes-Oxley Act of 2002, or Section 404, we will be required to furnish a report by our management on our internal control over financial reporting. However, while we remain an EGC, we will not be required to include an attestation report on internal control over financial reporting issued by our independent registered public accounting firm. To achieve compliance with Section 404 within the prescribed period, we will 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 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 neither we nor our independent registered public accounting firm will be able to conclude within the prescribed timeframe, or at all, that our internal control over financial reporting is effective as required by Section 404. If we identify one or more material weaknesses in our internal control over financial reporting, it could result in an adverse reaction in the financial markets due to a loss of confidence in the reliability of our financial statements.

Provisions in our amended and restated certificate of incorporation and bylaws and Delaware law could make an acquisition of us, which may be beneficial to our stockholders, more difficult and may prevent attempts by our stockholders to replace or remove our current management.

Provisions in our amended and restated certificate of incorporation and bylaws may discourage, delay or prevent a merger, acquisition or other change in control of us that stockholders may consider favorable, including transactions in which our stockholders might otherwise receive a premium for their shares. These provisions also could limit the price that investors might be willing to pay in the future for shares of our common stock, thereby depressing the market price of our common stock. In addition, because our board of directors is responsible for appointing the members of our management team, these provisions may frustrate or prevent any attempts by our stockholders to replace or remove our current management by making it more difficult for stockholders to replace members of our board of directors. Among other things, these provisions:

- establish a classified board of directors such that only one of three classes of members of the board is elected each year;
- allow the authorized number of our directors to be changed only by resolution of our board of directors;
- limit the manner in which stockholders can remove directors from the board;
- establish advance notice requirements for stockholder proposals that can be acted on at stockholder meetings and nominations to our board of directors;
- require that stockholder actions must be effected at a duly called stockholder meeting and prohibit actions by our stockholders by written consent;
- limit who may call stockholder meetings;
- authorize our board of directors to issue preferred stock without stockholder approval, which could be used to institute a stockholder rights plan, or so-called “poison pill,” that would work to dilute the stock ownership of a potential hostile acquirer, effectively preventing acquisitions that have not been approved by our board of directors; and
- require the approval of the holders of at least 75% of the votes that all our stockholders would be entitled to cast to amend or repeal certain provisions of our amended and restated certificate of incorporation or bylaws.

Moreover, because we are incorporated in Delaware, we are governed by the provisions of Section 203 of the Delaware General Corporation Law, which prohibits a person who owns in excess of 15% of our outstanding voting stock from merging or combining with us for a period of three years after the date of the transaction in which the person acquired in excess of 15% of our outstanding voting stock, unless the merger or combination is approved in a prescribed manner.

Our amended and restated certificate of incorporation designates the Court of Chancery of the State of Delaware as the sole and exclusive forum for certain types of actions and proceedings that may be initiated by our stockholders, which could limit our stockholders' ability to obtain a favorable judicial forum for disputes with us or our directors, officers or employees.

Our amended and restated certificate of incorporation, provides 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 (i) any derivative action or proceeding brought on our behalf, (ii) any action asserting a claim of breach of a fiduciary duty owed by any of our directors, officers and employees to us or our stockholders, (iii) any action asserting a claim arising pursuant to any provision of the Delaware General Corporation Law, our certificate of incorporation or our bylaws or (iv) any action asserting a claim that is governed by the internal affairs doctrine, in each case subject to the Court of Chancery having personal jurisdiction over the indispensable parties named as defendants therein. Any person purchasing or otherwise acquiring any interest in any shares of our capital stock shall be deemed to have notice of and to have consented to this provision of our amended and restated certificate of incorporation. This choice of forum provision may limit a stockholder's ability to bring a claim in a judicial forum that he, she or it finds 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. Stockholders who do bring a claim in the Court of Chancery could face additional litigation costs in pursuing any such claim, particularly if they do not reside in or near the State of Delaware. The Court of Chancery 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 or results may be more favorable to us than to our stockholders. Alternatively, if a court were to find this provision of our amended and restated certificate of incorporation inapplicable to, or unenforceable in respect of, one or more of the specified types of actions or proceedings, we may incur additional costs which could have a material adverse effect on our business, financial condition or results of operations.

Because we do not anticipate paying any cash dividends on our capital stock in the foreseeable future, capital appreciation, if any, will be our stockholders' sole source of gain.

We have never declared or paid cash dividends on our capital stock. We currently intend to retain all of our future earnings, if any, to finance the growth and development of our business. In addition, the terms of any future debt agreements may preclude us from paying dividends. As a result, capital appreciation, if any, of our common stock will be the sole source of gain for our stockholders for the foreseeable future.

ITEM 6. EXHIBITS

The exhibits filed or furnished as part of this Quarterly Report on Form 10-Q are set forth on the Exhibit Index, which is incorporated herein by reference.

INDEX TO EXHIBITS

Exhibit No.	Description	Incorporated by Reference to: Form or Schedule	Exhibit No.	Filing Date with SEC	SEC File Number	Filed Herewith
10.1	Retirement Agreement, by and between Voyager Therapeutics, Inc. and Dinah Sah, Ph.D., dated May 13, 2019.	8-K	10.01	5/21/2019	001-37625	
10.2	Employment Agreement, by and between Voyager Therapeutics, Inc. and Omar Khwaja, M.D., Ph.D, dated May 20, 2019.					X
10.3†	Termination Agreement, by and between Voyager Therapeutics, Inc. and Genzyme Corporation, dated June 14, 2019.					X
10.4†	Amended and Restated Option and License Agreement, by and between Voyager Therapeutics, Inc. and Genzyme Corporation, dated June 14, 2019.					X
10.5	Amendment No. 1 to the Collaboration and License Agreement, by and between Voyager Therapeutics, Inc. and Neurocrine Biosciences, Inc., dated June 14, 2019.					X
10.6	Consulting Agreement, by and between Voyager Therapeutics, Inc. and Dinah Sah, Ph.D., dated June 28, 2019.					X
31.1	Certification of Principal Executive Officer pursuant to Exchange Act Rules 13a-14 or 15d-14.					X
31.2	Certification of Principal Financial Officer pursuant to Exchange Act Rules 13a-14 or 15d-14.					X
32.1+	Certification of Principal Executive Officer and Principal Financial Officer pursuant to Exchange Act Rules 13a-14(b) or 15d-14(b) and 18 U.S.C. Section 1350.					X
101.INS	XBRL Instance Document. - the instance document does not appear in the Interactive Data File because its XBRL tags are embedded within the Inline XBRL document.					X
101.SCH	XBRL Taxonomy Extension Schema Document.					X
101.CAL	XBRL Taxonomy Extension Calculation Document.					X
101.LAB	XBRL Taxonomy Extension Definition Linkbase Document.					X

101.PRE	XBRL Taxonomy Extension Labels Linkbase Document.
101.DEF	XBRL Taxonomy Extension Presentation Link Document.

† Portions of this exhibit have been omitted pursuant to Item 601(b)(10)(iv) of Regulation S-K.

+ The certification furnished in Exhibit 32.1 hereto is deemed to be furnished with this Quarterly Report on Form 10-Q and will not be deemed to be "filed" for purposes of Section 18 of the Securities Exchange Act of 1934, as amended, except to the extent that the Registrant specifically incorporates it by reference.

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.

Date: August 9, 2019

VOYAGER THERAPEUTICS, INC.

By: */s/ G. Andre Turenne*
G. Andre Turenne
Chief Executive Officer, President, and Director
(Principal Executive Officer)

By: */s/ Allison Dorval*
Allison Dorval
Chief Financial Officer
(Principal Financial and Accounting Officer)

AMENDED AND RESTATED EMPLOYMENT AGREEMENT

This Amended and Restated Employment Agreement (this "Agreement") is made as of May 20, 2019 (the "Effective Date") by and between Voyager Therapeutics, Inc. (the "Company") and Omar Khwaja, MD, PhD, (the "Executive").

1. Employment.

General. The Company and the Executive desire that the Executive be employed as the Company's Chief Medical Officer and Head of Research & Development. The employment relationship between the Company and the Executive shall be governed by this Agreement commencing as of the Effective Date and continuing in effect until terminated by either party in accordance with this Agreement. The Executive's first day of employment (the "Commencement Date") shall be on a day to be mutually agreed upon by the Company and Executive, but shall not be later than May 20, 2019. At all times, the Executive's employment with the Company will be "at-will," meaning that the Executive's employment may be terminated by the Company or the Executive at any time and for any reason, subject to the terms of this Agreement.

Condition of Employment Following October 31, 2019. The Executive's continued employment with the Company following October 31, 2019 is conditioned on his being eligible to work in the United States commencing no later than November 1, 2019. The Executive shall provide to the Company, within three days of commencing work in the United States, documentation of his eligibility to work in the United States, as required by the Immigration Reform and Control Act of 1986. If the Executive needs to obtain a work visa in order to be eligible to work in the United States, his employment with the Company is conditioned upon his obtaining a work visa prior to November 1, 2019.

2. Position, Reporting and Duties. The Executive will serve as the Chief Medical Officer and Head of Research & Development of the Company, reporting to the Company's President and Chief Executive Officer ("CEO"), and will serve as and be considered a "C-Level" executive officer, exercising the traditional power and duties of such office in companies of similar size to the Company and carrying out such additional executive level duties as may be reasonably assigned by the CEO. The Executive shall devote the Executive's full working time and efforts to the business and affairs of the Company and shall not engage in any other business activities without the prior written approval of the CEO and provided that such activities do not create a conflict of interest or otherwise interfere with the Executive's performance of the Executive's duties to the Company. Beginning on the Commencement Date, and through no later than October 31, 2019, the Executive will be permitted to work remotely from Switzerland. Beginning no later than November 1, 2019, the Executive's normal place of work will be Cambridge, MA. It is understood and agreed that, as soon as he is eligible to work in the United States (but in no event later than November 1, 2019), the Executive will generally be on site in Cambridge, unless the Executive is traveling on behalf of the Company, or while traveling in the initial transition period during family relocation from Basel.

3. Compensation and Related Matters.

(a) Base Salary. The Executive's annual base salary is $440,000, which is subject to review and redetermination by the Company from time to time. The annual base salary in effect at any given time is referred to herein as "Base Salary." The Base Salary will be payable in a manner that is consistent with the Company's usual payroll practices for senior executives. The Executive shall be eligible to participate in the Company's annual salary review for the 2020 fiscal year, and in the annual salary review in each subsequent year thereafter.

(b) Bonus. The Executive is eligible to participate in the Company's Senior Executive Cash Incentive Bonus Plan, as approved by the Company's Board of Directors, its Compensation Committee or any other committee of the Board (collectively, the "Board") (the "Incentive Bonus Plan"). The terms of the Incentive Bonus Plan shall be established and may be altered by the Board in its sole discretion. For calendar year 2019, the Executive's target bonus under the Incentive Bonus Plan shall be 40% of the Executive's Base Salary. Any bonus paid for 2019 will be pro-

rated based on the Executive's Commencement Date. To earn any bonus, the Executive must be employed by the Company on the day such bonus is paid, except as provided to the contrary in either Section 6 or 7 below, because such bonus serves as an incentive for the Executive to remain employed with the Company. Both parties acknowledge and agree that any bonus is not intended and shall not be deemed a "wage" under any state or federal wage-hour law.

(c) Equity. Subject to approval by the Company's Compensation Committee and a majority of the Company's Independent Directors as defined in Nasdaq Listing Rule 5605(a)(2), and as a material inducement to the Executive entering into employment with the Company, the Executive will be granted on the Commencement Date (the "Grant Date") a one-time equity award outside of the Company's stock incentive plans as an "inducement grant" within the meaning of Nasdaq Listing Rule 5635(c)(4), consisting of an Option Award and an RSU Award (each as defined below):

1. The Executive will be granted a non-qualified option (the "Option Award") to purchase 170,000 shares of the Company's common stock (the "Common Stock"). The shares underlying the Option Award (the "Option Shares") will have an exercise price per share equal to the closing price of the Common Stock on The Nasdaq Global Select Market on the Grant Date. The Option Shares will vest and become exercisable, subject to the Executive's continued service on each applicable vesting date, as follows: 25% of the Option Shares will vest on the first anniversary of the Grant Date, and an additional 2.0833% of the Option Shares will vest on a monthly basis at the end of each one-month period following the one-year anniversary of the Grant Date until the four-year anniversary of the Grant Date.

The Executive will also be granted 30,000 restricted stock units (the "RSU Award"). The RSU Award will vest and become settleable, subject to the Executive's continued service on each applicable vesting date, over a three-year period as follows: 33.333% of the shares underlying the RSU Award will vest on the first anniversary of the Grant Date; an additional 33.333% of the shares underlying the RSU Award will vest on the two-year anniversary of the Grant Date; and the remaining shares underlying the RSU Award will vest on the three-year anniversary of the Grant Date.

Each of the Option Award and the RSU Award will be subject to and governed by the terms and conditions of the applicable equity award agreements between the Executive and the Company.

(d) Employee Benefits. The Executive shall be entitled to full participation in the Company's flexible vacation plan each calendar year and to such other holidays as the Company recognizes for employees having comparable responsibilities and duties. The Executive will be entitled to participate in the Company's employee benefit plans, subject to the terms and the conditions of such plans, and the Company's ability to amend and modify such plans at any time and from time to time without advance notice.

(e) Reimbursement of Business Expenses. The Company shall reimburse the Executive for travel, entertainment, business development and other expenses reasonably and necessarily incurred by the Executive in connection with the Company's business. Expense reimbursement shall be subject to such policies that the Company may adopt from time to time, including with respect to pre-approval.

(f) Relocation. In connection with the Executive's employment with the Company, the Executive will be required to relocate to the Greater Boston, Massachusetts area and establish his principal residence there on or before November 1, 2019. In order to assist with this process and in further consideration of the non-competition provision of the Confidentiality, Non-Solicitation, Non-Competition and Invention Assignment Agreement (the "Confidentiality Agreement"), the Company will reimburse the Executive for gross expenses up to $200,000 for reasonable expenses incurred by the Executive in such relocation (including moving expenses, costs related to the packing, moving, and unpacking of household goods and personal effects, travel expenses, and temporary housing expenses) (the "Relocation Expenses"), so long as such Relocation Expenses are incurred no later than the one-year anniversary of the Effective Date. The Relocation Expenses will be reimbursed in accordance with Company policy, but no later than sixty (60) days following the incurring of the expense, provided that the Executive delivers to the Company reasonable substantiation and documentation of the Relocation Expenses (and provided further, for the avoidance of doubt, that in no event will any reimbursement be made prior to the Commencement Date). All such reimbursements are taxable to the Executive, and the reimbursement shall be reduced by applicable withholdings required by law. For the avoidance of doubt, the Executive acknowledges and agrees that relocation is a material term

of this Agreement. If the Executive does not commence employment as the Company's Chief Medical Officer and Head of Research & Development on the Commencement Date, or if prior to the one-year anniversary of the Commencement Date, the Company terminates the Executive's employment for Cause (as defined below) or the Executive resigns without Good Reason (as defined below), the Executive will not be eligible for reimbursement of any unpaid Relocation Expenses and will be obligated to repay to the Company, within thirty (30) days following the Executive's separation, all Relocation Expenses received by the Executive prior to the Executive's last day of employment.

(g) Signing Bonus. In further consideration of the non-competition provision of the Confidentiality Agreement, the Executive will receive a one-time signing bonus of $100,000, less all applicable taxes and withholdings (the "Signing Bonus"); provided, however, that payment of such Signing Bonus is conditioned on the Executive using his best efforts, as quickly as is reasonably practicable, to prepare, collect and submit to immigration counsel retained by the Company all documents and materials that such counsel may request in connection with efforts to obtain authorization for the Executive to work in the United States. If Executive has satisfied this condition, as determined by the Company in its reasonable discretion, the Signing Bonus shall be payable in the Company's first regular payroll cycle following such determination. If, prior to the first anniversary of the Commencement Date, the Company terminates the Executive's employment for Cause (as defined below) or the Executive resigns his employment without Good Reason (as defined below), the Executive will be obligated to repay the entire Signing Bonus within thirty (30) days following his separation from employment.

(h) Work Authorization and Immigration Support. The Company will fully support the cost of Executive's work authorization visa and subsequent permanent residency application. Support will include legal expenses, filing fees and administrative support, and any required travel, and will cover the Executive, and the Executive's spouse and children.

3. Certain Definitions.

(a) "Cause" means (A) the commission by the Executive of (i) any felony; or (ii) a misdemeanor involving moral turpitude, deceit, dishonesty or fraud, (B) a good faith finding by the Company of: (i) conduct by the Executive constituting a material act of misconduct in connection with the performance of the Executive's duties, including, without limitation, misappropriation of funds or property of the Company or any of its subsidiaries or affiliates other than the occasional, customary and de minimis use of Company property for personal purposes; (ii) any conduct by the Executive that would reasonably be expected to result in material injury or reputational harm to the Company or any of its subsidiaries and affiliates if the Executive were retained in the Executive's position but, provided that the Company reasonably determines that such conduct is capable of being cured, only after receipt of written notice by the Company reasonably describing such conduct and if the Executive fails to cease and cure such conduct within fifteen (15) days of receipt of said written notice; (iii) continued non-performance by the Executive of the Executive's responsibilities hereunder (other than by reason of the Executive's physical or mental illness, incapacity or disability) but, provided that the Company reasonably determines that such conduct is capable of being cured, only after receipt of written notice by the Company reasonably describing such non-performance and the Executive's failure to cure such non-performance within fifteen (15) days of receipt of said written notice; (iv) a breach by the Executive of any confidentiality or restrictive covenant obligations to the Company, including under the Confidentiality, Non-Competition and Assignment Agreement (the "Confidentiality Agreement"); (v) a material violation by the Executive of any of the Company's written employment policies communicated to the Executive; or (vi) failure to cooperate with a bona fide internal investigation or an investigation by regulatory or law enforcement authorities as provided under Section 13 of this Agreement, after being instructed by the Company to cooperate, or the willful destruction or failure to preserve documents or other materials known to be relevant to such investigation or the inducement of others to fail to cooperate or to produce documents or other materials in connection with such investigation, or (C) the Executive's failure to (i) obtain a visa authorizing him to work in the United States beginning no later than November 1, 2019, and/or (ii) relocate to the Greater Boston, Massachusetts area and establish his principal residence there on or before November 1, 2019.

(b) "Disabled" means the Executive is unable to perform the essential functions of the Executive's then existing position or positions under this Agreement with or without reasonable accommodation for a period of 180 days (which days need not be consecutive) in any twelve (12) month period. If any question shall arise as to whether

during any period the Executive is disabled so as to be unable to perform the essential functions of the Executive's then existing position or positions with or without reasonable accommodation, the Executive may, and at the request of the Company shall, submit to the Company a certification in reasonable detail by a physician selected by the Company to whom the Executive or the Executive's guardian has no reasonable objection as to whether the Executive is so disabled or how long such disability is expected to continue, and such certification shall for the purposes of this Agreement be conclusive of the issue. The Executive shall cooperate with any reasonable request of the physician in connection with such certification. If such question shall arise and the Executive shall fail to submit such certification, the Company's determination of such issue shall be binding on the Executive. Nothing in this Section 4(b) shall be construed to waive the Executive's rights, if any, under existing law including, without limitation, the Family and Medical Leave Act of 1993, 29 U.S.C. §2601 et seq., and the Americans with Disabilities Act, 42 U.S.C. §12101 et seq.

(c) "Good Reason" means that the Executive has complied with the "Good Reason Process" (hereinafter defined) following the occurrence of any of the following events without the Executive's consent: (A) a material diminution in the Executive's responsibilities, authority or duties; (B) a material diminution in the Executive's Base Salary except for a reduction of the Executive's Base Salary that is part of an across-the-board salary reduction applied to substantially all senior management employees that is caused by the Company's financial performance and is similar to and proportionately not greater than the reductions affecting all or substantially all senior management employees of the Company; (C) following the Executive's relocation to the Greater Boston, Massachusetts area, any further relocation of the Executive's principal place of business from Cambridge more than fifty (50) miles other than in a direction that reduces the Executive's daily commuting distance; or (D) the material breach by the Company of this Agreement or any other agreements between the Executive and the Company relating to Equity Awards. "Good Reason Process" means that (i) the Executive reasonably determines in good faith that a "Good Reason" condition has occurred; (ii) the Executive notifies the Company in writing of the first occurrence of the Good Reason condition within 60 days of the first occurrence of such condition; (iii) the Executive cooperates in good faith with the Company's efforts for thirty (30) days following such notice (the "Cure Period") to remedy the condition; (iv) notwithstanding such efforts, at least one Good Reason condition continues to exist; and (v) the Executive terminates the Executive's employment within 60 days after the end of the Cure Period. If the Company cures the Good Reason condition during the Cure Period, Good Reason shall be deemed not to have occurred. The Company's success at curing a Good Reason condition shall not bar or preclude the Executive's right to notify the Company of the occurrence of another Good Reason condition and to proceed with the Good Reason Process.

(d) "Sale Event" means the consummation of (i) the sale of all or substantially all of the assets of the Company on a consolidated basis to an unrelated person or entity, (ii) a merger, reorganization or consolidation pursuant to which the holders of the Company's outstanding voting power immediately prior to such transaction do not own a majority of the outstanding voting power of the surviving or resulting entity (or its ultimate parent, if applicable), (iii) the acquisition, directly or indirectly, of all or a majority of the outstanding voting stock of the Company in a single transaction or a series of related transactions by a Person or group of Persons, (iv) a Deemed Liquidation Event (as defined in the Company's Certificate of Incorporation (as may be amended, restated or otherwise modified from time to time)), or (v) any other acquisition of the business of the Company, as determined by the Board. Notwithstanding the foregoing, a "Sale Event" shall not be deemed to have occurred as a result of (a) a merger effected solely to change the Company's domicile, and (b) shall not constitute a "Sale Event," and (b) of an acquisition of shares of Company common stock by the Company which, by reducing the number of shares outstanding, increases the proportionate number of shares beneficially owned by any person to a majority of the outstanding shares of common stock of the Company; provided, however, that if any person referred to in this clause (b) shall thereafter become the beneficial owner of any additional shares (other than pursuant to a stock split, stock dividend, or similar transaction or as a result of an acquisition of shares directly from the Company) and immediately thereafter beneficially owns a majority of the then outstanding shares, then a "Sale Event" shall be deemed to have occurred for purposes of this clause (b). Notwithstanding the foregoing, where required to avoid extra taxation under Section 409A of the Internal Revenue Code of 1986, as amended (the "Code"), a Sale Event must also satisfy the requirements of Treas. Reg. Section 1.409A-3(a)(5).

(e) "Sale Event Period" means the period ending twelve (12) months following the consummation of a Sale Event.

(f) "Terminating Event" means termination of the Executive's employment by the Company without Cause or by the Executive for Good Reason. A Terminating Event does not include: (i) the termination of the Executive's employment due to the Executive's death or a determination that the Executive is Disabled; (ii) the Executive's resignation for any reason other than Good Reason, (iii) the Company's termination of the Executive's employment for Cause, or (iv) any termination of this Agreement prior to the Commencement Date by either party for any reason.

4. Compensation in Connection with a Termination for any Reason. If the Executive's employment with the Company is terminated for any reason, the Company shall pay or provide to the Executive (or to the Executive's authorized representative or estate) any earned but unpaid Base Salary, unpaid expense reimbursements, and vested employee benefits.

5. Severance and Accelerated Vesting if a Terminating Event Occurs within the Sale Event Period. In the event a Terminating Event occurs within the Sale Event Period, subject to the Executive signing and complying with a separation agreement in a form and manner satisfactory to the Company containing, among other provisions, a general release of claims in favor of the Company and related persons and entities, covenants to return Company property and to not disparage the Company, and a reaffirmation of the Confidentiality Agreement (the "Separation Agreement and Release"), and the Separation Agreement and Release becoming irrevocable, all within 60 days after the Date of Termination or by an earlier date as determined by the Company, the following shall occur:

(a) the Company shall pay to the Executive an amount equal to twelve (12) months of the Executive's Base Salary in effect immediately prior to the Terminating Event (or the Executive's Base Salary in effect immediately prior to the Sale Event, if higher), determined in each case immediately before any event that constitutes Good Reason;

(b) the Company shall pay to the Executive an amount equal to the annual bonus target for the current year based on the Date of Termination;

(c) if the Executive timely elects and is eligible to continue receiving group health insurance pursuant to the "COBRA" law, the Company will, until the earlier of (x) the date that is twelve (12) months following the Date of Termination, and (y) the date on which the Executive obtains alternative coverage (as applicable, the "Sale Event COBRA Contribution Period"), continue to pay the share of the premiums for such coverage to the same extent it was paying such premiums on the Executive's behalf immediately prior to the Date of Termination. The remaining balance of any premium costs during the Sale Event COBRA Contribution Period, and all premium costs thereafter, shall be paid by the Executive monthly for as long as, and to the extent that, the Executive remains eligible for COBRA continuation. The Executive agrees that, should the Executive obtain alternative medical and/or dental insurance coverage prior to the date that is twelve (12) months following the Date of Termination, the Executive will so inform the Company in writing within five (5) business days of obtaining such coverage. Notwithstanding anything to the contrary herein, in the event that the Company's payment of the amounts described in Section 6(c) would subject the Company to any tax or penalty under the Patient Protection and Affordable Care Act (as amended from time to time, the "ACA") or Section 105(h) of the Internal Revenue Code of 1986, as amended ("Section 105(h)"), or applicable regulations or guidance issued under the ACA or Section 105(h), the Executive and the Company agree to work together in good faith to restructure such benefit.

(d) 100% of all equity awards held by the Executive shall immediately accelerate and become fully exercisable or nonforfeitable as of the Date of Termination and the provisions of this Section 6(d) shall be deemed to be incorporated by reference into the agreements governing all such awards.

For avoidance of doubt, the Separation Agreement and Release for purposes of this Agreement shall not require a waiver of any rights under the indemnification agreement between the Company and the Executive or any rights described in Section 5 above. Notwithstanding the foregoing, if the Executive's employment is terminated in connection with a Sale Event and the Executive immediately becomes reemployed by any direct or indirect successor to the business or assets of the Company, the termination of the Executive's employment upon the Sale Event shall not be considered a termination without Cause for purposes of this Agreement.

The amounts payable under Sections 6(a) and 6(b) shall be paid out in substantially equal installments in accordance with the Company's payroll practice over twelve (12) months commencing within 60 days after the Date of Termination; *provided, however*, that if the 60-day period begins in one calendar year and ends in a second calendar year, the severance shall begin to be paid in the second calendar year by the last day of such 60-day period; *provided further*, that the initial payment shall include a catch-up payment to cover amounts retroactive to the day immediately following the Date of Termination. Each payment pursuant to this Agreement is intended to constitute a separate payment for purposes of Treasury Regulation Section 1.409A-2(b)(2).

6. Severance if a Terminating Event Occurs Outside the Sale Event Period. In the event a Terminating Event occurs at any time other than during the Sale Event Period, subject to the Executive signing the Separation Agreement and Release and the Separation Agreement and Release becoming irrevocable, all within 60 days after the Date of Termination or by an earlier date as determined by the Company, the following shall occur:

(a) the Company shall pay to the Executive an amount equal to twelve (12) months of the Executive's annual Base Salary in effect immediately prior to the Terminating Event (but only after disregarding any event that constitutes Good Reason);

(b) the Company shall pay to the Executive a prorated portion of the annual bonus target for the current year based on the Date of Termination; and

(c) if the Executive timely elects and is eligible to continue receiving group health insurance pursuant to the "COBRA" law, the Company will, until the earlier of (x) the date that is twelve (12) months following the Date of Termination, and (y) the date on which the Executive obtains alternative coverage (as applicable, the "Non-Sale Event COBRA Contribution Period"), continue to pay the share of the premiums for such coverage to the same extent it was paying such premiums on the Executive's behalf immediately prior to the Date of Termination. The remaining balance of any premium costs during the Non-Sale Event COBRA Contribution Period, and all premium costs thereafter, shall be paid by the Executive on a monthly basis for as long as, and to the extent that, the Executive remains eligible for COBRA continuation. The Executive agrees that, should the Executive obtain alternative medical and/or dental insurance coverage prior to the date that is twelve (12) months following the Date of Termination, the Executive will so inform the Company in writing within five (5) business days of obtaining such coverage. Notwithstanding anything to the contrary herein, in the event that the Company's payment of the amounts described in Section 7(c) would subject the Company to any tax or penalty under the ACA or Section 105(h), or applicable regulations or guidance issued under the ACA or Section 105(h), the Executive and the Company agree to work together in good faith to restructure such benefit.

The amounts payable under Section 7(a) and 7(b) shall be paid out in substantially equal installments in accordance with the Company's payroll practice over twelve (12) months commencing within 60 days after the Date of Termination; provided, however, that if the 60-day period begins in one calendar year and ends in a second calendar year, the severance shall begin to be paid in the second calendar year by the last day of such 60-day period; provided further, that the initial payment shall include a catch-up payment to cover amounts retroactive to the day immediately following the Date of Termination. Each payment pursuant to this Agreement is intended to constitute a separate payment for purposes of Treasury Regulation Section 1.409A-2(b)(2).

7. Confidentiality, Non-Solicitation, Non-Competition and Invention Assignment Agreement. The Executive acknowledges and agrees that he must execute the Confidentiality Agreement between the Company and the Executive, attached hereto as Exhibit A, as a condition of his employment with the Company. The Executive acknowledges that the Executive's receipt of the grant of a stock option award and a restricted stock unit award as set forth in Section 3(c) is contingent on the Executive's agreement to the non-competition provisions set forth in the Confidentiality Agreement. The Executive further acknowledges that such consideration was mutually agreed upon by the Executive and the Company and is fair and reasonable in exchange for the Executive's compliance with such non-competition obligations. The terms of the Confidentiality Agreement are incorporated by reference in this Agreement and the Executive hereby reaffirms the terms of the Confidentiality Agreement as a material term of this Agreement.

8. Additional Limitation.

(a) Anything in this Agreement to the contrary notwithstanding, in the event that the amount of any compensation, payment or distribution by the Company to or for the benefit of the Executive, whether paid or payable or distributed or distributable pursuant to the terms of this Agreement or otherwise, calculated in a manner consistent with Section 280G of the Code and the applicable regulations thereunder (the "Aggregate Payments"), would be subject to the excise tax imposed by Section 4999 of the Code, then the Aggregate Payments shall be reduced (but not below zero) so that the sum of all of the Aggregate Payments shall be $1.00 less than the amount at which the Executive becomes subject to the excise tax imposed by Section 4999 of the Code; provided that such reduction shall only occur if it would result in the Executive receiving a higher After Tax Amount (as defined below) than the Executive would receive if the Aggregate Payments were not subject to such reduction. In such event, the Aggregate Payments shall be reduced in the following order, in each case, in reverse chronological order beginning with the Aggregate Payments that are to be paid the furthest in time from consummation of the transaction that is subject to Section 280G of the Code: (i) cash payments not subject to Section 409A of the Code; (ii) cash payments subject to Section 409A of the Code; (iii) equity-based payments and acceleration; and (iv) non-cash forms of benefits; provided that in the case of all the foregoing Aggregate Payments all amounts or payments that are not subject to calculation under Treas. Reg. §1.280G-1, Q&A-24(b) or (c) shall be reduced before any amounts that are subject to calculation under Treas. Reg. §1.280G-1, Q&A-24(b) or (c).

(b) For purposes of this Section, the "After Tax Amount" means the amount of the Aggregate Payments less all federal, state, and local income, excise and employment taxes imposed on the Executive as a result of the Executive's receipt of the Aggregate Payments. For purposes of determining the After Tax Amount, the Executive shall be deemed to pay federal income taxes at the highest marginal rate of federal income taxation applicable to individuals for the calendar year in which the determination is to be made, and state and local income taxes at the highest marginal rates of individual taxation in each applicable state and locality, net of the maximum reduction in federal income taxes which could be obtained from deduction of such state and local taxes.

The determination as to whether a reduction in the Aggregate Payments shall be made pursuant to this Section shall be made by a nationally recognized accounting firm selected by the Company prior to the Change in Control (the "Accounting Firm"), which shall provide detailed supporting calculations both to the Company and the Executive within 15 business days of the Date of Termination, if applicable, or at such earlier time as is reasonably requested by the Company or the Executive. Any determination by the Accounting Firm shall be binding upon the Company and the Executive.

9. Section 409A.

(a) Anything in this Agreement to the contrary notwithstanding, if at the time of the Executive's "separation from service" within the meaning of Section 409A of the Code, the Company determines that the Executive is a "specified employee" within the meaning of Section 409A(a)(2)(B)(i) of the Code, then to the extent any payment or benefit that the Executive becomes entitled to under this Agreement on account of the Executive's separation from service would be considered deferred compensation subject to the 20 percent additional tax imposed pursuant to Section 409A(a) of the Code as a result of the application of Section 409A(a)(2)(B)(i) of the Code, such payment shall not be payable and such benefit shall not be provided until the date that is the earlier of (i) six months and one day after the Executive's separation from service, or (ii) the Executive's death.

(b) The parties intend that this Agreement will be administered in accordance with Section 409A of the Code. To the extent that any provision of this Agreement is ambiguous as to its compliance with Section 409A of the Code, the provision shall be read in such a manner so that all payments hereunder comply with Section 409A of the Code. The parties agree that this Agreement may be amended, as reasonably requested by either party, and as may be necessary to fully comply with Section 409A of the Code and all related rules and regulations in order to preserve the payments and benefits provided hereunder without additional cost to either party.

(c) All in-kind benefits provided and expenses eligible for reimbursement under this Agreement shall be provided by the Company or incurred by the Executive during the time periods set forth in this Agreement. All

reimbursements shall be paid as soon as administratively practicable, but in no event shall any reimbursement be paid after the last day of the taxable year following the taxable year in which the expense was incurred. The amount of in-kind benefits provided or reimbursable expenses incurred in one taxable year shall not affect the in-kind benefits to be provided or the expenses eligible for reimbursement in any other taxable year. Such right to reimbursement or in-kind benefits is not subject to liquidation or exchange for another benefit.

(d) To the extent that any payment or benefit described in this Agreement constitutes "non-qualified deferred compensation" under Section 409A of the Code, and to the extent that such payment or benefit is payable upon the Executive's termination of employment, then such payments or benefits shall be payable only upon the Executive's "separation from service." The determination of whether and when a separation from service has occurred shall be made in accordance with the presumptions set forth in Treasury Regulation Section 1.409A-1(h).

(e) The Company makes no representation or warranty and shall have no liability to the Executive or any other person if any provisions of this Agreement are determined to constitute deferred compensation subject to Section 409A of the Code but do not satisfy an exemption from, or the conditions of, such Section.

10. **Taxes**. All forms of compensation referred to in this Agreement are subject to reduction to reflect applicable withholding and payroll taxes and other deductions required by law. The Executive hereby acknowledges that the Company does not have a duty to design its compensation policies in a manner that minimizes tax liabilities.

11. **Notice and Date of Termination.**

(a) Notice of Termination. The Executive's employment with the Company may be terminated by the Company or the Executive at any time and for any reason. Any termination of the Executive's employment (other than by reason of death) shall be communicated by written Notice of Termination from one party hereto to the other party hereto in accordance with this Section. For purposes of this Agreement, a "Notice of Termination" shall mean a notice which shall indicate the specific termination provision in this Agreement relied upon.

(b) Date of Termination. "Date of Termination" shall mean: (i) if the Executive's employment is terminated by the Executive's death, the date of the Executive's death; (ii) if the Executive's employment is terminated on account of Executive's Disability or by the Company for Cause or without Cause, the date specified in the Notice of Termination; (iii) if the Executive's employment is terminated by the Executive for any reason except for Good Reason, 30 days after the date specified in the Notice of Termination, and (iv) if the Executive's employment is terminated by the Executive with Good Reason, the date specified in the Notice of Termination given after the end of the Cure Period. Notwithstanding the foregoing, in the event that the Executive gives a Notice of Termination to the Company, the Company may unilaterally accelerate the Date of Termination and such acceleration shall not result in the termination being deemed a termination by the Company for purposes of this Agreement.

12. **Litigation and Regulatory Cooperation**. During and after the Executive's employment, and at all times, so long as there is not a significant conflict with the Executive's then employment, the Executive shall cooperate reasonably with the Company in the defense or prosecution of any claims or actions now in existence or which may be brought in the future against or on behalf of the Company which relate to events or occurrences that transpired while the Executive was employed by the Company. The Executive's reasonable cooperation in connection with such claims or actions shall include, but not be limited to, being available to meet with counsel to prepare for discovery or trial and to act as a witness on behalf of the Company at mutually convenient times. During and after the Executive's employment, the Executive also shall cooperate reasonably with the Company in connection with any investigation or review of the Company by any federal, state or local regulatory authority as any such investigation or review relates to events or occurrences that transpired while the Executive was employed by the Company. The Company shall reasonably compensate Executive for the time dedicated to, and shall reimburse the Executive for any reasonable out of pocket expenses incurred in connection with, the Executive's performance of the obligations set forth in this Section; provided, however, that the Company will not pay the Executive any fee or amount for time spent providing testimony in any arbitration, trial, administrative hearing or other proceeding.

13. **Relief**. If the Executive breaches, or proposes to breach, any portion of this Agreement, including the Confidentiality Agreement, or, if applicable, the Separation Agreement and Release, the Company shall be entitled, in addition to all other remedies that it may have, to an injunction or other appropriate equitable relief to restrain any such breach, and, if applicable, the Company shall have the right to suspend or terminate the payments, benefits and/or accelerated vesting, as applicable. Such suspension or termination shall not limit the Company's other options with respect to relief for such breach and shall not relieve the Executive of its duties under this Agreement, the Confidentiality Agreement or the Separation Agreement and Release.

14. **Scope of Disclosure Restrictions**. Nothing in this Agreement or the Confidentiality Agreement prohibits the Executive from communicating with government agencies about possible violations of federal, state, or local laws or otherwise providing information to government agencies, filing a complaint with government agencies, or participating in government agency investigations or proceedings. The Executive is not required to notify the Company of any such communications; provided, however, that nothing herein authorizes the disclosure of information the Executive obtained through a communication that was subject to the attorney-client privilege. Further, notwithstanding the Executive's confidentiality and nondisclosure obligations, the Executive is hereby advised as follows pursuant to the Defend Trade Secrets Act: "An individual shall not be held criminally or civilly liable under any Federal or State trade secret law for the disclosure of a trade secret that (A) is made (i) in confidence to a Federal, State, or local government official, either directly or indirectly, or to an attorney; and (ii) solely for the purpose of reporting or investigating a suspected violation of law; or (B) is made in a complaint or other document filed in a lawsuit or other proceeding, if such filing is made under seal. An individual who files a lawsuit for retaliation by an employer for reporting a suspected violation of law may disclose the trade secret to the attorney of the individual and use the trade secret information in the court proceeding, if the individual (A) files any document containing the trade secret under seal; and (B) does not disclose the trade secret, except pursuant to court order."

15. **Governing Law; Consent to Jurisdiction; Forum Selection**. The resolution of any disputes as to the meaning, effect, performance or validity of this Agreement or the Confidentiality Agreement, or arising out of, related to, or in any way connected with the Executive's employment with the Company or any other relationship between the Executive and the Company ("Disputes") will be governed by the law of the Commonwealth of Massachusetts, excluding laws relating to conflicts or choice of law. The Executive and the Company submit to the exclusive personal jurisdiction of the federal and state courts located in the Commonwealth of Massachusetts in connection with any Dispute or any claim related to any Dispute and agree that any claims or legal action shall be commenced and maintained solely in a state or federal court located in the Commonwealth of Massachusetts.

16. **Integration**. This Agreement constitutes the entire agreement between the parties with respect to compensation, severance pay, benefits and accelerated vesting and supersedes in all respects all prior agreements between the parties concerning such subject matter, including without limitation the Employment Agreement dated as of January 14, 2019 between the Executive and the Company. Notwithstanding the foregoing, the Confidentiality Agreement, and any other agreement or obligation relating to confidentiality, noncompetition, non-solicitation or assignment of inventions shall not be superseded by this Agreement, and, as described in Section 8 above, the Executive acknowledges and agrees that any such agreements and obligations remain in full force and effect. For purposes of this Agreement, the Company shall include affiliates and subsidiaries thereof.

17. **Enforceability**. If any portion or provision of this Agreement (including, without limitation, any portion or provision of any Section of this Agreement) shall to any extent be declared illegal or unenforceable by a court of competent jurisdiction, then the remainder of this Agreement, or the application of such portion or provision in circumstances other than those as to which it is so declared illegal or unenforceable, shall not be affected thereby, and each portion and provision of this Agreement shall be valid and enforceable to the fullest extent permitted by law.

18. **Waiver**. No waiver of any provision hereof shall be effective unless made in writing and signed by the waiving party. The failure of any party to require the performance of any term or obligation of this Agreement, or the waiver by any party of any breach of this Agreement, shall not prevent any subsequent enforcement of such term or obligation or be deemed a waiver of any subsequent breach.

19. **Notices**. Any notices, requests, demands and other communications provided for by this Agreement shall be sufficient if in writing and (i) sent by email to the email addresses used by the CEO or by the Executive (as applicable) in their usual course of business; (ii) delivered by hand; (iii) sent by a nationally recognized overnight courier service or (iv) sent by registered or certified mail, postage prepaid, return receipt requested, in each case (clauses (iii) and (iv)) to the Executive at the last address the Executive has filed in writing with the Company, or (as applicable) to the Company at its main office, attention of the CEO or Vice President, Human Resources.

20. **Amendment**. This Agreement may be amended or modified only by a written instrument signed by the Executive and by a duly authorized representative of the Company.

21. **Assignment and Transfer by the Company; Successors**. The Company shall have the right to assign and/or transfer this Agreement to any entity or person, including without limitation the Company's parents, subsidiaries, other affiliates, successors, and acquirers of Company stock or other assets, provided that such entity or person receives all or substantially all of the Company's assets. The Executive hereby expressly consents to such assignment and/or transfer. This Agreement shall inure to the benefit of and be enforceable by the Company's assigns, successors, acquirers and transferees.

22. **Counterparts**. This Agreement may be executed in any number of counterparts, each of which when so executed and delivered shall be taken to be an original, but all of which together shall constitute one and the same document.

IN WITNESS WHEREOF, the parties have executed this Agreement effective on the date and year first above written.

VOYAGER THERAPEUTICS, INC.

By: */s/ Andre Turenne*

Name: Andre Turenne

Title: President & Chief Executive Officer

EXECUTIVE:

/s/ Omar Khwaja
Omar Khwaja, M.D., Ph.D.

Exhibit 10.3

Certain identified information has been excluded from the exhibit because it is both (i) not material and (ii) would likely cause competitive harm to the Company, if publicly disclosed. Double asterisks denote omissions.

TERMINATION AGREEMENT

This TERMINATION AGREEMENT (the "**Agreement**"), is entered into as of June 14, 2019 (the "**Agreement Date**"), to terminate that certain Collaboration Agreement, dated February 11, 2015, as amended by Amendment No. 1 to Collaboration Agreement, dated March 28, 2017 (together, the "**Collaboration Agreement**"), by and between Voyager Therapeutics, Inc., a corporation organized and existing under the laws of Delaware ("**Voyager**"), and Genzyme Corporation, a corporation organized and existing under the laws of the Commonwealth of Massachusetts ("**Genzyme**"). Genzyme and Voyager are each referred to herein as a "**Party**" and collectively as the "**Parties**."

RECITALS

WHEREAS, with respect to the PD Collaboration Program, the Parties have previously entered into a Post-Termination Agreement under Collaboration Agreement, dated December 8, 2017;

WHEREAS, the Parties now wish to terminate the Collaboration Agreement, including their respective rights and obligations under the FA Collaboration Program, the HD Collaboration Program, the SMA Collaboration Program and the Future Collaboration Program subject to the surviving rights and obligations set forth herein;

WHEREAS, the Parties wish to grant and receive certain licenses relating to the FA Collaboration Program, the HD Collaboration Program and the SMA Collaboration Program;

WHEREAS, the Parties will simultaneously enter into an Amended and Restated Option and License Agreement, of even date herewith, pursuant to which Voyager will grant Genzyme certain rights with respect to capsids Controlled by Voyager; and.

NOW, THEREFORE, for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties hereto, intending to be legally bound, hereby agree as follows:

1. **Definitions**. Capitalized terms that are not defined in this Agreement shall have the meaning set forth in the Collaboration Agreement. Unless specifically set forth to the contrary herein, the following terms, whether used in the singular or plural shall have the respective meanings set forth herein.

   1.1 "**Active MTAs**" means the material transfer agreements set forth in Schedule 1.1.

   1.2 "**FA Collaboration Product**" means any Gene Therapy Product developed by either Party or jointly under a FA Collaboration Program.

1.3 "**HD Collaboration Product**" means any Gene Therapy Product developed by either Party or jointly under a HD Collaboration Program.

1.4 "**Genzyme HD Sequence**" means a sequence set forth in Schedule 1.4. For purposes of clarity, the Genzyme [**] HD Sequence is a Genzyme HD Sequence.

1.5 "**Genzyme [**] HD Sequence**" means the sequence identified as SEQ ID No. [**] and set forth in Schedule 1.4, and any variations or derivatives thereof which target the same region of the HTT gene as registered at GenBank [**].

1.6 "**Genzyme Stuffer Sequence**" means the sequence in Schedule 1.3 and, subject to the assessment performed under Section 7.3, any derivatives thereof that are reasonably useful as filler sequence(s) in a viral vector in order to achieve the length acceptable for AAV vector packaging or encapsulation into infectious virus particles.

1.7 "**Post-Termination FA Product**" means any of the following: (a) the FA Collaboration Product known as VY-FXN01, (b) any other FA Collaboration Product Developed by the Parties before the Agreement Date, and (c) any Gene Therapy Product in the field of FA for which the Development, Manufacture, or Commercialization of such Gene Therapy Product would infringe at least one Valid Claim of a Collaboration Patent Right.

1.8 "**Post-Termination HD Product**" means any of the following: (a) the HD Collaboration Product known as VY-HTT01, (b) any other HD Collaboration Product Developed by the Parties before the Agreement Date, (c) any Gene Therapy Product encoding an miRNA with at least [**]% similarity to the HTT miRNA encoded by VY-HTT01, and (d) any Gene Therapy Product in the field of HD for which the Development, Manufacture, or Commercialization of such Gene Therapy Product would infringe at least one Valid Claim of a Collaboration Patent Right. Notwithstanding the foregoing, Post-Termination HD Product shall not include any Gene Therapy Product encoding a miRNA identified as a Genzyme HD Sequence.

1.9 **"Post-Termination SMA Product**" means any of the following: (a) the SMA Collaboration Product formerly known as [**], (b) any other SMA Collaboration Product Developed by the Parties before the Agreement Date, and (c) any Gene Therapy Product in the field of SMA for which the Development, Manufacture, or Commercialization of such Gene Therapy Product would infringe at least one Valid Claim of a Collaboration Patent Right.

1.10 "**Residual Knowledge**" means, with respect to a Party, intangible Know-How developed in the course of or relating to the Collaboration or otherwise to this Agreement or the Collaboration Agreement that has not been licensed to such Party or for which such Party does not otherwise have rights and that has been unintentionally retained in the unaided memories of any employees, contractors, or consultants of such Party. An individual's memory is unaided if the individual has

not intentionally memorized such information for the purposes of retaining and subsequently using or disclosing it.

1.11 "**SMA Collaboration Product**" means any Gene Therapy Product developed by either Party or jointly under a SMA Collaboration Program.

2. **Termination of Collaboration Agreement**. As of the Agreement Date, the Parties mutually agree that the Collaboration Agreement is terminated in its entirety and all rights and obligations under the Collaboration Agreement shall cease, except as provided in this Agreement. For the avoidance of doubt, subject to the terms of this Agreement, as of the Agreement Date:

2.1 Except as explicitly set forth herein, the Collaboration shall terminate and performance of the Collaboration shall cease in its entirety;

2.2 All license grants in the Collaboration Agreement from either Party to the other shall immediately terminate;

2.3 Genzyme's right to designate a Voyager CNS Orphan Disease Program as a Collaboration Program under Section 2.2.1 of the Collaboration Agreement shall immediately terminate;

2.4 All exclusivity obligations under Section 13.5 of the Collaboration Agreement shall immediately terminate;

2.5 Voyager's right to elect to use a Genzyme HD Sequence under Sections 4.6 and 9.1.6.3(b)(iv) of the Collaboration Agreement shall immediately terminate;

2.6 Voyager's right to make the Producer Cell Process Election under Sections 4.7.1 and 9.1.6.3(b)(v) of the Collaboration Agreement shall immediately terminate; and

2.7 The Parties acknowledge that, (a) other than the Active MTAs, all material transfer agreements entered into by the Parties in connection with the Collaboration Agreement have expired, and (b) except as provided in Section 8.1 of this Agreement, all SOWs for In-Kind Services under the Collaboration Agreement have been completed.

3. **Reversion of Collaboration Programs**. As of the Agreement Date, (a) the SMA Collaboration Program shall revert to Genzyme, and Genzyme shall have the right to continue the research and Development of Gene Therapy Products previously conducted in the SMA Collaboration Program by the Parties and the Commercialization of products resulting therefrom; (b) the FA Collaboration Program shall revert to Voyager, and Voyager shall have the right to continue the research and Development of Gene Therapy Products previously conducted in the FA Collaboration by the Parties and the Commercialization of products resulting therefrom; and (c) the HD Collaboration Program, excluding the Genzyme HD Sequences, shall revert to Voyager, and Voyager shall have the right to continue the research and Development of Gene Therapy Products

previously conducted in the HD Collaboration Program, excluding the Genzyme HD Sequences, by the Parties and the Commercialization of products resulting therefrom.

4. **Licenses Granted to Voyager**. Subject to the terms and conditions of this Agreement, as of the Agreement Date, Genzyme hereby grants to Voyager:

4.1 License Grants Relating to FA Collaboration Program.

(a) An exclusive (even as to Genzyme), irrevocable, perpetual, royalty-free, fully-paid sublicensable (through multiple tiers), non-transferable (except in accordance with Section 17.1 of the Collaboration Agreement), worldwide license under Genzyme's interest in the Collaboration Technology generated under or used in the FA Collaboration Program to Manufacture, Develop and Commercialize Post-Termination FA Products; and

(b) A non-exclusive, irrevocable, perpetual, royalty-free, fully-paid, sublicensable (through multiple tiers), non-transferable (except in accordance with Section 17.1 of the Collaboration Agreement), worldwide license under the Genzyme Technology (excluding any Patent Rights Covering or Know-How related to the Genzyme Producer Cell Process) that has been used in the Development or Manufacture of a Post-Termination FA Product prior to the Agreement Date to Develop, Manufacture, and Commercialize such Post-Termination FA Product.

4.2 License Grants Relating to HD Collaboration Program.

(a) An exclusive (even as to Genzyme), sublicensable (through multiple tiers), non-transferable (except in accordance with Section 17.1 of the Collaboration Agreement), worldwide license under Genzyme's interest in the Collaboration Technology generated under or used in the HD Collaboration Program to Manufacture, Develop and Commercialize Post-Termination HD Products; and

(b) A non-exclusive sublicensable (through multiple tiers), non-transferable (except in accordance with Section 17.1 of the Collaboration Agreement), worldwide license under the Genzyme Technology (excluding any Patent Rights Covering or Know-How related to the Genzyme Producer Cell Process) that has been used in the Development or Manufacture of a Post-Termination HD Product prior to the Agreement Date to Develop, Manufacture, and Commercialize the Post-Termination HD Product.

(c) The licenses granted by Genzyme to Voyager under the foregoing clauses (a) and (b) shall be royalty-bearing for the Post-Termination Royalty Term applicable to each Post-Termination HD Product in each country in the world, and, after the Post-Termination Royalty Term applicable to such Post-Termination HD Product in such country, shall convert to a fully-paid, perpetual, exclusive license (in the case of the license granted in clause (a)) or non-exclusive license (in the case of the license granted in clause (b)) in such country.

(d) For purposes of clarity, the licenses granted by Genzyme to Voyager under the foregoing clauses (a) and (b) do not include any rights under Genzyme Patent Rights or under the Genzyme Collaboration Patent Rights Covering the Genzyme HD Sequences or rights to any Know How related to the Genzyme HD Sequences.

5. **License Granted to Genzyme**. Subject to the terms and conditions of this Agreement, as of the Agreement Date, Voyager hereby grants to Genzyme an exclusive (even as to Voyager), royalty-free, fully-paid, sublicensable (through multiple tiers), non-transferable (except in accordance with Section 17.1 of the Collaboration Agreement), worldwide license under Voyager's interest in the Collaboration Technology generated under or used in the SMA Collaboration Program, to Manufacture, Develop, and Commercialize any Post-Termination SMA Product.

6. **Know-How Covenants Not to Sue and Destruction of Competitively Sensitive Information**.

6.1 Except to enforce the provisions of Section 6.3 below, Genzyme, on behalf of itself and its Affiliates and their respective directors, officers, employees and agents, (collectively, in such capacities, the "**Genzyme Parties**") and its and their respective successors and assigns, hereby covenants not to sue or assert any claim or liability against any Voyager Party (as defined below) with respect to any Residual Knowledge that constitutes Genzyme Know-How or Joint Collaboration Know-How.

6.2 Except to enforce the provisions of Section 6.3, Voyager, on behalf of itself and its Affiliates and their respective directors, officers, employees and agents (collectively, in such capacities, the "**Voyager Parties**") and its and their respective successors and assigns, hereby covenants not to sue or assert any claim or liability against any Genzyme Party with respect to any Residual Knowledge that constitutes Voyager Know-How or Joint Collaboration Know-How.

6.3 Nothing in this Agreement or the Collaboration Agreement shall restrict either the Genzyme Parties or the Voyager Parties from using Residual Knowledge, provided, however, that if any such Residual Knowledge is, as between the Parties, the Confidential Information solely of the other Party (in such capacity, the "Disclosing Party"), (a) any such use shall be subject to the non-disclosure obligations under Section 10.1 of the Collaboration Agreement and (b) individuals within the Genzyme Parties or Voyager Parties who hold Residual Knowledge shall not (whether orally, electronically or in writing) reference the Disclosing Party in connection with, or attribute to the Disclosing Party, any such Residual Knowledge. By way of example, neither Party shall be prohibited from utilizing a particular assay, process, protocol, dosage, or similar Know-How held as Residual Knowledge, but the individuals holding such Residual Knowledge shall not disclose (including to fellow individuals or entities within the Genzyme Parties or Voyager Parties, as the case may be) whether or not the Disclosing Party uses or has used any such particular assays, processes, protocols, dosages, or other non-public specifics.

6.4 Destruction of Confidential Information.

(a) Within [**] of the Agreement Date

(i) each Party shall delete from any of its respective sharepoint sites (or if such Party did not use sharepoint, then any similar central data repository that were used as the primary channel to share information regarding the Collaboration) any Confidential Information solely of the other Party, and

(ii) the Alliance Manager for each of the Parties shall send an e-mail to their respective team members still employed by such Party and who had access to any such sharepoint site or central data repository as described in the preceding subclause (i), instructing each such team member to (X) delete and/or destroy all electronic and printed files containing Confidential Information solely of the other Party, and (Y) to send an email to the Alliance Manager confirming that such deletion and/or destruction has been completed;

provided that in either case of (i) and (ii), neither Party will be required to destroy any computer files that are created during automatic system back-ups and stored securely by such Party.

(b) Within [**] of the Agreement Date, upon written request of the other Party, the Alliance Manager shall provide a certificate confirming that the requirements of 6.4(a) have been satisfied.

6.5 Notwithstanding anything to the contrary contained in Section 6.1, Section 6.2, Section 6.3 and Section 6.4, and unless explicitly stated otherwise herein, neither Party is obliged to provide the other Party with any Know-How, nor explain or further educate the other Party regarding any Know-How

7. **Covenants regarding Collaboration Patent Rights**.

7.1 Voyager covenants that it, will not, and will cause its Affiliates, licensees, and sublicensees to not, file or prosecute any claim in the Joint Collaboration Patent Rights or Voyager Collaboration Patent Rights referring directly or indirectly to the Genzyme [**] HD Sequence or any other Genzyme HD Sequence. Voyager shall cancel any such claims within [**] of the Agreement Date.

7.2 Neither Party shall be permitted, other than as provided pursuant to the licenses granted under Section 4 and Section 5 of this Agreement, to enter into a stand-alone license to any Joint Collaboration Patent Rights to a Third Party without the prior written consent of the other Party; provided, however, that in the context of a *bona fide* collaboration with a Third Party requiring a license under multiple Patent Rights, either Party may license its interest under any Joint Collaboration Patent Rights to such Third Party, without the consent of the other Party, which are necessary to Develop, Manufacture or Commercialize Post-Termination HD

Products, Post-Termination FA Products or Post-Termination SMA Products consistent with the rights respectively allocated to the Parties in Section 3. Neither Party shall be permitted to assign its interest in the Joint Collaboration Patent Rights to a Third Party without the prior written consent of the other Party. Notwithstanding the foregoing, either Party may, without the other Party's written consent, assign its interest in the Joint Collaboration Patent Rights to a party that acquires, by or otherwise in connection with, merger, sale of assets or otherwise, all or substantially all of the business of the assigning Party to which the subject matter of the Joint Collaboration Patent Right relates, provided that the assignee agrees in writing to assume all of the assigning Party's obligations under this Agreement.

7.3 The Parties agree to use [**] of [**] as IP counsel to conduct an inventorship assessment of any inventions claimed in the Voyager Collaboration Patent Rights that include all or a portion of Genzyme's Stuffer Sequence. If the Parties later decide to change IP counsel conducting this analysis, the Parties will work together in good faith to select a new IP counsel having appropriate experience. The costs of the inventorship assessment will be borne equally by the parties. The inventorship assessment shall determine inventorship in accordance with U.S. patent laws. If the results of the inventorship assessment are that one or more employees of Genzyme or its Affiliates (or a Third Party acting on their behalf) are inventor(s) of any claimed invention, then Voyager shall take, at its sole expense, all reasonable actions with respective patent offices that are necessary to add such Genzyme employee or employees as inventors and Genzyme as a co-applicant or co-owner, as the case may be. At Genzyme's sole discretion, if any claim for which a Genzyme employee or employees must be added as an inventor or inventors is pending in a patent application, then Genzyme may request that Voyager, at its sole expense, cancel such claim or claims and take all steps reasonably available (including cooperating with Genzyme and its external counsel) in order to establish divisional or similar applications that solely contain claims invented by the Genzyme employee or employees, and such divisional or similar applications will become Genzyme Patent Rights. If any claim for which a Genzyme employee or employees must be added as an inventor or inventors is found in an issued patent, Voyager will fully cooperate with Genzyme (and its external counsel) with regard to adding and formally registering Genzyme as a co-owner of the patent.

8. **Program Transition**.

8.1 [**] Study. Following the Agreement Date, Genzyme shall continue to conduct the ongoing [**] study, as described more fully in Schedule 8.1 to this Agreement (the "**[**] Study**"), and Genzyme shall complete such [**] Study and provide to Voyager in electronic form the raw data described on Schedule 8.1, and in the format described on Schedule 8.1 by [**] unless otherwise mutually agreed by the Parties. Performance of the [**] Study shall be at Genzyme's sole cost and expense. The Parties further agree that once Genzyme has provided the information required under Schedule 8.1, it shall have no further obligation to Voyager to conduct any further studies, or provide any other data relating to the [**] Study.

8.2 Voyager Document Request. Until the date that is [**] after the Agreement Date, Voyager may request from Genzyme copies of specific data, reports, records, materials or other information that relate to the Development, Manufacture or Commercialization of any HD Collaboration Product, and Genzyme shall provide such data, reports, records, materials or other information if available. Such data, reports, records, materials or other information may include (a) governmental or regulatory correspondence, conversation logs and filings solely relating to any HD Collaboration Product, (b) non-clinical and clinical data relating to the HD Collaboration Program and (c) adverse event data related to any HD Collaboration Product, in each case, in Genzyme's possession or Control.

8.3 Genzyme Document Request. Until the date that is [**] after the Agreement Date, Genzyme may request from Voyager copies of specific data, reports, records, materials or other information that relate to the Development, Manufacture or Commercialization of any SMA Collaboration Product, and Voyager shall provide such data, reports, records, materials or other information if available. Such data, reports, records, materials or other information may include (a) governmental or regulatory correspondence, conversation logs and filings solely relating to any SMA Collaboration Product, (b) non-clinical and clinical data relating to the SMA Collaboration Program and (c) adverse event data related to any SMA Collaboration Product, in each case, in Voyager's possession or Control.

9. **Prosecution and Maintenance, Defense and Enforcement of Patent Rights**.

9.1 Voyager shall have the sole responsibility to, at Voyager's discretion and at Voyager's sole cost and expense, file, prosecute and maintain (including the defense of any interference or opposition proceedings or *inter partes* review), all (a) Voyager Patent Rights, (b) Voyager Collaboration Patent Rights that do not solely relate to any SMA Collaboration Product and (c) any Joint Collaboration Patent Rights that solely relate to any Post-Termination FA Product or Post-Termination HD Product. Genzyme shall have no rights under Section 15.2.1.3 of the Collaboration Agreement or otherwise to prosecute or maintain any Voyager Collaboration Patent Rights set forth above in this subsection.

9.2 Voyager shall have the sole and exclusive right, but not the obligation, to take any reasonable measures it deems appropriate with respect to any infringement of any (a) Voyager Technology, (b) Voyager Collaboration Technology that does not solely relate to any Post-Termination SMA Product, (c) Joint Collaboration Technology that solely relates to any (i) Post-Termination FA Product or (ii) Post-Termination HD Product, and (d) Genzyme Collaboration Technology that solely relates to any (i) Post-Termination FA Product or (ii) Post-Termination HD Product. Voyager shall not be obligated to share any amounts recovered as a result of any such measures with Genzyme.

9.3 Genzyme shall have the sole responsibility to, at Genzyme's discretion and at Genzyme's sole cost and expense, file, prosecute and maintain (including the defense of any interference or opposition proceedings or *inter partes* review), all

(a) Genzyme Patent Rights, (b) Genzyme Collaboration Patent Rights that do not solely relate to any Post-Termination FA Product or Post-Termination HD Product, (c) Joint Collaboration Patent Rights that solely relate to any Post-Termination SMA Product, (d) Voyager Collaboration Patent Rights that solely relate to any Post-Termination SMA Product and (e) Patent Rights that Cover Genzyme HD Sequence Technology and/or one or more Genzyme HD Sequences. Voyager shall have no rights under Section 15.2.2.2(c) of the Collaboration Agreement or otherwise to prosecute or maintain any Patent Rights set forth above in this subsection.

9.4 Genzyme shall have the sole and exclusive right, but not the obligation, to take any reasonable measures it deems appropriate with respect to any infringement of any (a) Genzyme Technology, (b) Genzyme Collaboration Technology that does not solely relate to any (i) Post-Termination FA Product or (ii) Post-Termination HD Product, (c) Joint Collaboration Technology that solely relates to any Post-Termination SMA Product, (d) Voyager Collaboration Technology that solely relates to any Post-Termination SMA Product and (e) Patent Rights that Cover Genzyme HD Sequence Technology and/or one or more Genzyme HD Sequences. Genzyme shall not be obligated to share any amounts recovered as a result of any such measures with Voyager.

10. **Financial Terms**.

10.1 Certain Definitions. For purposes of construing certain defined terms used in this Section 10, including but not limited to the definition of Net Sales, First Commercial Sale and Step-Down Product, references to "Licensed Product" in the corresponding definitions under the Collaboration Agreement shall be read to mean "Post-Termination HD Product" and references to "Genzyme" shall be replaced with "Voyager" and in each case applied *mutatis mutandis* to the situation involving Licensed Products sold by Genzyme under the Collaboration Agreement.

10.2 No Payments Owed under Collaboration Agreement. Each Party agrees that it is not owed any amounts by the other Party under the Collaboration Agreement as of immediately prior to the Agreement Date.

10.3 Upfront Payment. Voyager shall pay Genzyme Ten Million Dollars ($10,000,000) within fifteen (15) days of the Agreement Date.

10.4 HD Milestone Payment. Voyager shall pay Genzyme Ten Million Dollars ($10,000,000) within fifteen (15) days of the first IND filing for a Post-Termination HD Product (such IND filing, the "**HD IND Filing**").

10.5 Sublicense Fees. In consideration of the licenses and rights granted to Voyager hereunder, Voyager shall pay to Genzyme the percentages of all Third Party Fees receivable from any of Voyager's Sublicensees as set forth below ("**Sublicense Fees**"). As used herein, "**Third Party Fee**" means that portion of any consideration in any form due to Voyager or one of its Affiliates by a Sublicensee attributable to

any rights to either (a) a Post-Termination FA Product in any country of the world other than the United States, or (b) a Post-Termination HD Product in any country in the world, excluding such amounts received by Voyager or its Affiliates as (x) reimbursement or payment for reasonable, incremental costs (not including any capital expenditures) to be incurred by Voyager or its Affiliates in the performance of research or development activities relating to Post-Termination HD Products or Post-Termination FA Products or (y) reimbursement or payment for unreimbursed costs and expenses with respect to prosecution and maintenance of Patent Rights relating to Post-Termination HD Products or Post-Termination FA Products that are incurred by Voyager or its Affiliates with respect to Patent Rights that are licensed to Voyager pursuant to this Agreement and incurred after the Agreement Date; provided, that the aggregate amount of deductions from Third Party Fees solely because of the exclusions set forth in subclause (x) and (y) shall in no event exceed [**] percent ([**]%) of what Third Party Fees would have been without giving effect to subclauses (x) and (y). For clarity, payments made by a Sublicensee in consideration of equity or debt securities of Voyager sold at fair market value to the Sublicensee shall not be considered a Third Party Fee, provided that amounts paid in consideration of equity or debt securities of Voyager in excess of fair market value shall be considered a Third Party Fee. For purposes of this Agreement, "**Sublicensee**" means a Third Party to whom Voyager grants a direct or indirect sublicense under any of the Collaboration Technology or Genzyme Technology.

Product	**Third Party Fee**	**Sublicense Fee**
Post-Termination FA Product	Third Party Fees, excluding any Third Party Fees from Neurocrine Biosciences Inc., in excess of $[**] (the "**FA Threshold**") that are owed pursuant to an agreement executed before first patient dosed in a Clinical Study in the United States, [**] (the "**FA End Date**").	[**]% of Third Party Fee in excess of the FA Threshold

Post-Termination HD Product	Third Party Fees in excess of $[**] (the "**Initial HD Threshold**") that are owed pursuant to an agreement executed prior to the HD IND Filing.	50% of Third Party Fee in excess of the Initial HD Threshold
	Third Party Fees in excess of $[**] (the "**Second HD Threshold**") that are owed pursuant to an agreement executed after the HD IND Filing but before first patient dosed in a Clinical Study for HD in the United States, [**] (the "**HD End Date**").	50% of Third Party Fee in excess of the Second HD Threshold

Voyager shall pay all Sublicense Fees received during each Calendar Quarter within [**] following the expiration of each such Calendar Quarter. All payments shall be accompanied by a report that includes a calculation of all Sublicense Fees payable to Voyager for the applicable Calendar Quarter. For the avoidance of doubt, no Sublicense Fees shall be due with respect to any amounts received (i) from Neurocrine Biosciences, Inc. related to any Post-Termination FA Product, (ii) pursuant to agreements executed after the FA End Date, or (iii) pursuant to agreements executed after the HD End Date.

10.6 Royalties Payable to Genzyme. Voyager shall pay to Genzyme royalties on annual worldwide Net Sales by Voyager and its Related Parties of [**] percent ([**]%) of the worldwide Net Sales of each Post-Termination HD Product until the latest (determined on a Post-Termination HD Product-by-Post-Termination HD Product and country-by-country basis) of (a) the expiration of the last Valid Claim of the Patent Rights included in the license granted by Genzyme to Voyager under Section 4.2(a) or Section 4.2(b) of this Agreement, in each case Covering the Manufacture, use, offer for sale, sale or importation of such Post-Termination HD Product in a country, (b) the expiration of Regulatory Exclusivity for such Post-Termination HD Product in such country, or (c) the [**] of the First Commercial Sale of such Post-Termination HD Product in such country (the "**Post-Termination Royalty Term**").

10.7 Third Party Royalty Offsets. Voyager may reduce the amount of royalties payable under Section 10.6 with respect to any Post-Termination HD Product on a country-by-country basis by [**] percent ([**]%) of the amounts payable by Voyager to any Third Party in consideration for a license, granted after the Agreement Date, to any Patent Right which Covers such Post-Termination HD Product in such country; provided, however, that the royalties payable under Section 10.6 with respect to such Post-Termination HD Product on a country-by-country basis shall not be reduced in any such event below [**] percent ([**]%) of the amounts set forth in Section 10.6 by applying the reduction set forth in this Section 10.7; and provided, further, that if any of such amounts cannot be offset against royalties due with respect to such Post-Termination HD Product for any given royalty period due to the preceding proviso, such unused amount may be

carried forward and offset against royalties due with respect to such Post-Termination HD Product in future royalty periods.

10.8 Royalty Adjustment for No Patent Rights, No Regulatory Exclusivity and Step-Down Products. If, on a country-by-country basis at any time during the Royalty Term, (a) both (i) the Manufacture, use, offer for sale, sale or importation of a Post-Termination HD Product is not Covered by any Valid Claim in the Patent Rights included in the license granted by Genzyme to Voyager under Section 4.2(a) or Section 4.2(b) of this Agreement in such country and (ii) there is no applicable Regulatory Exclusivity in such country for such Post-Termination HD Product or (b) both (i) one or more Third Parties have received Regulatory Approval to sell in such country a Step-Down Product with respect to such Post-Termination HD Product and (ii) Voyager's Net Sales of such Licensed Product in such country during any four (4) consecutive Calendar Quarters following the date on which such Step-Down Product is first commercially available in such country are less than [**] percent ([**]%) of Voyager's Net Sales of such Post-Termination HD Product in such country during the four (4) full Calendar Quarters immediately preceding to the date on which such Step-Down Product is first commercially available in such country, then the royalties payable pursuant to Section 10.6 on the Net Sales of such Post-Termination HD Product in such country shall thereafter be reduced to [**] percent ([**]%) of the amounts otherwise payable pursuant to Section 10.6 with respect to such Post-Termination HD Product in such country.

10.9 Reports; Payment of Royalty. During the term of this Agreement, following the First Commercial Sale of any Post-Termination HD Product by or on behalf of Voyager, Voyager shall furnish to Genzyme a written report within [**] after the end of each Calendar Quarter showing, on a Post-Termination HD Product-by-Post-Termination HD Product basis, the Net Sales of each Post-Termination HD Product and the royalties payable under this Agreement with respect to each such Post-Termination HD Product. Royalties shown to have accrued by each royalty report shall be due and payable [**] following the date such royalty report is due.

10.10 Audits.

(a) On a Post-Termination HD Product-by-Post-Termination HD Product basis and if (and only if) Voyager executes a sublicense that gives rise to Third Party Fees with respect to a Post-Termination FA Product (excluding any Third Party Fees from Neurocrine Biosciences Inc.) prior to the FA End Date, a Post-Termination FA Product-by-Post-Termination FA Product basis, upon the written request of Genzyme and not more than [**], Voyager and its Related Parties shall permit an independent certified public accounting firm of internationally-recognized standing selected by Genzyme and reasonably acceptable to Voyager, at Genzyme's expense except as set forth below, to have access during normal business hours to such of the records of the other Party as may be reasonably necessary to verify the accuracy of the royalty and other amounts payable (including Third Party Fees) or reports under this Agreement in respect of such

Post-Termination HD Product or Post-Termination FA Product for any year ending not more than [**] prior to the date of such request for the sole purpose of verifying the basis and accuracy of payments made under this in respect of such Post-Termination HD Product or Post-Termination FA Product as applicable. Notwithstanding the foregoing, Genzyme may not make more than [**], provided that a request may cover multiple Post-Termination HD Products and/or Post-Termination FA Products.

(b) If such accounting firm identifies a discrepancy made during such period, Voyager shall pay the other Party the amount of the discrepancy, within [**] after the date Genzyme delivers to Voyager such accounting firm's written report so concluding, or as otherwise agreed by the Parties in writing. The fees charged by such accounting firm shall be paid by Genzyme, unless such discrepancy represents an underpayment by Voyager of at least [**] percent ([**]%), on a Post-Termination HD Product-by-Post-Termination HD Product basis or Post-Termination FA Product-by- Post-Termination FA Product basis, of the total amounts due in respect of such Post-Termination HD Product or Post-Termination FA Product as applicable in the audited period, in which case such fees shall be paid by Voyager.

(c) Unless an audit for such year has been commenced prior to and is ongoing upon the [**] of the end of such year, the calculation of royalties, expense reimbursement and other payments payable with respect to such year shall be binding and conclusive upon both Parties, and each Party and its Related Parties shall be released from any further liability or accountability with respect to such royalties or expense reimbursement for such year.

(d) Genzyme shall treat all financial information subject to review under this Section 10.10 or under any sublicense agreement in accordance with the confidentiality and non-use provisions of Section 10 of the Collaboration Agreement (Confidentiality and Publication), and shall cause its accounting firm to enter into a confidentiality agreement with Voyager or its Related Parties obligating it to retain all such information in confidence pursuant to such confidentiality agreement, which terms shall be no less stringent than the provisions of Section 10 of the Collaboration Agreement (Confidentiality and Publication).

10.11 Payment Exchange Rate. All payments to be made under this Agreement shall be made in United States dollars and shall be paid by bank wire transfer in immediately available funds to such bank account in the United States as may be designated in writing by the receiving Party from time to time. In the case of Net Sales made or expenses incurred by Voyager and its Related Parties in currencies other than United States dollars during a Calendar Quarter, the rate of exchange to be used in computing the amount of United States dollars due shall be the rate of exchange utilized by Voyager in its worldwide accounting system and calculated in accordance with GAAP.

10.12 Late Payments. If a Party does not receive payment of any sum due to it on or before the due date therefor, simple interest shall thereafter accrue on the sum due

to such Party from the due date until the date of payment at a per-annum rate of [**] percent ([**]%), or the maximum rate allowable by Applicable Law, whichever is less.

10.13 Blocked Payments. If, by reason of Laws in any jurisdiction of the world, it becomes impossible or illegal for Voyager to transfer royalties or other payments under this Agreement to Genzyme, Voyager shall promptly notify Genzyme. During any such period described above, Voyager shall deposit such payments in local currency in the relevant jurisdiction to the credit of Genzyme in a recognized banking institution designated by Genzyme or, if none is designated by Genzyme within a period of [**], in a recognized banking institution selected by Voyager and identified in a written notice given to Genzyme.

10.14 Taxes. If a timely and appropriately completed and executed Internal Revenue Service Form W-9 is provided by Genzyme to Voyager, the Parties acknowledge and agree that no United States tax withholding shall be applied with respect to any payments due under this Section 10 (Financial Terms). Voyager shall use reasonable efforts to minimize tax withholding on payments made to Genzyme. Notwithstanding such efforts, if Voyager concludes that tax withholdings under the Laws of any country are required with respect to payments to Genzyme, Voyager shall first notify Genzyme and provide Genzyme with [**] to determine whether there are actions Genzyme can undertake to avoid such withholding. During this notice period, Voyager shall refrain from making such payment until Genzyme instructs Voyager that (a) Genzyme intends to take actions (satisfactory to both Parties) that shall obviate the need for such withholding, in which case Voyager shall make such payment only after it is instructed to do so by Genzyme, or (b) Voyager should make such payment and withhold the required amount and pay it to the appropriate Governmental Authority. Notwithstanding the foregoing, if, as a result of (i) a permitted assignment of this Agreement (in whole or in part) by Voyager to an Affiliate or a Third Party outside of the United States or (ii) the exercise by Voyager of its rights under this Agreement (in whole or in part) through an Affiliate or Third Party outside of the United States (or the direct exercise of such rights by an Affiliate of such Party outside of the United States), foreign withholding tax in excess of the foreign withholding tax amount that would have been payable by Voyager in the absence of such assignment or exercise of rights becomes payable with respect to amounts due to Genzyme hereunder or thereunder, such amounts owed by Voyager to Genzyme shall be increased so that the amount actually paid by Voyager to Genzyme equals the amount that would have been payable to Genzyme by Voyager in the absence of such excess withholding (after withholding of the excess withholding tax and any additional withholding tax on such increased amount). However, if a similar assignment or exercise of rights described in (i) or (ii) of the preceding sentence by Genzyme results in foreign withholding tax in excess of the foreign withholding tax amount that would have been payable in the absence of such assignment or exercise of rights to Genzyme, any amount due to Genzyme shall not be increased for such excess withholding and, subject to the terms of this Agreement, the required amount shall be withheld

and submitted to the appropriate Governmental Authority. In all cases, whether or not there has been a permitted assignment of this Agreement by Voyager or the exercise by Voyager of its rights under this Agreement through an Affiliate or Third Party, (A) Voyager shall promptly provide Genzyme with copies of receipts or other evidence reasonably required and sufficient to allow Genzyme to document such tax withholdings adequately for purposes of claiming foreign tax credits and similar benefits, (B) the Parties shall cooperate reasonably in completing and filing documents required under the provisions of any applicable tax laws or under any other applicable Law, in connection with the making of any required tax payment or withholding payment, or in connection with any claim to a refund of or credit for any such payment, and (C) the Parties shall cooperate to minimize such taxes in accordance with applicable Laws, including using reasonable efforts to access the benefits of any applicable treaties.

10.15 Payment of Back Royalties. If Voyager would owe a royalty payment to Genzyme under this Section 10 (Financial Terms) but for a decision by a court or other governmental agency of competent jurisdiction holding a patent claim unenforceable, unpatentable or invalid and if such decision is later vacated or reversed by a final nonappealable decision by a court or other governmental agency of competent jurisdiction, Genzyme may invoice Voyager for such unpaid royalty payments after such decision is vacated or reversed and Voyager shall make any such unpaid royalty payments to Genzyme within [**] after receipt of such invoice.

11. **Confidential Information**. Each Party shall continue to be bound by the obligations of Section 10.1 of the Collaboration Agreement (Nondisclosure Obligation).

12. **Termination of Agreement**.

12.1 Termination for Cause. This Agreement may be terminated in its entirety at any time upon written notice by either Party if the other Party is in material breach of its obligations hereunder and has not cured such breach within [**] in the case of a payment breach, or within [**] in the case of all other breaches, after notice requesting cure of the breach; provided, however, that if any breach other than a payment breach is not reasonably curable within [**] and if a Party is making a bona fide effort to cure such breach, such termination shall be delayed for a time period to be agreed by both Parties, not to exceed an additional [**], in order to permit such Party a reasonable period of time to cure such breach.

12.2 Effects of Termination. If this Agreement is terminated by Genzyme under Section 12.1 (Termination for Cause), then all rights and licenses granted to Voyager hereunder shall immediately terminate, and the licenses granted by Voyager to Genzyme under Section 5 shall survive any such termination. If this Agreement is terminated by Voyager under Section 12.1 (Termination for Cause), then all rights and licenses granted to Genzyme hereunder shall immediately terminate, and the licenses granted by Genzyme to Voyager under Section 4, as well as Voyager's financial obligations under Section 10 (Financial Terms), shall survive any such termination.

13. **Press Release**. Voyager shall issue a press release announcing the execution of this Agreement substantially in the form attached hereto as Schedule 13. Other than the press release referred to in the preceding sentence, neither Party shall issue a press release or public announcement relating to the Agreement or the other Party without the prior written approval of the other Party, which approval shall not be unreasonably withheld, conditioned or delayed, except that a Party may (i) once a press release or other public statement is approved in writing by both Parties, make subsequent public disclosure of the information contained in such press release or other written statement without the further approval of the other Party, and (ii) issue a press release or public announcement as required, in the reasonable judgment of such Party, by Law, including by the rules or regulations of the United States Securities and Exchange Commission, the French Financial Markets Authority, the French Prudential Supervisory Authority or similar regulatory agency in a country other than the United States or France or of any stock exchange or listing entity.

14. **Survival of Specified Provisions in the Collaboration Agreement**. Notwithstanding Section 16.4 of the Collaboration Agreement, subject to Section 15 of this Agreement, only the following sections will survive the termination of the Collaboration Agreement and will remain in full force and effect: 10 (Confidentiality and Publication), 13.4 (Warranty Disclaimer), 14 (Indemnification; Limitation of Liability; Insurance), 15.1 (Inventorship; Ownership), solely with respect to Know-How invented before the Agreement Date (but not 15.1.3 (Employee Assignment) and 15.1.5 (Assignment of CHDI Collaboration Technology)), 15.8 (Common Interest), and 17 (Miscellaneous). Defined terms set out in Article 1 of the Collaboration will survive to the extent they are relevant to the provisions of this Agreement; provided, that references to "Agreement Product", "Collaboration Product" and "Licensed Product" used in the defined terms shall be read to mean Post-Termination FA Product, Post-Termination HD Product or Post-Termination SMA Product as the context requires.

15. **Active MTAs**. The provisions of the Active MTAs that refer to the Collaboration Agreement shall refer to the relevant provisions of this Agreement or the surviving provisions of the Collaboration Agreement as modified by this Agreement; provided, however, that any provision of the Collaboration Agreement that survives as a result of any reference to it in an Active MTA, survives only for purposes of such Active MTA.

16. **Entire Agreement**. The Parties acknowledge and agree that the terms and conditions of this Agreement shall govern the termination of the Collaboration Agreement and, in the

event of any conflict between the terms of this Agreement and the terms of the Collaboration Agreement or any Active MTA, the terms of this Agreement shall govern. This Agreement together with the surviving provisions of the Collaboration Agreement, the Active MTAs and any exhibits or attachments thereto constitutes the entire agreement between the Parties regarding the subject matter hereof.

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

[THE REMAINDER OF THIS PAGE HAS BEEN LEFT INTENTIONALLY BLANK]

IN WITNESS WHEREOF, the Parties have executed this Agreement as of the Agreement Date.

GENZYME CORPORATION		**VOYAGER THERAPEUTICS, INC.**	
BY:	/s/ Muzammil Mansuri	BY:	/s/ G. Andre Turenne
NAME:	Muzammil Mansuri	NAME:	G. Andre Turenne
TITLE:	Executive Vice President, Strategy And Business Development	TITLE:	President and Chief Executive Officer

Exhibit 10.4

Certain identified information has been excluded from the exhibit because it is both (i) not material and (ii) would likely cause competitive harm to the Company, if publicly disclosed. Double asterisks denote omissions.

AMENDED AND RESTATED OPTION AND LICENSE AGREEMENT

This AMENDED AND RESTATED OPTION AND LICENSE AGREEMENT (this "**Agreement**") is made and entered into as of June 14, 2019 (the "**Effective Date**") by and between Voyager Therapeutics, Inc., a corporation organized and existing under the laws of Delaware ("**Voyager**"), and Genzyme Corporation, a corporation organized and existing under the laws of the Commonwealth of Massachusetts ("**Genzyme**", collectively with Voyager, the "**Parties**" and each, individually, a "**Party**"), and amends and restates that certain Non-Exclusive Option and License Agreement by and between Voyager and Genzyme (the "**Original Agreement**") dated as of February 11, 2015.

WHEREAS, Voyager owns or otherwise Controls certain Patent Rights related to recombinant adeno-associated virus vectors for use in gene therapy products; and

WHEREAS, Voyager desires to grant to Genzyme, and Genzyme wishes to obtain from Voyager, a series of exclusive options, on a Specified Capsid-by-Specified Capsid basis, to acquire an exclusive license under such Patent Rights so that Genzyme may develop and commercialize Licensed Products in the Field in the Territory on the terms and conditions set forth in this Agreement.

NOW, THEREFORE, the Parties hereto agree as follows:

1. DEFINITIONS

1.1 "**AAV**" means adeno-associated virus vector.

1.2 "**AAV Patent Rights**" means (a) all Patent Rights that are exclusively, or in the case of the [**] Capsids co-exclusively, Controlled by Voyager or its Affiliates on the Effective Date or during the Capsid Option Period claiming AAV capsid variants (including AAV capsid mutants) with respect to their use in a Specified Indication, (b) any subsequent Patent Rights Controlled by Voyager, the practice of which would infringe the Patent Rights set forth in clause (a), (c) all Patent Rights exclusively, or in the case of the [**] Capsids co-exclusively, Controlled by Voyager that claim AAV capsid variants (including AAV capsid mutants) that claim priority to any such Patent Rights set forth in clauses (a) and (b), and (d) all international or foreign counterparts of any of the foregoing Patent Rights set forth in clauses (a) - (c). The AAV Patent Rights existing as of the Effective Date are those Patent Rights identified on Schedule 8.2.1 (AAV Patent Rights).

1.3 "**Affiliate**" means, with respect to a Person, any other Person which controls, is controlled by, or is under common control with the applicable Person. For purposes of this definition, "control" will mean: (a) in the case of corporate entities, direct or indirect ownership of at least fifty percent (50%) of the stock or shares entitled to vote for the election of directors, or otherwise having the power to control or direct the affairs of such Person; and (b) in the case of

non-corporate entities, direct or indirect ownership of at least fifty percent (50%) of the equity interest or the power to direct the management and policies of such non-corporate entities.

1.4 "**Bankrupt Party**" has the meaning set forth in Section 3.6 (Bankruptcy and Section 365(n)).

1.5 "**Bankruptcy Code**" has the meaning set forth in Section 3.6 (Bankruptcy and Section 365(n)).

1.6 "**BLA**" means a Biologics License Application as described in 21 C.F.R. §601.2.

1.7 "**Calendar Quarter**" means the respective periods of three (3) consecutive calendar months ending on March 31, June 30, September 30 and December 31 of each calendar year, provided that (a) the first Calendar Quarter of the Term shall begin on the Effective Date and end on the first to occur of March 31, June 30, September 30 or December 31 thereafter and the last Calendar Quarter of the Term shall end on the last day of the Term and (b) the first Calendar Quarter of a Royalty Term for a Licensed Product in a country shall begin on the First Commercial Sale of a Licensed Product in such country and end on the first to occur of March 31, June 30, September 30 or December 31 thereafter and the last Calendar Quarter of a Royalty Term shall end on the last day of such Royalty Term.

1.8 "**[**]**" means [**].

1.9 "**[**]**" means that [**].

1.10 "**[**] Capsid**" has the meaning set forth in Section 2.1.1(c).

1.11 "**Capsid**" means a functional assembly of proteins (including fragments and derivatives thereof), such as VP1, VP2 or VP3, which serves to package, coat or encapsulate an AAV genome for delivery to cells.

1.12 "**Capsid Option Period**" means the period beginning on the Effective Date and ending on the last day of the Evaluation Period.

1.13 "**Clinical Study**" or "**Clinical Studies**" means any experiment that involves administration of an experimental biologic product or drug to one or more human subjects and that either is subject to requirements for prior submission to a Regulatory Authority (e.g. an Investigational New Drug application) or is not subject to requirements for prior submission to a Regulatory Authority but the results of which are intended to be submitted later to, or held for inspection by, a Regulatory Authority as part of an application for a research permit or Regulatory Approval, and includes studies relating to the safety, tolerability, pharmacological activity, pharmacokinetics, dose ranging or efficacy of the biologic product or drug.

1.14 "**Confidential Information**" means any and all information and data, including all scientific, pre-clinical, clinical, regulatory, manufacturing, marketing, financial and commercial information or data, whether communicated in writing or orally or by any other method, which is provided by one Party to the other Party in connection with this Agreement.

1.15 "**Control**", "**Controlling**" or "**Controlled by**" means, with respect to any intellectual property right (including any Patent Right), the possession of (whether by ownership or license) the ability of a Person or its Affiliates to assign, transfer, or grant access to, or to grant a license or sublicense of, such right as provided for in this Agreement without violating the terms of any agreement or other arrangement with any Third Party existing at the time such Person would be required hereunder to assign, transfer or grant another Person such access or license or sublicense. Notwithstanding the foregoing, with respect to any Patent Right acquired or in-licensed after the Effective Date (including by virtue of Voyager's exercise of an option existing as of the Effective Date) for which Voyager or one of its Affiliates would be required to make payments to any Third Party in connection with the license or access granted to Genzyme under this Agreement, such intellectual property will be treated as "Controlled" by Voyager to the extent that, and only to the extent that and for so long as, Genzyme agrees and does promptly pay to Voyager all such applicable payments to such Third Party arising out of the grant and exercise of the license to Genzyme hereunder.

1.16 "**Cover**", "**Covering**" or "**Covered**" means, with respect to a particular subject matter at issue and the relevant Patent Right, that, but for a license granted to a Party or a Third Party under an issued claim included in such Patent Right, the manufacture, use, sale, offer or sale or importation by such Party of the subject matter at issue would infringe such claim.

1.17 "**Development Milestone Event**" has the meaning set forth in Section 4.2 (Development Milestone Payments).

1.18 "**Development Milestone Payment**" has the meaning set forth in Section 4.2 (Development Milestone Payments).

1.19 "**Disclosing Party**" has the meaning set forth in Section 7.1 (Nondisclosure Obligation).

1.20 "**Dispute**" means any dispute arising between the Parties in connection with or relating to this Agreement, the transactions contemplated hereby or any document or instrument delivered in connection herewith or therewith, other than a dispute that is referable to an accounting firm pursuant to Section 5.4 (Audit)

1.21 "**DM1**" means myotonic dystrophy type 1.

1.22 "**Effective Date**" has the meaning set forth in the Preamble.

1.23 "**Evaluation Period**" means the period beginning upon the later of (a) the end of the Selection Period and (b) Genzyme's selection of one (1) or more Specified Capsids and ending upon the earlier of (y) [**] from the end of the Selection Period or (z) the date on which Genzyme has provided an Option Exercise Notice for two (2) Specified Capsids.

1.24 "**Existing In-License Agreement**" means the [**] and the [**].

1.25 "**FSHD**" means facioscapulohumeral muscular dystrophy.

1.26 "**Field**" means the use of a Licensed Product to prevent, diagnose or treat the applicable Specified Indication designated by Genzyme pursuant to Section 2.4 (Option Exercise).

1.27 "**First Commercial Sale**" means, with respect to a country, the initial sale of a Licensed Product in such country, by or on behalf of Genzyme, following receipt of Regulatory Approval for such Licensed Product in such country.

1.28 "**First Report**" has the meaning set forth in Section 2.1.1(a) (Voyager Reports).

1.29 "**Future In-License Agreement**" means any agreement between Voyager (or any of its Affiliates), on the one hand, and a Third Party, on the other hand, pursuant to which Voyager or any of its Affiliates acquires Control, after the Effective Date, of any AAV Patent Rights Covering a Voyager Capsid.

1.30 "**GAAP**" means generally accepted accounting principles as practiced in the United States or International Financial Reporting Standards, in each case, consistently applied.

1.31 "**Genzyme**" has the meaning set forth in the Preamble.

1.32 "**Genzyme Indemnitees**" has the meaning set forth in Section 10.2 (Indemnification by Voyager).

1.33 "**Genzyme Studies**" has the meaning set forth in Section 2.1.2 (Genzyme Evaluation).

1.34 "**Governmental Authority**" means any applicable government authority, court, tribunal, arbitrator, agency, department, legislative body, commission or other instrumentality of (a) any government of any country or territory, (b) any nation, state, province, county, city or other political subdivision thereof or (c) any supranational body.

1.35 "**HSR**" has the meaning set forth in Section 2.4 (Option Exercise).

1.36 "**Indemnitee**" has the meaning set forth in Section 10.3 (Indemnification Procedure).

1.37 "**In-License Agreement**" means (a) any Existing In-License Agreement and (b) any Future In-License Agreement.

1.38 "**Laws**" means all applicable laws, statutes, rules, regulations, orders, judgments, injunctions, ordinances or other pronouncements having the binding effect of law of any Governmental Authority, including if either Party is or becomes subject to a legal obligation to a Regulatory Authority or other Governmental Authority (such as a corporate integrity agreement or settlement agreement with a Governmental Authority).

1.39 "**Licensed AAV Patent Rights**" means any and all AAV Patent Rights that are necessary to research, develop, make, have made, import, use, or sell or offer for sale a Licensed Capsid in the Field.

1.40 "**Licensed Capsid**" means any Specified Capsid to which a license is granted pursuant to Section 3.1.

1.41 "**Licensed Product**" means any product containing a Licensed Capsid.

1.42 "**Losses**" has the meaning set forth in Section 10.1 (Indemnification by Genzyme).

1.43 "**Net Sales**" means, with respect to a Licensed Product, the aggregate gross invoiced sales prices from sales of all units of such Licensed Product sold by Genzyme and its Related Parties to independent Third Parties (other than a sublicensee) after deducting, if not previously deducted, from the amount invoiced or received: (a) trade, quantity and cash discounts, credits or allowances actually given; (b) returns, rejections or recalls (due to spoilage, damage, expiration of useful life or otherwise); (c) Third Party rebates, chargebacks, hospital buying group/group purchasing organization administration fees or managed care organization rebates actually given; (d) rebates and similar payments made with respect to sales paid for by any governmental or regulatory authority such as Federal or state Medicaid, Medicare or similar state program; (e) distribution fees and sales commissions paid to Third Parties; (f) retroactive price reductions or billing corrections; (g) value added, sales and use, excise and other similar taxes and surcharges, customary transportation and insurance, custom duties, and other governmental charges; and (h) amounts previously included in Net Sales of such Licensed Product that are adjusted or written-off by Genzyme or its Related Parties as bad debt or otherwise uncollectible in accordance with the standard practices of Genzyme or its Related Parties for writing off uncollectible amounts consistently applied; *provided, however*, if any such written-off amounts are subsequently collected, such collected amounts will be included in Net Sales in the period in which they are subsequently collected. Such amounts will be determined from the books and records of Genzyme or its Related Parties, maintained in accordance with International Financial Reporting Standards or GAAP. In the case of any sale or other disposal for value, such as barter or counter-trade, of a Licensed Product, or part thereof, other than in an arm's length transaction exclusively for cash, Net Sales shall be calculated as above on the value of the non-cash consideration received or the fair market price (if higher) of such Licensed Product in the country of sale or disposal, as determined in accordance with IFRS or GAAP, as applicable Notwithstanding the foregoing, the following will not be included in Net Sales: (1) sales between or among Genzyme and its Related Parties (but Net Sales will include sales to the first Third Party (other than a sublicensee) by Genzyme or its Related Parties); (2) samples of Licensed Product used to promote additional Net Sales, in amounts consistent with the normal business practices of Genzyme or its Related Parties where the Licensed Product is supplied without charge or at or below the actual manufacturing cost thereof (without allocation of indirect costs or any mark-up); and (3) disposal or use of Licensed Products in Clinical Studies or under compassionate use, patient assistance, named patient use or test marketing programs or non-registrational studies or other similar programs or studies where the Licensed Product is supplied without charge or at or below the actual manufacturing cost thereof (without allocation of indirect costs or any mark-up). In the case where a Licensed Product is sold as part of a Combination Product in a country in the Territory, Net Sales for the Licensed Product included in such Combination Product in such country shall be calculated as follows:

(a) if the Licensed Product is sold separately in such country and the other device or active ingredient or ingredients in the Combination Product are

sold separately in such country, Net Sales for the Licensed Product shall be calculated by multiplying actual Net Sales of such Combination Product in such country by the fraction A/(A+B), where A is the invoice price of the Licensed Product when sold separately in such country and B is the total invoice price of the other device or active ingredient or ingredients in the Combination Product when sold separately in such country;

(b) if the Licensed Product is sold separately in such country but the other device or active ingredient or ingredients in the Combination Product are not sold separately in such country, Net Sales for the Licensed Product shall be calculated by multiplying actual Net Sales of such Combination Product in such country by the fraction A/D, where A is the invoice price of the Licensed Product when sold separately in such country and D is the invoice price of the Combination Product in such country;

(c) if the Licensed Product is not sold separately in such country but the other device or active ingredient or ingredients in the Combinations Product are sold separately in such country, Net Sales for the Licensed Product shall be calculated by multiplying actual Net Sales of such Combination Product by the fraction 1 - (B/D), where B is the invoice price of the other device or active ingredient or ingredients in the Combination Product when sold separately in such country and D is the invoice price of the Combination Product in such country; or

(d) if neither the Licensed Product nor the other device or active ingredient or ingredients in the Combination Product are sold separately in such country, the Parties shall determine Net Sales for the Licensed Product in such Combination Product by mutual agreement based on the relative contribution of the Licensed Product and each other device or active ingredient to the Combination Product, and shall take into account in good faith any applicable allocations and calculations that may have been made for the same period in other countries.

For purposes of this Section 1.43 "**Combination Product**" means a product that includes a device for delivery or at least one active ingredient other than a Licensed Product.

1.44 "**Non-Bankrupt Party**" has the meaning set forth in Section 3.6 (Bankruptcy and Section 365(n)).

1.45 "**Option**" has the meaning set forth in Section 2.3 (Option Grant).

1.46 "**Option Exercise Notice**" has the meaning set forth in Section 2.4 (Option Exercise).

1.47 "**Option Exercise Payment**" has the meaning set forth in Section 4.1 (Option Exercise Payment).

1.48 "**Party**" or "**Parties**" has the meaning set forth in the Preamble.

1.49 "**Patent Rights**" means (a) all issued patents (including any extensions, restorations by any existing or future extension or registration mechanism (including patent term adjustments, patent term extensions, supplemental protection certificates or the equivalent thereof), substitutions, confirmations, re-registrations, re-examinations, reissues, patents and patent claims maintained after post grant examination (including inter partes review, post grant review or opposition proceeding) and patents of addition); (b) patent applications (including all provisional applications, substitutions, requests for continuation, continuations, continuations-in-part, divisionals and renewals); (c) inventor's certificates; and (d) all equivalents of the foregoing in any country or transnational intellectual property organization of the world.

1.50 "**Person**" means any natural person, corporation, unincorporated organization, partnership, association, sole proprietorship, joint stock company, joint venture, limited liability company, trust or government, Governmental Authority or any other similar entity.

1.51 "**Phase III Study**" means a study in humans of the efficacy and safety of a product, which is prospectively designed to demonstrate statistically whether such product is effective and safe for use in a particular indication in a manner sufficient (alone or together with one or more other such studies) to file an application for Regulatory Approval for the product, as further defined in 21 C.F.R. § 312.21(c) (or the equivalent thereof outside the United States).

1.52 "**Pompe Disease**" means Glycogen Storage Disease II, caused by a variation in the GAA gene.

1.53 "**Receiving Party**" has the meaning set forth in Section 7.1 (Nondisclosure Obligation).

1.54 "**Regulatory Approval**" means any and all approvals, licenses, registrations or authorizations of any Regulatory Authority that are necessary for the marketing and sale of a product in a country or group of countries.

1.55 "**Regulatory Authority**" means any Governmental Authority involved in granting approvals for the development, manufacturing, commercialization, reimbursement or pricing of Licensed Products, including the United States Food and Drug Administration, the European Medicines Agency, the Japanese Ministry of Health, Labour and Welfare and the Pharmaceuticals and Medical Devices Agency in Japan.

1.56 "**Reimbursement Approval**" means, with respect to a Licensed Product, the receipt by Genzyme or a Related Party of Genzyme of authorization for reimbursement of or funding of such Licensed Product in the national health service or insurance from the national-level Governmental Authority responsible for authorizing reimbursement for or determining pricing for, pharmaceutical products in such country or national regulatory jurisdiction.

1.57 "**Related Parties**" means: (a) with respect Voyager and its Affiliates; and (b) with respect to Genzyme, its Affiliates and its permitted sublicensees hereunder.

1.58 "**ROFN Notice**" has the meaning set forth in Section 2.1.1(d).

1.59 "**Royalty Term**" means on a Licensed Product-by-Licensed Product and country-by-country basis, the period commencing with the First Commercial Sale of such Licensed Product in a country and continuing until the expiration of the last Valid Claim of the Licensed AAV Patent Rights Covering the manufacture, use, offer for sale, sale or importation of such Licensed Product in the country of sale.

1.60 "**Sales Milestone Event**" has the meaning set forth in Section 4.3 (Sales Milestone Payments).

1.61 "**Sales Milestone Payment**" has the meaning set forth in Section 4.3 (Sales Milestone Payments).

1.62 "**Second Report**" has the meaning set forth in Section 2.1.1(a) (Voyager Reports).

1.63 "**Selection Period**" means the period beginning on the Effective Date and ending upon the earlier of (a) [**] after the delivery of the Second Report by Voyager or (b) the date on which Genzyme has selected four (4) Voyager Capsids for internal evaluation pursuant to Section 2.1.2 (Genzyme Evaluation).

1.64 "**Specified Capsid**" means any Voyager Capsid that Genzyme selects for evaluation during the Evaluation Period pursuant to Section 2.1.2 (Genzyme Evaluation) or Section 2.1.3 (Additional Selections).

1.65 "**Specified Indication**" means (a) Pompe Disease or (b) the indication designated pursuant to Section 2.2 (Identification of Second Specified Indication), in each case ((a) or (b)) as designated by Genzyme pursuant to Section 2.4 (Option Exercise). For the avoidance of doubt, upon designation pursuant to Section 2.2 (Identification of Second Specified Indication), there shall be two (2) potential Specified Indications, and the second such Specified Indication shall be one of DM1 or FSHD.

1.66 "**Step-Down Product**" means, with respect to a Licensed Product in a country, a product introduced in such country by a Person other than Genzyme or its Affiliates that (a) includes the same or substantially the same transgene as such Licensed Product and has obtained Regulatory Approval by a Regulatory Authority pursuant to a process that relies on pivotal safety or efficacy data from such Regulatory Authority's previous grant of Regulatory Approval for such Licensed Product; or (b) otherwise meets the criteria for constituting a "biosimilar" or "interchangeable" product pursuant to Section 351(k) of the Public Health Service Act (42 U.S.C. § 262(k)) or EMA Directive 2001/83/EC or any successors thereto.

1.67 "**Term**" has the meaning set forth in Section 9.1 (Term).

1.68 "**Territory**" means worldwide.

1.69 "**Third Party**" means any Person that is not a Party or an Affiliate of a Party.

1.70 "**[**]**" that [**].

1.71 "**[**]**" means [**].

1.72 "**Valid Claim**" means (a) a claim of an issued and unexpired patent within the Licensed AAV Patent Rights, which claim has not been revoked or held unenforceable, unpatentable or invalid by a decision of a court or other governmental agency of competent jurisdiction and that has not been abandoned, disclaimed, denied or admitted to be invalid or unenforceable through reissue, re-examination or disclaimer or otherwise; or (b) a claim of a patent application within the Licensed AAV Patent Rights that has been pending less than [**] from the date of filing of the earliest patent application from which such patent application claims priority, which claim has not been cancelled, withdrawn or abandoned or finally rejected by an administrative agency action from which no appeal can be taken.

1.73 "**Voyager**" has the meaning set forth in the Preamble.

1.74 "**Voyager Capsid**" means (a) initially, a Capsid that is (i) owned by Voyager or (ii) exclusively, or, solely in the case of the [**], co-exclusively, Controlled by Voyager, in each case ((i) and (ii)) for use in Pompe Disease, DM1, or FSHD and, (b) from and after determination of the second Specified Indication pursuant to Section 2.2 until the end of the Selection Period, means a Capsid that is (i) owned by Voyager or (ii) exclusively or, solely in the case of the [**], co-exclusively Controlled by Voyager, in each case ((i) and (ii)) for use in a Specified Indication.

1.75 "**Voyager Indemnitees**" has the meaning set forth in Section 10.1 (Indemnification by Genzyme).

1.76 "**Voyager In-Licensed Capsid**" has the meaning set forth in Section 2.1.1(b) (Voyager Reports).

1.77 "**Voyager Studies**" means any non-human animal studies using a Specified Capsid conducted by or on behalf of Voyager during each [**] period after the Effective Date until the end of the Evaluation Period.

1.78 "**Voyager Reports**" has the meaning set forth in Section 2.1.1(a) (Voyager Reports).

2. OPTION

2.1 Reports and Evaluation.

2.1.1 Voyager Reports.

(a) Voyager shall provide to Genzyme written reports summarizing the result of its research and development activities, with respect to Voyager Capsids (the "**Voyager Reports**") on or before [**] (the "**First Report**") and [**] (the "**Second Report**"). The form and substance of the Voyager Reports shall follow the requirements set forth on Schedule 2.1.1 (Voyager Reports).

(b) Voyager shall provide copies of any In-License Agreements for any in-licensed Voyager Capsid referenced in a Voyager Report (each, a "**Voyager In-Licensed Capsid**") if requested by Genzyme following receipt of such

Voyager Report, subject to the confidentiality provisions of such In-License Agreement and redaction by Voyager of sensitive information not relevant to rights or obligations pertaining to potential sublicense by Genzyme. If during the Selection Period Voyager acquires exclusive rights to a Voyager In-Licensed Capsid that was previously excluded from a Voyager Report because Voyager did not have exclusive rights to such Voyager In-Licensed Capsid, then Voyager shall notify Genzyme in writing within [**] of acquiring such exclusive rights and shall provide the information required under this Section 2.1.1.

(c) In recognition of the proprietary nature of the information shared in the Voyager Reports related to Voyager Capsids Covered by Patent Rights Licensed to Voyager under the [**] (each, a "**[**] Capsid**"), Genzyme covenants not to license rights to use any [**] Capsid in a Specified Indication from a Third Party, in lieu of the license rights it could have otherwise obtained to such [**] Capsids in the Specified Indications under this Agreement.

(d) Beginning on the Effective Date and continuing until the [**] thereof, if Genzyme intends to obtain a license from a Third Party for a [**] Capsid in an indication other than a Specified Indication, Genzyme shall provide written notice to Voyager of such intention and Voyager shall have the right, within [**] after receiving such notice, to submit to Genzyme written notice that it elects to negotiate a transaction with respect to such [**] Capsid (the "**ROFN Notice**"). In such event, Genzyme and Voyager shall use good faith efforts to finalize a definitive license agreement for such [**] Capsid within [**] of such ROFN Notice; provided that if either Voyager does not provide such written notice within such [**] period or, or Voyager provides such notice of interest but for any reason Genzyme and Voyager do not enter into a definitive agreement within the [**] negotiation period, Genzyme shall be free to enter into an agreement with Third Party(ies) relating to any [**] Capsid, without further obligation to Voyager.

2.1.2 Genzyme Evaluation. During the Selection Period, Genzyme may select up to four (4) Voyager Capsids (or such greater number as mutually agreed by the Parties) to evaluate in non-human animal studies (the "**Genzyme Studies**"), henceforward a Specified Capsid, by providing written notice to Voyager identifying which Voyager Capsid(s) Genzyme has chosen to evaluate. Upon selection of a Voyager Capsid for evaluation, Voyager hereby grants to Genzyme, during the Evaluation Period, a non-exclusive, royalty-free, non-transferable, and sublicensable (solely to Third Party contract research organizations) license under the AAV Patent Rights to conduct or have conducted the Genzyme Studies, subject to the provisions of Section 3.3.1. Every [**] after the Effective Date until the end of the Evaluation Period and upon the end of the Evaluation Period if that does not otherwise occur at a [**] interval, each Party will provide the other Party a written report summarizing the data listed on Schedule 2.1.2 related to, as applicable, the Genzyme Studies or the Voyager Studies as they pertain to the Specified Capsids conducted during such [**] period to the extent such data has been generated by a Party.

Within [**] after delivery of the report outlined on Schedule 2.1.2 (or as otherwise agreed by the Parties), the Parties will discuss (either via teleconference or face-to-face) the contents of such report.

2.1.3 Additional Selections. Genzyme may select up to two (2) additional Voyager Capsids in addition to the four (4) Voyager Capsids available under Section 2.1.2 (Genzyme Evaluation) for evaluation under Section 2.1.2 (Genzyme Evaluation); provided, that Genzyme must select the additional Voyager Capsids prior to the end of the Selection Period. Genzyme shall pay to Voyager [**] dollars ($[**]) for each Voyager Capsid selected pursuant to this Section 2.1.3 (Additional Selections). For the avoidance of doubt, no more than six (6) Voyager Capsids may be selected for evaluation under this Agreement.

2.2 Identification of Second Specified Indication. No later than at the time of the delivery of the First Report, Voyager will determine in its sole discretion if DM1 will be permitted to be the second Specified Indication and provide Genzyme with written notice of its determination. If Voyager determines that DM1 will not be the second Specified Indication and so notifies Genzyme in writing, FSHD shall be the second Specified Indication. If Voyager does not provide Genzyme written notice that DM1 will not be permitted to be the second Specified Indication by the time of delivery of the First Report, Genzyme may, in its sole discretion, select one (1) of DM1 or FSHD as the second Specified Indication and shall notify Voyager of its selection within [**] following delivery of the First Report by Voyager.

2.3 Option Grant. Voyager hereby grants to Genzyme a series of exclusive options (each, an "**Option**") under which Genzyme shall have the right, but not the obligation, to take a license under Section 3.1 (License to Genzyme) to any Specified Capsid, subject to the terms and conditions of this Agreement.

2.4 Option Exercise. Genzyme may exercise an Option at any time during the Capsid Option Period by providing written notice to Voyager of such exercise (the "**Option Exercise Notice**"), which Option Exercise Notice shall specify (i) the applicable Specified Indication and Specified Capsid to which such Option applies and (ii) that the exercise of the Option does not, in Genzyme's good faith assessment based on advice from specialized counsel, trigger reporting requirements under the Hart-Scott-Rodino Antitrust Improvement ("**HSR**") Act; provided, however, that Genzyme may exercise such Options with respect to no more than one (1) Specified Capsid per Specified Indication; and provided, further, that if Genzyme concludes filings under the HSR Act are required, (A) Genzyme will notify Voyager of its conclusion and the parties will use reasonable best efforts to make the requisite filings as promptly as possible, and in any event no later than [**] after the notice, and collaborate with each other in taking appropriate steps to achieve termination of the applicable waiting periods under the HSR Act as promptly as possible; and (B) the effectiveness of the license granted under Section 3.1 shall be suspended until expiration or termination of the applicable waiting periods under the HSR Act. For the avoidance of doubt, Genzyme may exercise both Options for the same Specified Capsid for use in each of the Specified Indications and such election shall count as two (2) Option exercises.

3. LICENSE GRANT

3.1 License to Genzyme. Subject to the terms and conditions of this Agreement, effective upon exercise of an Option by Genzyme with respect to a Specified Capsid for a Specified Indication in accordance with Section 2.4 (Option Exercise), Voyager hereby grants to Genzyme, during the Term, an exclusive (even as to Voyager and its Affiliates), royalty-bearing and sublicensable (solely in accordance with Section 3.2 (Sublicenses)) license under the Licensed AAV Patent Rights with respect to such Specified Capsid, henceforth a Licensed Capsid, to make, have made, use (including, for purposes of clarity, research and development), sell, offer for sale, import, export and otherwise exploit Licensed Products containing such Licensed Capsid within the Field and in the Territory.

3.2 Sublicenses. Genzyme will have the right to sublicense any of the rights granted to it pursuant to Section 3.1 (License to Genzyme) through multiple tiers to any Third Party; *provided that* Genzyme may not sublicense any rights within the Licensed AAV Patent Rights other than on an exclusive basis and solely for use in connection with a Licensed Product that is Covered by intellectual property Controlled by Genzyme or its Affiliates. Each such sublicense must be subject to a written agreement that is consistent with the terms of this Agreement. Genzyme will provide notice and a copy of each such written agreement to Voyager within [**] of executing same, which may be redacted to remove confidential information of either party. Genzyme will be responsible for the failure by any of its sublicensees to comply with the relevant restrictions, limitations and obligations contained in this Agreement, and any uncured material breach of this Agreement by any such sublicensee will be deemed to be an uncured material breach of this Agreement by Genzyme; *provided that* Genzyme will be permitted to cure such breach in accordance with Section 9.3 (Termination for Material Breach).

3.3 In-License Agreements.

3.3.1 Genzyme acknowledges that the licenses granted by Voyager hereunder may include sublicenses under certain licenses granted to Voyager or its Affiliates pursuant to In-License Agreements, and that such sublicenses are subject to the applicable terms of such In-License Agreements, the scope of the licenses granted to Voyager or the applicable Affiliate thereunder and the rights granted to or retained by the Third Party counterparties and any other Third Parties (including Governmental Authorities). If the Specified Capsids or Licensed Capsids, as applicable at any given time, are Covered by Patent Rights licensed to Voyager under In-License Agreements, Genzyme covenants to comply with, and to cause its sublicensed Affiliates and to require its sublicensees to comply with, the applicable In-License Agreements, pursuant to their terms (including with respect to the research license granted in Section 2.1.2 (Genzyme Evaluation)). Without limiting the generality of the foregoing, if the Specified Capsids or Licensed Capsids, as applicable at any given time, are Covered by Patent Rights licensed to Voyager under an Existing In-License Agreement, then Genzyme shall comply with the provisions of such Existing In-License Agreement identified on Schedule 3.3.1. To the extent there is a conflict between any of the terms of any In-License Agreement and the rights granted to Genzyme hereunder the terms of such In-License Agreement shall control with respect to the AAV Patent Rights licensed to Voyager under such In-License Agreement.

3.3.2 Genzyme shall reimburse Voyager for any payment obligation incurred by Voyager under an In-License Agreement related to a Licensed Product or Genzyme's activities hereunder, including but not limited to royalties and milestone payments relating to a Licensed Product, subject (in the case of Future In-License Agreements) to Section 4.8 (Anti-Stacking), provided that in each case the relevant financial terms of such In-License Agreement giving rise to such payment obligations were provided to Genzyme prior to its exercise of the Option with respect thereto to the extent such In-License Agreement was executed prior to Genzyme's exercise of the Option.

3.3.3 If and for so long as the Specified Capsids or Licensed Capsids, as applicable at any given time, are Covered by Patent Rights licensed to Voyager under the [**], Voyager will (i) not amend, or otherwise modify or permit to be amended or modified, the [**] as it pertains to the Specified Indications (or, before the second Specified Indication is determined, as it pertains to DM1 or FSHD) in any way which would reasonably be expected to adversely affect the rights of Genzyme hereunder without Genzyme's prior written consent, and (ii) provide written notice to Genzyme if (x) Voyager receives a notice of termination from or submits a notice of termination to [**] regarding the [**] and (y) the [**] is terminated, indicating in such notice that Genzyme will thereafter be obligated to render to [**] all consideration that Genzyme would have owed to Voyager under this Agreement.

3.4 Rights of Affiliates. Genzyme may exercise its rights and perform is obligations under this Agreement directly through one or more of its Affiliates. Genzyme's Affiliates will have the benefit of all rights of Genzyme under this Agreement. Accordingly, in this Agreement "Genzyme" will be interpreted to mean "Genzyme and/or its Affiliates" where necessary to give Genzyme's Affiliates the benefit of the rights provided to Genzyme in this Agreement, including the license granted pursuant to Section 3.1 (License to Genzyme) hereof; ***provided, however,*** that Genzyme will remain responsible hereunder for the acts and omissions of its Affiliates.

3.5 Retained Rights. Genzyme acknowledges and agrees that: (a) the licenses granted hereunder are exclusive only within the Specified Indications; (b) Voyager retains the right to use the Licensed AAV Patent Rights for any other purpose; and (c) Voyager may license the Licensed AAV Patent Rights to Third Parties for use outside the Specified Indications.

3.6 Bankruptcy and Section 365(n). All rights and licenses granted under or pursuant to this Agreement by Voyager to Genzyme, including those set forth in Section 3.1 (License to Genzyme), are and will otherwise be deemed to be, for purposes of Section 365(n) of Title 11 of the United States Code (the "**Bankruptcy Code**"), licenses of right to "intellectual property" as defined under Section 101 of the Bankruptcy Code. The Parties agree that each Party, its Affiliates and its and their respective sublicensees, as sublicensees of such rights under this Agreement, will retain and may fully exercise all of its and their rights and elections under the Bankruptcy Code and any foreign counterpart thereto. The Parties further agree that upon commencement of a bankruptcy proceeding by or against a Party (the "**Bankrupt Party**") under the Bankruptcy Code, the other Party (the "**Non-Bankrupt Party**") will be entitled to a complete duplicate of, or complete access to (as the Non-Bankrupt Party deems appropriate), all such intellectual property and all embodiments of such intellectual property. Such intellectual property and all embodiments of such intellectual property will be promptly delivered to the Non-Bankrupt Party: (a) upon any

such commencement of a bankruptcy proceeding and upon written request by the Non-Bankrupt Party, unless the Bankrupt Party elects to continue to perform all of its obligations under this Agreement; or (b) if not delivered under (a) above, upon the rejection of this Agreement by or on behalf of the Bankrupt Party and upon written request by the Non-Bankrupt Party. The Bankrupt Party (in any capacity, including debtor-in-possession) and its successors and assigns (including any trustee) agree not to interfere with the exercise by the Non-Bankrupt Party or its Affiliates of its rights and licenses to such intellectual property in accordance with this Agreement, and agrees to assist the Non-Bankrupt Party and its Affiliates in obtaining such intellectual property and such embodiments of intellectual property in the possession or Control of Third Parties as are reasonably necessary or desirable for the Non-Bankrupt Party to exercise such rights and licenses in accordance with this Agreement. The foregoing provisions are without prejudice to any rights the Non-Bankrupt Party may have arising under the Bankruptcy Code or other applicable Laws. Further, each Party agrees and acknowledges that all payments by Genzyme to Voyager hereunder, other than royalties pursuant to Section 4.4 (Royalty Payments), do not constitute royalties within the meaning of Section 365(n) of the Bankruptcy Code.

3.7 No Implied Rights. Except as expressly provided in this Agreement, no rights are granted to either Party hereunder, and no additional rights will be deemed granted to either Party by implication, estoppel or otherwise, with respect to any intellectual property rights. All rights not expressly granted by either Party to the other hereunder are reserved.

4. CONSIDERATION

4.1 Option Exercise Payment. Each time Genzyme exercises an Option pursuant to Section 2.4 (Option Exercise) for a Specified Capsid, Genzyme shall pay the following non-refundable, non-creditable payments to Voyager (each "**Option Exercise Payment**"):

Number of Options Exercised for Specified Capsid	Option Exercise Payment
First time Option is exercised for such Specified Capsid	$1,000,000
Second time Option is exercised for such Specified Capsid	$1,000,000

Genzyme shall pay each Option Exercise Payment within [**] after receipt of an invoice from Voyager for such Option Exercise Payment after the date on which Genzyme provides the applicable Option Exercise Notice.

4.2 Development Milestone Payments. Genzyme shall provide Voyager with written notice of the achievement by Genzyme or any of its Related Parties of any development milestone event for each Licensed Product within the Field (each, a "**Development Milestone Event**") set forth below in this Section 4.2 within [**] after such event has first occurred; provided, however, that Genzyme shall inform Voyager of such event prior to any public disclosure of such event by Genzyme. Voyager shall invoice Genzyme within [**] of receipt of such written notice by Voyager, and Genzyme shall pay the associated development milestone payment (each, a "**Development Milestone Payment**") within [**] of the receipt of such invoice.

Development Milestone Event	Development Milestone Payment
[**]	[**]
[**]	[**]

For each Licensed Product, each Development Milestone Payment will be payable only once, regardless of the number of times with respect to any such Licensed Product the specified Development Milestone occurs.

4.3 Sales Milestone Payments. On a Specified Indication-by-Specified Indication basis, Genzyme will pay to Voyager a one-time, non-refundable, non-creditable payment of twenty million dollars ($20,000,000) (the "**Sales Milestone Payment**") when aggregate Net Sales for all Licensed Products in such Specified Indication in the Territory during the Royalty Term reaches [**] dollars ($[**]) (the "**Sales Milestone Event**"). Genzyme shall provide Voyager with written notice of the achievement during the Royalty Term by Genzyme or any of its Related Parties of the Sales Milestone Event within [**] after the end of the Calendar Quarter in which such event has occurred. Voyager shall invoice Genzyme within [**] of receipt of such written notice by Genzyme, and Genzyme shall remit the Sales Milestone Payment within [**] of the receipt of such invoice. For each Specified Indication, the Sales Milestone Payment will be payable only once, regardless of the number of times with respect to each such Specified Indication a [**] dollar ($[**]) Net Sales increment subsequently occurs.

4.4 Royalty Payments. On a Licensed Product-by-Licensed Product basis, Genzyme will pay to Voyager, during the Royalty Term, on a quarterly basis for the immediately preceding Calendar Quarter, tiered royalties based on the Territory-wide annual Net Sales of Licensed Products Covered by a Valid Claim at the rates specified below.

Annual Net Sales Level	**Marginal Royalty Rate**
Less than $[**]	[**]%
$[**] to [**]	[**]%
$[**] to $[**]	[**]%
Greater than $[**]	[**]%

Royalties payable on annual Net Sales of a Licensed Product will be paid at the rate applicable to that portion of Net Sales within each of the Net Sales levels (above). For example, if Genzyme receives [**] in Net Sales of a Licensed Product in a given calendar year, then the royalties payable by Genzyme under this Section 4.4 (Royalty Payments) during such calendar year would be calculated as follows:

Royalties = [**]

Following expiration of the applicable Royalty Term for a given Licensed Capsid in a given country, no further royalties will be payable with respect to sales of Licensed Products containing such Licensed Capsid in such county and, thereafter, the licenses granted to Genzyme under Section 3.1 (License to Genzyme) with respect to such Licensed Product in such country will automatically become fully paid-up, perpetual, irrevocable and royalty-free.

4.5 Consideration Due. For the purposes of this Section 4 (Consideration), any Licensed Product that contains the same Licensed Capsid for the same Specified Indication will constitute one and the same Licensed Product.

4.6 No Multiple Royalties. No multiple royalties will be due to Voyager because a Licensed Product is Covered by more than one AAV Patent Right.

4.7 Step-Down Adjustment. If, on a country-by-country basis at any time during the Royalty Term, both (a) one or more Third Parties have received Regulatory Approval to sell in such country a Step-Down Product with respect to such Licensed Product and (b) Genzyme's Net Sales of such Licensed Product in such country during any [**] following the date on which such Step-Down Product is first commercially available in such country are less than [**] percent ([**]%) of Genzyme's Net Sales of such Licensed Product in such country during the [**] immediately preceding to the date on which such Step-Down Product is first commercially available in such country, then the royalties payable pursuant to Section 4.4 (Royalty Payments) on the Net Sales of such Licensed Product in such country shall thereafter be reduced to [**] percent ([**]%) of the amounts otherwise payable pursuant to Section 4.4 (Royalty Payments) with respect to such Licensed Product in such country.

4.8 Anti-Stacking. Genzyme may reduce the amount of royalties payable under this Agreement with respect to any Licensed Product on a country-by-country basis by up to [**] percent ([**]%) of the amounts (i) payable by Genzyme to any Third Party in consideration for a license, granted to Genzyme after the Effective Date, to any Patent Right which Covers or is necessary for use in the development, manufacture or commercialization of such Licensed Product in such country or (ii) payable by Genzyme with respect to a Future In-License Agreement pursuant to Section 3.3.2; *provided, however*, that the royalties payable under this Agreement with respect to such Licensed Product will not be reduced in any such event below [**] percent ([**]%) of the amounts otherwise payable under this Agreement by applying the reduction set forth in this Section 4.8 (Anti-Stacking); and *provided, further*, that if any of such amounts cannot be offset against royalties due with respect to such Licensed Product for any given royalty period due to the preceding proviso, such unused amount may be carried forward and offset against royalties due with respect to such Licensed Product in future royalty periods. For avoidance of doubt, no reduction will be made under this Section 4.8 (Anti-Stacking) for amounts payable by Genzyme with respect to an Existing In-License Agreement pursuant to Section 3.3.2.

4.9 Payment of Back Royalties. If Genzyme would owe a royalty payment to Voyager under Section 4.4 (Royalty Payments) but for a decision by a court or other governmental agency of competent jurisdiction holding an issued patent claim unenforceable, unpatentable or invalid and if such decision is later vacated or reversed by a final nonappealable decision by a court or other governmental agency of competent jurisdiction, Voyager may invoice Genzyme for such unpaid royalty payments after such decision is vacated or reversed and Genzyme shall make any such unpaid royalty payments to Voyager within [**] after receipt of such invoice.

5. REPORTS; RECORD KEEPING; AUDIT

5.1 Royalty Reports. During the Term, following the First Commercial Sale of any Licensed Product by or on behalf of a Genzyme under this Agreement, Genzyme will furnish to Voyager a written report within [**] after the end of each calendar quarter showing, on a Licensed Product-by-Licensed Product basis, the Territory-wide Net Sales of each such Licensed Product and Genzyme's calculation of the royalties and Sales Milestone Payments payable under this Agreement with respect to such Licensed Product. Royalties shown to have accrued by each

royalty report will be due and payable [**] following the date such royalty report is due. Notwithstanding the foregoing, Genzyme agrees that to the extent that an In-License Agreement applicable to a given Licensed Capsid requires more thorough or more frequent reporting or requires that reports be provided on a different timeline than that set forth in this Section 5.1, Voyager shall notify Genzyme of the deadline and content of such reports, and Genzyme shall use reasonable efforts to provide such reports to Voyager as requested by Voyager no less [**] prior to the date that Voyager is required to submit such report pursuant to the applicable In-License Agreement; provided however that in no event shall Genzyme be required to provide any report regarding Net Sales of a Licensed Product prior to [**] following the end of the Calendar Quarter in which such Net Sales occurred.

5.2 Currency; Payment Method; Exchange Rate. All payments to be made under this Agreement will be made in United States dollars and will be paid by bank wire transfer in immediately available funds to such bank account in the United States as may be designated in writing by the receiving Party from time to time. In the case of Net Sales made or expenses incurred by a Party and its Related Parties in currencies other than United States dollars during a calendar quarter, the rate of exchange to be used in computing the amount of United States dollars due will be the rate of exchange utilized by such Party in its worldwide accounting system and calculated in accordance with GAAP.

5.3 Taxes. If a timely and appropriately completed and executed Internal Revenue Service Form W-9 is provided by Voyager to Genzyme, the Parties acknowledge and agree that no United States tax withholding will be applied with respect to any payments due under Section 4 (Consideration). Genzyme will use reasonable efforts to minimize tax withholdings on payments made to Voyager. Notwithstanding such efforts, if Genzyme concludes that tax withholdings under the Laws of any country are required with respect to payments to Voyager, then Genzyme will first notify Voyager and provide Voyager with [**] to determine whether there are actions Genzyme can undertake to avoid such withholding. During this notice period, Genzyme will refrain from making such payment until Voyager instructs Genzyme that: (a) Voyager intends to take actions (satisfactory to both Parties) that will obviate the need for such withholding, in which case Genzyme will make such payment only after it is instructed to do so by Voyager; or (b) Genzyme should make such payment and withhold the required amount and pay it to the appropriate Governmental Authority. Notwithstanding the foregoing, if, as a result of (i) a permitted assignment of this Agreement (in whole or in part) by Genzyme to an Affiliate or a Third Party outside of the United States or (ii) the exercise by Genzyme of its rights under this Agreement (in whole or in part) through an Affiliate or Third Party outside of the United States (or the direct exercise of such rights by an Affiliate of such Party outside of the United States), foreign withholding tax in excess of the foreign withholding tax amount that would have been payable by Genzyme in the absence of such assignment or exercise of rights becomes payable with respect to amounts due to Voyager hereunder or thereunder, such amounts owed by Genzyme to Voyager shall be increased so that the amount actually paid by Genzyme to Voyager equals the amount that would have been payable to Voyager by Genzyme in the absence of such excess withholding (after withholding of the excess withholding tax and any additional withholding tax on such increased amount). However, if a similar assignment or exercise of rights described in (i) or (ii) of the preceding sentence by Voyager results in foreign withholding tax in excess of the foreign withholding tax amount that would have been payable in the absence of such assignment or exercise of rights to Voyager, any amount due to Voyager shall not be increased for such excess

withholding and, subject to the terms of this Agreement, the required amount shall be withheld and submitted to the appropriate Governmental Authority. In all cases, whether or not there has been a permitted assignment of this Agreement by Genzyme or the exercise by Genzyme of its rights under this Agreement through an Affiliate or Third Party, (A) Genzyme shall promptly provide Voyager with copies of receipts or other evidence reasonably required and sufficient to allow Voyager to document such tax withholdings adequately for purposes of claiming foreign tax credits and similar benefits, (B) the Parties shall cooperate reasonably in completing and filing documents required under the provisions of any applicable tax Laws or under any other applicable Law, in connection with the making of any required tax payment or withholding payment, or in connection with any claim to a refund of or credit for any such payment, and (C) the Parties shall cooperate to minimize such taxes in accordance with applicable Laws, including using reasonable efforts to access the benefits of any applicable treaties.

5.4 Audit.

5.4.1 On a Licensed Product-by-Licensed Product basis, upon the written request of Voyager, and not more than [**], Genzyme and its Related Parties will permit an independent certified public accounting firm of internationally-recognized standing selected by Voyager and reasonably acceptable to Genzyme, at Voyager's expense (except as set forth below), to have access during normal business hours to such of the records of the Genzyme and its Related Parties as may be reasonably necessary to verify the accuracy of the amounts payable to Voyager hereunder with respect to such Licensed Product for any calendar year ending not more than [**] prior to the date of such request for the sole purpose of verifying the basis and accuracy of payments made under this Agreement with respect to such Licensed Product. Notwithstanding the foregoing, Voyager may not make more than [**], *provided that* a request may cover multiple Licensed Products.

5.4.2 If any audit performed under this Section 5.4 (Audit) results in the discovery of a discrepancy (a) to Voyager's detriment, then Genzyme will pay to Voyager the amount of such discrepancy within [**] of Genzyme's receipt of the accounting firm's written report so concluding; or (b) to Genzyme's detriment, then Genzyme will credit the amount of such discrepancy against future monies owed to Voyager under this Agreement; *provided that*, if there no future monies are due to Voyager, then Voyager will pay to Genzyme the amount of such discrepancy within [**] of Voyager's receipt of the accounting firm's written report so concluding. The fees charged by such accounting firm will be paid by Voyager, unless such discrepancy represents an underpayment by Genzyme of at least [**] percent ([**]%), on a Licensed Product-by-Licensed Product basis, of the total amounts due with respect to such Licensed Product in the audited period, in which case such fees will be paid by Genzyme.

5.4.3 Unless an audit has been commenced prior to and is ongoing upon the [**], the calculation of royalties and other payments payable with respect to such year will be binding and conclusive upon both Parties, and each Party and its Related Parties will be released from any further liability or accountability with respect to such royalties for such year.

5.4.4 Voyager will cause its accounting firm to enter into a confidentiality agreement with Genzyme or its Related Parties obligating it to retain all financial information subject to review under this Section 5.4 (Audit) (or under any sublicense agreement) in confidence pursuant to such confidentiality agreement, which terms will be no less stringent than the provisions of Section 7 (Confidentiality) hereof. All reports delivered by the accounting firm pursuant to this Section 5.4 (Audit) will be the Confidential Information of Genzyme.

6. PROSECUTION, MAINTENANCE AND ENFORCEMENT

6.1 Prosecution of Licensed AAV Patent Rights.

6.1.1 Voyager will have the exclusive right, but not obligation, to prepare, file, prosecute, maintain and extend the Licensed AAV Patent Rights at Voyager's sole cost and through counsel of Voyager's choosing.

6.1.2 With respect to any Licensed AAV Patent Right that is a patent application that (i) first discloses the amino acid or nucleic acid sequence of a Licensed Capsid or (ii) first contains a claim that specifically claims the amino acid or nucleic acid sequence of a Licensed Capsid, Voyager will, in consultation with Genzyme and to the extent that the original disclosure of the relevant Licensed AAV Patent Right allows, take all steps reasonably available in order to establish divisional or similar applications that solely claims the sequence of a Licensed Capsid ("**Designated Patent Rights**").

6.1.3 With respect to Designated Patent Rights, Voyager will: (a) provide Genzyme with copies of, and an opportunity to review and comment upon, the text of any draft patent applications at least [**] before filing; provided, that if it is not reasonably practicable to provide such application in such [**] period, then Voyager will provide a draft copy of such application and a statement of intent to file such application as soon as is practicable; (b) provide Genzyme with a copy of each material submission made to and document received from a patent authority, court or other tribunal regarding such Patent Rights reasonably promptly after making such filing or receiving such document, including a copy of each application for such Patent Right as filed together with notice of its filing date and application number; (c) keep Genzyme reasonably advised of the status of all material communications, and actual and prospective filings or submissions regarding such Patent Rights, and will give Genzyme copies of and a reasonable opportunity to review and comment on any such material communications, filings and submissions proposed to be sent to any patent authority or judicial body; and (d) consider in good faith Genzyme's reasonable comments on such communications, filings and submissions for such Patent Rights.

6.2 Enforcement of Licensed AAV Patent Rights

6.2.1 Notification of Infringement. In the event that Voyager becomes aware of any actual, alleged or threatened infringement of the Licensed AAV Patent Rights in a Field, it will promptly notify Genzyme and provide Genzyme with all details of such infringement of which it is aware. In the event that Genzyme becomes aware of any actual,

alleged or threatened infringement of the Licensed AAV Patent Rights, it will promptly notify Voyager and provide Voyager with all details of such infringement of which it is aware. Any notice provided from one Party to the other Party pursuant to this Section 6.2.1 shall be referred to as an "**Infringement Notice**."

6.2.2 With respect to any actual, alleged or threatened material infringement in the Field, it is the intention of the Parties that any such infringement will first be addressed through enforcement of the Designated Patent Rights, provided, however, that if the Parties mutually in good faith determine that the Designated Patent Rights are not sufficiently enforceable with respect to the particular infringement (for which, if needed, the Parties may decide to request advice from outside counsel in the country or countries where the infringement occurs), Genzyme may request Voyager to enforce any other Licensed AAV Patent Rights that are not Designated Patent Rights ("**Non-Designated Patent Rights**") with respect to such infringing activity, in which case the Parties will promptly discuss such enforcement in good faith.

6.2.3 Following receipt of an Infringement Notice from, or delivery of an Infringement Notice to, Voyager, Genzyme will have the first right, but not the obligation, at its sole expense (including where applicable Voyager's reasonable expenses), through counsel of its choosing, to control enforcement (by initiating an infringement action or taking other appropriate legal action), including defense and settlement thereof, against any actual, alleged or threatened Third Party infringement of the Designated Patent Rights to the extent such infringement is in a Field. If, however, Genzyme does not initiate an infringement action or otherwise take affirmative measures to abate any such actual, alleged or threatened Third Party infringement of the Designated Patent Rights in a Field within [**] after the date that Genzyme first becomes aware of such infringement, then Voyager will have the right, but not the obligation, at its own expense, to bring suit (or take other appropriate legal action) against any such actual, alleged or threatened infringement of such Patents by a Third Party in, including the defense and settlement thereof.

6.2.4 Following receipt of an Infringement Notice from, or delivery of an Infringement Notice to, Genzyme, Voyager will have the first right, but not the obligation, at its sole expense (including where applicable Genzyme's reasonable expenses), through counsel of its choosing, to control enforcement (by initiating an infringement action or taking other appropriate legal action) against any actual, alleged or threatened infringement of any Non-Designated Patent Rights, including the defense and settlement of thereof. If Voyager does not initiate an infringement action or otherwise take affirmative measures to abate any such actual, alleged or threatened Third Party infringement (to the extent such infringement is in the Field) of any Non-Designated Patent Rights in a Field within [**] after the date that Voyager first becomes aware of such infringement, then, with Voyager's prior written consent (not to be unreasonably withheld), Genzyme will have the right, but not the obligation, at its own expense, to bring suit (or take other appropriate legal action) against any such actual, alleged or threatened infringement of such Non-Designated Patent Rights by a Third Party, including the defense and settlement thereof.

6.2.5 With regard to any suit referred to in Section 6.2.3 or 6.2.4, the enforcing Party may, but is not obligated to bring suit in its own name, or if required by applicable Law, jointly with the other Party, for infringement of the applicable Patents.

6.2.6 For so long as Genzyme's rights under Section 3 remain exclusive, Genzyme may control settlement of any claim or suit for infringement in a Field of the Designated Patent Rights solely by granting the infringing party a sublicense under such Patents to the extent consistent with the license granted to Genzyme and in accordance with the sublicensing provisions of this Agreement.

6.2.7 In the event either Party brings an infringement action in accordance with this Section 6.2, such Party will notify the other Party at least [**] prior to filing such action. The non-enforcing Party will, at the enforcing Party's reasonable request and expense, reasonably assist the enforcing Party, including, in the event that it is determined that the non-enforcing Party is an indispensable Party to such action, by being named as a party in such action, and cooperate in any such action at the enforcing Party's request; provided, however that Voyager will not be required to transfer any right, title, or interest in or to any of its Patents (or other assets) to Genzyme to confer standing on Genzyme hereunder. In addition, if either Party brings an infringement action hereunder, the other Party will have the right to be represented separately in such action by counsel of its own choice, at its own expense. Genzyme shall not be obligated to assist (financially or otherwise) Voyager in enforcing Licensed AAV Patent Rights outside the Field.

6.2.8 All recoveries with respect to any action under this Section 6.2 will first be applied pro rata to reimburse the Parties' respective reasonable costs and expenses incurred in accordance with this Section 6.2 and any remaining amounts shall be will be retained by or paid to Genzyme and shall be treated as Net Sales, and Genzyme shall pay Voyager a royalty in respect of such recovery in accordance with Section 4.4 (Royalty Payments).

6.2.9 Neither Party will bear any liability to the other Party as a consequence of any litigation conducted pursuant to this Section 6.2 or any unfavorable decision regarding the same, including any decision holding any Patent Right is invalid or unenforceable.

6.3 For the avoidance of any doubt, except as explicitly set forth in Section 6.1 or Section 6.2, Voyager shall retain all prosecution, maintenance and enforcement rights with respect to the AAV Patent Rights and Genzyme shall have no rights with respect to the prosecution, maintenance or enforcement of the AAV Patent Rights.

6.4 If the Licensed AAV Patent Rights include Patent Rights licensed to Voyager under an In-License Agreement, to the extent there is a conflict between any of the terms of such In-License Agreement (or any patent management agreement related thereto) and the terms set forth in this Section 6, the terms of such In-License Agreement (or patent management agreement related thereto) shall control.

7. CONFIDENTIALITY

7.1 Nondisclosure Obligation. All Confidential Information disclosed by one Party (the "**Disclosing Party**") to the other Party (the "**Receiving Party**") under this Agreement will be

maintained in confidence by the Receiving Party and will not be disclosed to a Third Party or used for any purpose except as set forth in this Agreement without the prior written consent of the Disclosing Party, except to the extent that such Confidential Information:

7.1.1 is known by the Receiving Party at the time of its receipt, and not through a prior disclosure by the Disclosing Party, as documented by the Receiving Party's business records;

7.1.2 is known to the public before its receipt from the Disclosing Party, or thereafter becomes known to the public through no breach of this Agreement by the Receiving Party;

7.1.3 is subsequently disclosed to the Receiving Party by a Third Party who is not known by the Receiving Party to be under an obligation of confidentiality to the Disclosing Party; or

7.1.4 is developed by the Receiving Party independently of Confidential Information received from the Disclosing Party, as documented by the Receiving Party's business records.

7.2 Genzyme Studies. Genzyme shall not disclose any data, results or reports from the Genzyme Studies to Third Parties until Genzyme has exercised an Option pursuant to Section 2.4 (Option Exercise) for the Specified Capsid that is the subject of such Genzyme Study, provided, that the term "Third Parties" as used in this Section 7.2 shall be deemed to not include any Third Parties that were involved in the performance or review of such Genzyme Studies.

7.3 Certain Permitted Disclosures. Notwithstanding the obligations of confidentiality and non-use set forth in Section 7.1 (Nondisclosure Obligation), the Receiving Party may use and disclose Confidential Information disclosed to it, and disclose the existence and terms of this Agreement, as may be reasonably required by such Party in order for it to perform its obligations and to exploit its rights under this Agreement, and specifically to: (a) Related Parties and their employees, directors, agents, consultants, advisors or other Third Parties for the performance of its obligations hereunder (or for such entities to determine their interest in performing such activities) in accordance with this Agreement, in each case, who are under an obligation of confidentiality with respect to such information that is no less stringent than the terms of this Section 7 (Confidentiality); (b) Governmental Authorities or other Regulatory Authorities in order to obtain patents or perform its obligations or exploit its rights under this Agreement; ***provided that*** such Confidential Information will be disclosed only to the extent reasonably necessary to do so; (c) the extent required by Law, including by the rules or regulations of the United States Securities and Exchange Commission or similar regulatory agency in a country other than the United States or of any stock exchange or listing entity; and (d) any bona fide actual or prospective underwriters, investors, lenders or acquirers of such Party or substantially all of its assets, and to consultants and advisors of such Party, in each case, who are under an obligation of confidentiality with respect to such information that is no less stringent than the terms of this Section 7 (Confidentiality). If a Party is required by Law to disclose Confidential Information that is subject to the non-disclosure provisions of this Section 7 (Confidentiality), such Party will promptly inform the other Party of the disclosure that is being sought in order to provide the other Party an

opportunity to challenge or limit the disclosure. Notwithstanding this Section 7.3 (Certain Permitted Disclosures), Confidential Information that is required to be disclosed by Law will remain otherwise subject to the confidentiality and non-use provisions of this Section 7.1 (Nondisclosure Obligation). If either Party concludes that a copy of any of this Agreement must be filed with the United States Securities and Exchange Commission or similar regulatory agency in a country other than the United States, such Party will provide the other Party with a copy of such agreement showing any provisions hereof as to which the Party proposes to request confidential treatment, will provide the other Party with an opportunity to comment on any such proposed redactions and to suggest additional redactions and will take such Party's comments into consideration before filing such agreement.

7.4 Non-Use of Trademarks. Except to the extent required to comply with applicable Law or a valid order of a Governmental Authority, neither Party nor its Related Parties (or Third Parties acting on its or their behalf) will use the corporate names, logos or trademarks of the other Party without the other Party's prior written consent, and each Party and its Related Parties will retain all right, title and interest in and to its and their respective corporate names, logos and trademarks.

7.5 No Public Announcement. Neither Party will issue a press release or other public announcement relating to this Agreement without the prior written approval of the other Party, which approval will not be unreasonably withheld, conditioned or delayed, except that a Party may (a) once a press release or other public statement is approved in writing by both Parties, make subsequent public disclosure of the information contained in such press release or other written statement without the further approval of the other Party and (b) issue a press release or public announcement as required, in the reasonable judgment of such Party, by Law, including by the rules or regulations of the United States Securities and Exchange Commission or similar regulatory agency in a country other than the United States or of any stock exchange or listing entity.

8. REPRESENTATIONS AND WARRANTIES

8.1 Mutual Representations and Warranties. Each Party represents and warrants to the other Party that, as of the Effective Date:

8.1.1 it is a corporation duly organized, validly existing and in good standing under the laws of its jurisdiction of incorporation or formation;

8.1.2 it has all requisite corporate power and corporate authority to enter into this Agreement and to carry out its obligations under this Agreement;

8.1.3 all requisite corporate action on the part of such Party, its directors and stockholders required by applicable Law for the authorization, execution and delivery by such Party of this Agreement, and the performance of all obligations of such Party under this Agreement, has been taken; and

8.1.4 the execution, delivery and performance of this Agreement by such Party, and its compliance with the provisions hereof, do not and will not: (a) violate any provision of applicable Law or any ruling, writ, injunction, order, permit, judgment or decree of any Governmental Authority; (b) constitute a breach of, or default under (or an event which,

with notice or lapse of time or both, would become a default under) or conflict with, or give rise to any right of termination, cancellation or acceleration of, any agreement, arrangement or instrument, whether written or oral, by which such Party or any of its assets are bound; or (c) violate or conflict with any of the provisions of such Party's organizational documents (including any articles or memoranda of organization or association, charter, bylaws or similar documents).

8.2 Voyager's Representations and Warranties. Voyager represents and warrants to Genzyme that, as of the Effective Date:

8.2.1 Schedule 8.2.1 (AAV Patent Rights) sets forth a complete and accurate list of all AAV Patent Rights;

8.2.2 with respect to AAV Patent Rights owned by Voyager, Voyager is the sole and exclusive owner of such AAV Patent Rights free and clear of any claims, liens, charges or encumbrances;

8.2.3 Voyager has sufficient legal or beneficial title, ownership or other Control of the AAV Patent Rights to grant the licenses to such AAV Patent Rights pursuant to this Agreement;

8.2.4 with respect to AAV Patent Rights owned by Voyager, each such AAV Patent Right is in full force and effect and Voyager or its Affiliates have timely paid all filing and renewal fees payable with respect to such patents and applications

8.2.5 with respect to AAV Patent Rights licensed to Voyager under the [**], each such AAV Patent Right, to Voyager's knowledge, is in full force and effect and Voyager or its Affiliates have timely paid all filing and renewal fees payable with respect to such patents and applications;

8.2.6 to Voyager's knowledge, the AAV Patent Rights are, or, upon issuance, will be, valid and enforceable patents;

8.2.7 no Third Party: (a) to Voyager's knowledge, is infringing any AAV Patent Right; or (b) has challenged or threatened to challenge the extent, validity or enforceability of any AAV Patent Right;

8.2.8 to Voyager's knowledge, practicing the AAV Patent Rights in the Field does not infringe the intellectual property rights of any Third Party;

8.2.9 there is no: (a) claim, demand, suit, proceeding, arbitration, inquiry, investigation or other legal action of any nature, whether civil, criminal, regulatory or otherwise, pending or, to Voyager's knowledge, threatened against Voyager or any of its Affiliates; or (b) judgment or settlement against or owed by Voyager or any of its Affiliates, in each case, in connection with the AAV Patent Rights or relating to the transactions contemplated by this Agreement;

8.2.10 to Voyager's knowledge, no rights or licenses are required under the AAV Patent Rights for Genzyme to develop, manufacture or commercialize Licensed Capsids or Licensed other than those granted under Section 3; and

8.2.11 Voyager has not previously entered into any agreement, whether written or oral, with respect to or otherwise assigning, transferring, licensing, conveying or otherwise encumbering its right, title or interest in or to the AAV Patent Rights that is inconsistent with the rights and licenses granted to Genzyme under this Agreement.

8.3 Updates to Patent Schedule. Voyager covenants to update Schedule 8.2.1 (AAV Patent Rights) no less frequently than [**], and more frequently as may be reasonably requested by Genzyme.

9. TERM AND TERMINATION

9.1 Term. This Agreement will be effective beginning on the Effective Date and will extend to the expiration of the last to expire Royalty Term (collectively, the "**Term**"), unless sooner terminated as provided in this Section 9 (Term and Termination).

9.2 Termination for Convenience by Genzyme. Genzyme will have the right to terminate this Agreement in its entirety or on a Licensed Product-by-Licensed Product basis at any time after the Effective Date on thirty (30) days' prior notice to Voyager.

9.3 Termination for Material Breach. This Agreement may be terminated in its entirety at any time during the Term upon written notice by either Party if the other Party is in material breach of its obligations hereunder and has not cured such breach within [**] in the case of a payment breach, or within [**] in the case of all other breaches, after notice requesting cure of the breach; ***provided that*** if any breach other than a payment breach is not reasonably curable within [**], and if a Party is making a bona fide effort to cure such breach, such termination will be delayed for a time period to be agreed upon by both Parties, not to exceed an additional [**], in order to permit such Party a reasonable period of time to cure such breach. If a breach relates to the non-payment of any amount allegedly due under this Agreement, then the cure period will be tolled pending resolution of any genuine dispute between the Parties as to whether such payment is due hereunder.

9.4 Effects of Expiration or Termination.

9.4.1 Generally. Without limiting any other legal or equitable remedies that either Party may have, upon expiration or termination of this Agreement, the following will apply:

9.4.1.1 within [**] of the effective date of any such expiration or termination Genzyme will submit a final royalty report to Voyager and pay to Voyager any amounts then-owed within [**] of such submission;

9.4.1.2 in the event Voyager owes a payment to Genzyme pursuant to Section 5.4.2 (Audit), Voyager will make such payment to Genzyme within [**] of the effective date of any such expiration or termination; and

9.4.1.3 within [**] of the effective date of any such expiration or termination, each Party will destroy or return to the other Party, at the other Party's option, all tangible items bearing, containing or contained in the Confidential Information of the other Party, with any such destruction certified to in writing by the destroying Party; *provided that* each Party may retain one (1) copy of the Confidential Information of the other Party for use in reviewing or fulfilling its ongoing obligations hereunder.

9.4.2 Specific Effects of Expiration. On a country-by-country basis, in the case of expiration of this Agreement in a country in the Territory, Genzyme's license with regard to the Licensed AAV Patent Rights in such country pursuant to Section 3.1 (License to Genzyme) will become fully-paid up, perpetual, irrevocable and royalty-free.

9.4.3 Specific Effects of Termination. Without limiting any other legal or equitable remedies that either Party may have, if this Agreement is terminated by Genzyme pursuant to Section 9.2 (Termination for Convenience by Genzyme) or by either Party pursuant to Section 9.3 (Termination for Material Breach), then:

9.4.3.1 All licenses granted in this Agreement will terminate on the effective date of termination;

9.4.3.2 Genzyme will be allowed to sell, for a period of [**] following the effective date of termination, Licensed Products that are in process of manufacture or in stock as of the effective date of termination; *provided that* Genzyme will continue to pay Voyager any amounts that accrue and are owed pursuant to this Agreement as a result of such sale;

9.4.3.3 If this Agreement is terminated for any reason other than a termination by Genzyme pursuant to Section 9.3, then Section 2.1.1(c) shall survive such termination until the [**] of such termination, and all Sections necessary to effectuate the interpretation and implementation of Section 2.1.1(c) shall survive as long as necessary to give effect to Section 2.1.1(c).

9.5 Accrued Rights. No expiration or termination of this Agreement will relieve either Party from any liability which, at the time of such expiration or termination, has already accrued to the other Party or which is attributable to a period of time prior to such expiration or termination, or preclude either Party from pursuing any rights or remedies it may have, at Law or in equity, which accrued or are based upon any event occurring prior to such expiration or termination.

10. INDEMNIFICATION; LIMITATION ON LIABILITY

10.1 Indemnification By Genzyme. Genzyme will indemnify, hold harmless and defend Voyager, its Related Parties, and their respective directors, officers, employees and agents ("**Voyager Indemnitees**") from and against any and all Third Party claims, suits, losses, liabilities, damages, costs, fees and expenses (including reasonable attorneys' fees and litigation expenses) (collectively, "**Losses**") arising out of or resulting from, directly or indirectly, (a) any breach of, or inaccuracy in, any representation or warranty made by Genzyme in this Agreement, or any breach or violation of any covenant or agreement of Genzyme in or in the performance of this

Agreement or (b) the gross negligence or willful misconduct by or of Genzyme and its Related Parties, and their respective directors, officers, employees and agents in the performance of Genzyme's obligations under this Agreement. Genzyme will have no obligation to indemnify the Voyager Indemnitees to the extent that the Losses arise out of or result from, directly or indirectly, any breach of, or inaccuracy in, any representation or warranty made by Voyager in this Agreement, or any breach or violation of any covenant or agreement of Voyager in or in the performance of this Agreement, or the negligence or willful misconduct by or of any of the Voyager Indemnitees, or matters for which Voyager is obligated to indemnify Genzyme under Section 10.2 (Indemnification by Voyager).

10.2 Indemnification By Voyager. Voyager will indemnify, hold harmless, and defend Genzyme, its Related Parties and their respective directors, officers, employees and agents ("**Genzyme Indemnitees**") from and against any and all Losses arising out of or resulting from, directly or indirectly, (a) any breach of, or inaccuracy in, any representation or warranty made by Voyager in this Agreement, or any breach or violation of any covenant or agreement of Voyager in or in the performance of this Agreement or (b) the gross negligence or willful misconduct by or of Voyager and its Related Parties, and their respective directors, officers, employees and agents in the performance of Voyager's obligations under this Agreement. Voyager will have no obligation to indemnify the Genzyme Indemnitees to the extent that the Losses arise out of or result from, directly or indirectly, any breach of, or inaccuracy in, any representation or warranty made by Genzyme in this Agreement, or any breach or violation of any covenant or agreement of Genzyme in or in the performance of this Agreement, or the negligence or willful misconduct by or of any of the Genzyme Indemnitees, or matters for which Genzyme is obligated to indemnify Voyager under Section 10.1 (Indemnification by Genzyme).

10.3 Indemnification Procedure. In the event of any such claim against any Genzyme Indemnitee or Voyager Indemnitee (individually, an "**Indemnitee**"), the indemnified Party will promptly notify the other Party in writing of the claim and the indemnifying Party will manage and control, at its sole expense, the defense of the claim and its settlement. The Indemnitee will cooperate with the indemnifying Party and may, at its option and expense, be represented in any such action or proceeding. The indemnifying Party will not be liable for any settlements, litigation costs or expenses incurred by any Indemnitee without the indemnifying Party's written authorization. Notwithstanding the foregoing, if the indemnifying Party believes that any of the exceptions to its obligation of indemnification of the Indemnitees set forth in Section 10.1 (Indemnification by Genzyme) or Section 10.2 (Indemnification by Voyager) may apply, the indemnifying Party will promptly notify the Indemnitees, which will then have the right to be represented in any such action or proceeding by separate counsel at their expense; ***provided that*** the indemnifying Party will be responsible for payment of such expenses if the Indemnitees are ultimately determined to be entitled to indemnification from the indemnifying Party for the matters to which the indemnifying Party notified the Indemnitees that such exception(s) may apply.

10.4 Limitation on Liability.

10.4.1 NEITHER PARTY WILL BE ENTITLED TO RECOVER FROM THE OTHER PARTY ANY LOST PROFITS OR SPECIAL, INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES IN CONNECTION WITH THIS AGREEMENT, EXCEPT TO THE EXTENT THAT SUCH DAMAGES (A) ARE

INCLUDED IN THIRD PARTY INDEMNIFICATION CLAIMS ARISING PURSUANT TO THIS SECTION 10 (INDEMNIFICATION; LIMITATION ON LIABILITY); (B) ARISE FROM BREACHES OF SECTION 7 (CONFIDENTIALITY) OR (C) ARE THE RESULT OF FRAUD OR WILLFUL MISCONDUCT OF A PARTY HERETO. IN NO EVENT WILL GENZYME'S LIABILITY UNDER THIS AGREEMENT EXCEED THE TOTAL AMOUNT OF PAYMENTS RECEIVED BY VOYAGER HEREUNDER DURING THE TWELVE (12) MONTH PERIOD IMMEDIATELY PRECEDING THE EVENT(S) GIVING RISE TO THE LIABILITY.

10.4.2 EXCEPT AS EXPRESSLY STATED TO THE CONTRARY, THE LIMITATIONS STATED ABOVE WILL APPLY WHETHER THE ASSERTED CLAIM, LIABILITY OR DAMAGES ARE BASED ON CONTRACT (INCLUDING BREACH OF WARRANTY), TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR ANY OTHER LEGAL OR EQUITABLE GROUNDS, AND REGARDLESS OF WHETHER THE ASSERTED CLAIM, LIABILITY OR DAMAGES ARISE FROM PERSONAL INJURY, PROPERTY DAMAGE, ECONOMIC LOSS OR ANY OTHER KIND OF INJURY, LOSS OR DAMAGE. EACH OF SUCH LIMITATION IS INTENDED TO BE ENFORCEABLE REGARDLESS OF WHETHER ANY OTHER EXCLUSIVE OR NON-EXCLUSIVE REMEDY UNDER THIS AGREEMENT FAILS OF ITS ESSENTIAL PURPOSE.

11. DISPUTE RESOLUTION

11.1 Escalation. Should a Dispute arise between the Parties, the Parties will adhere to the following procedures in their attempts to resolve the Dispute:

11.1.1 The Party claiming that the Dispute exists will give notice in writing to the other Party of the nature of the Dispute.

11.1.2 Within [**] of such notice, the [**] of each Party (or their designees) will meet in person at a mutually acceptable time and location or by means of telephone or video conference to negotiate a settlement of the Dispute.

11.1.3 If the [**] of each Party (or their designees) fail to resolve the Dispute within such [**] period, then either Party may pursue a legal remedy in accordance with Section 12.3 (Jurisdiction) and Section 12.4 (Venue).

11.2 Waiver of Jury Trial. EACH OF THE PARTIES HERETO IRREVOCABLY WAIVES ANY AND ALL RIGHT TO TRIAL BY JURY IN ANY LEGAL PROCEEDING ARISING OUT OF OR RELATING TO THIS AGREEMENT OR THE TRANSACTIONS CONTEMPLATED HEREBY.

12. MISCELLANEOUS

12.1 Entire Agreement; Amendments. This Agreement contains the entire understanding of the Parties with respect to the subject matter hereof, and supersedes all previous arrangements with respect to the subject matter hereof, whether written or oral. This Agreement

(including the Schedules attached hereto) may be amended, or any term hereof modified, only by a written instrument duly-executed by authorized representatives of both Parties hereto.

12.2 Governing Law. This Agreement will be construed and the respective rights of the Parties determined in accordance with the substantive Laws of The Commonwealth of Massachusetts, notwithstanding any provisions of Massachusetts Law or any other Law governing conflicts of laws to the contrary, and the patent Laws of the relevant jurisdiction without reference to any rules of conflict of laws.

12.3 Jurisdiction. Each Party by its execution hereof (a) hereby irrevocably submits to the jurisdiction of the United States District Court and state courts located in Boston, Massachusetts for the purpose of any Dispute arising between the Parties, except as otherwise expressly provided in this Agreement; (b) hereby waives, to the extent not prohibited by applicable Law, and agrees not to assert, by way of motion, as a defense or otherwise, in any such Dispute, any claim that (i) it is not subject personally to the jurisdiction of the above-named court, (ii) its property is exempt or immune from attachment or execution, (iii) any such Dispute brought in the above-named court should be dismissed on grounds of forum non conveniens, should be transferred or removed to any court other than the above-named court, or should be stayed by reason of the pendency of some other proceeding in any other court other than the above-named court or (iv) this Agreement or the subject matter hereof may not be enforced in or by such court; and (c) hereby agrees not to commence any such Dispute other than before the above-named court. Notwithstanding the previous sentence a Party may commence any Dispute in a court other than the above-named court solely for the purpose of enforcing an order or judgment issued by the above-named court.

12.4 Venue. Each Party agrees that for any Dispute between the Parties, such Party will bring such Dispute only in the federal courts of the United States of America located in Boston, Massachusetts and any appellate court having jurisdiction over appeals from such courts. Each Party further waives any claim and will not assert that venue should properly lie in any other location within the selected jurisdiction.

12.5 Assignment. Except as provided in this Section 12.5 (Assignment), this Agreement may not be assigned or otherwise transferred, nor may any right or obligation hereunder be assigned or transferred, by either Party without the written consent of the other Party. Notwithstanding the foregoing, either Party may, without the other Party's written consent, assign this Agreement and its rights and obligations hereunder in whole or in part to an Affiliate or to a party that acquires, by or otherwise in connection with, merger, sale of assets or otherwise, all or substantially all of the business of the assigning Party to which the subject matter of this Agreement relates, provided that the assignee agrees in writing to assume all of the assigning Party's obligations under this Agreement. The assigning Party will remain responsible for the performance by its assignee of this Agreement or any obligations hereunder so assigned. Any purported assignment in violation of this Section 12.5 (Assignment) will be void.

12.6 Severability. If any provision hereof should be held invalid, illegal or unenforceable in any respect in any jurisdiction, the Parties hereto will substitute, by mutual consent, valid provisions for such invalid, illegal or unenforceable provisions, which valid provisions in their economic effect are sufficiently similar to the invalid, illegal or unenforceable

provisions that it can be reasonably assumed the Parties would have entered into this Agreement with such valid provisions. If such valid provisions cannot be agreed upon, the invalidity, illegality or unenforceability of one or several provisions of this Agreement will not affect the validity of this Agreement as a whole, unless the invalid, illegal or unenforceable provisions are of such essential importance to this Agreement that it is to be reasonably assumed that the Parties would not have entered into this Agreement without the invalid, illegal or unenforceable provisions.

12.7 Headings. The captions to the Sections hereof are not a part of this Agreement, but are merely for convenience to assist in locating and reading the several Sections hereof.

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

12.9 Interpretation. Except where the context expressly requires otherwise: (a) the use of any gender herein will be deemed to encompass references to either or both genders, and the use of the singular will be deemed to include the plural (and vice versa); (b) the words "include", "includes" and "including" will be deemed to be followed by the phrase "without limitation" and will not be interpreted to limit the provision to which it relates; (c) the word "will" will be construed to have the same meaning and effect as the word "shall"; (d) any definition of or reference to any agreement, instrument or other document herein will be construed as referring to such agreement, instrument or other document as from time to time amended, supplemented or otherwise modified (subject to any restrictions on such amendments, supplements or modifications set forth herein); (e) any reference herein to any Person will be construed to include the Person's successors and assigns; (f) the words "herein", "hereof' and "hereunder", and words of similar import, will be construed to refer to this Agreement in each of their entirety, as the context requires, and not to any particular provision hereof; (g) all references herein to Sections or Schedules will be construed to refer to Sections or Schedules of this Agreement, and references to this Agreement include all Schedules hereto; (h) the word "notice" means notice in writing (whether or not specifically stated) and will include notices, consents, approvals and other written communications contemplated under this Agreement; (i) provisions that require that a Party, the Parties or any committee hereunder "agree," "consent" or "approve" or the like will require that such agreement, consent or approval be specific and in writing, whether by written agreement, letter, approved minutes or otherwise (but excluding e-mail and instant messaging); (j) references to any specific law, rule or regulation, article, Section or other division thereof, will be deemed to include the then-current amendments thereto or any replacement or successor law, rule or regulation thereof; and (k) the term "or" will be interpreted in the inclusive sense commonly associated with the term "and/or."

12.10 No Implied Waivers; Rights Cumulative. No failure on the part of Voyager or Genzyme to exercise, and no delay in exercising, any right, power, remedy or privilege under this Agreement, or provided by statute or at Law or in equity or otherwise, will impair, prejudice or constitute a waiver of any such right, power, remedy or privilege, or be construed as a waiver of any breach of this Agreement or as an acquiescence therein, nor will any single or partial exercise of any such right, power, remedy or privilege preclude any other or further exercise thereof or the exercise of any other right, power, remedy or privilege.

12.11 Notices. All notices which are required or permitted hereunder will be in writing and sufficient if delivered personally, sent by facsimile (and promptly confirmed by personal delivery, registered or certified mail or overnight courier), sent by nationally-recognized overnight courier or sent by registered or certified mail, postage prepaid, return receipt requested, addressed as follows:

If to Voyager, to:	Voyager Therapeutics, Inc. 75 Sidney Street Cambridge, Massachusetts 02139 Attention: Chief Executive Officer Facsimile No.: (617) 621-2971
With a copy to:	WilmerHale LLP 7 World Trade Center 250 Greenwich Street New York, NY 10007 Attention: Brian Johnson Facsimile No.: (212) 230-8888
If to Genzyme, to:	Sanofi 50 Binney Street Cambridge, MA 02142 Attention: Brian Bronk, Head of Rare Disease Business Development and Licensing
With a copy to:	Sanofi 50 Binney Street Cambridge, MA 02142 Attention: Attention: Dan Haines, Head of Legal Global Functions
And to:	Ropes & Gray LLP Prudential Tower 800 Boylston Street Boston, MA 02199-3600 Attention: David M. McIntosh Facsimile No.: (617) 235-0507

or to such other address as the Party to whom notice is to be given may have furnished to the other Party in writing in accordance herewith. Any such notice will be deemed to have been given: (a) when delivered, if personally delivered or sent by facsimile on a business day (or if delivered or sent on a non-business day, then on the next business day); (b) on receipt, if sent by overnight courier; or (c) on receipt, if sent by mail.

12.12 Force Majeure. Neither Party will be held liable to the other Party nor be deemed to have defaulted under or breached this Agreement for failure or delay in performing any obligation under this Agreement to the extent that such failure or delay is caused by or results from causes beyond the reasonable control of the affected Party, potentially including embargoes, war, acts of war (whether war is declared or not), insurrections, riots, civil commotions, strikes, lockouts or other labor disturbances, fire, floods, or other acts of God. The affected Party will notify the other Party of such force majeure circumstances as soon as reasonably practical and will promptly undertake all reasonable efforts necessary to cure such force majeure circumstances.

12.13 [**] as Third Party Beneficiary. If and for so long as the Specified Capsids or Licensed Capsids, as applicable at any given time, are Covered by Patent Rights licensed to Voyager under the [**], Genzyme and Voyager agree that if the [**] is terminated, and if Genzyme wishes to maintain its sublicense under the [**] as contemplated by and to the extent permitted under Section 2.3 of the [**], then Genzyme (a) shall render directly to [**] all consideration that Genzyme would have owed to Voyager under this Agreement if the [**] had not been terminated, and (b) [**] shall be a third party beneficiary under Sections 5 and 6 of this Agreement.

12.14 Independent Contractors. It is expressly agreed that Voyager and Genzyme are independent contractors and that the relationship between Voyager and Genzyme does not constitute a partnership, joint venture or agency. Voyager will not have the authority to make any statements, representations or commitments of any kind, or to take any action, which will be binding on Genzyme, without the prior written consent of Genzyme, and Genzyme will not have the authority to make any statements, representations or commitments of any kind, or to take any action, which will be binding on Voyager without the prior written consent of Voyager.

12.15 Survival. The following sections will survive expiration or termination of this Agreement and will remain in full force and effect: Section 2.1.1(c) (Voyager Reports), Section 4 (Consideration) and Section 5 (Reports; Recording Keeping; Audit) (to the extent such Sections survive pursuant to Section 9.4.3.3), Section 7 (Confidentiality), Section 9.4 (Effects of Expiration or Termination), Section 10 (Indemnification; Limitation on Liability), Section 11 (Dispute Resolution) and Section 12 (Miscellaneous). Except as otherwise set forth in this Section 12.14 (Survival), upon expiration or termination of this Agreement, all rights and obligations of the Parties under this Agreement will cease.

12.16 Counterparts. The Agreement may be executed in two or more counterparts, including by facsimile or PDF signature pages, each of which will be deemed an original, but all of which together will constitute one and the same instrument.

12.17 Binding Effect; No Third Party Beneficiaries. As of the Effective Date, this Agreement will be binding upon and inure to the benefit of the Parties and their respective permitted successors and permitted assigns. Except as expressly set forth in Section 12.13 of this Agreement, no Person other than the Parties and their respective Affiliates and permitted assignees hereunder will be deemed an intended beneficiary hereunder or have any right to enforce any obligation of this Agreement.

[SIGNATURE PAGE FOLLOWS]

IN WITNESS WHEREOF, the Parties have executed this Agreement as of the Effective Date.

GENZYME CORPORATION		**VOYAGER THERAPEUTICS, INC.**	
BY:	/s/ Muzammil Mansuri	BY:	/s/ G. Andre Turenne
NAME:	Muzammil Mansuri	NAME:	G. Andre Turenne
TITLE:	Executive Vice President, Strategy and Business Development	TITLE:	President and Chief Executive Officer

Exhibit 10.5

AMENDMENT NO. 1 TO COLLABORATION AND LICENSE AGREEMENT

This Amendment No. 1 to Collaboration and License Agreement (the "Amendment") entered into and effective on June 14, 2019 (the "Amendment Execution Date"), is made by and between Voyager Therapeutics, Inc., a Delaware corporation, having its principal place of business at 75 Sidney Street, Cambridge, MA 02139 ("Voyager"), and Neurocrine Biosciences, Inc., a Delaware corporation, having its principal place of business at 12780 El Camino Real, San Diego, CA 92130 ("Neurocrine"). Voyager and Neurocrine each may be referred to individually as a "Party", or together as the "Parties" Capitalized terms that are not defined in this Amendment shall have the meaning set forth in the Agreement (as defined below).

WHEREAS, on January 28, 2019, Voyager and Neurocrine entered into a Collaboration and License Agreement (the "Agreement");

WHEREAS, Voyager intends to enter into a Termination Agreement with Genzyme (the "Genzyme Termination Agreement"), terminating Genzyme's rights under the Genzyme Agreement to the FA Program outside the United States;

WHEREAS, the Parties desire to amend the Agreement to modify the definition of "Territory" as set forth below;

NOW, THEREFORE, in consideration of the premises and mutual covenants contained herein, the Parties hereby agree to modify the Agreement as follows:

1. In consideration for agreements made in this Amendment, upon the effectiveness of the Genzyme Termination Agreement, Neurocrine shall pay Voyager a one-time, non-refundable, non-creditable upfront payment of Five Million Dollars ($5,000,000) within five (5) Business Days (the "Amendment Effective Time"), provided that Voyager and Genzyme enter into the Genzyme Termination Agreement no later than July 31, 2019 (unless extended by written agreement between the Parties). Voyager shall provide Neurocrine written notice confirming that Voyager and Genzyme have entered into the Genzyme Termination Agreement and that the Genzyme Termination Agreement is effective.

2. As of the Amendment Effective Time, Genzyme's rights to the FA Program outside the United States shall be deemed to have expired, and the terms of Section 5.4 of the Agreement regarding the expanded definition of Territory with respect to Neurocrine's rights to the FA Program outside the United States shall automatically come into effect.

3. As of the Amendment Effective Time, the Territory will be expanded to include countries outside the United States with respect to the FA Program under the terms of the Agreement.

   As contemplated pursuant to Section 2.1.2 of the Agreement, as of the Amendment Execution Date, the Parties hereby mutually agree that the Potential Target List shall consist of the Targets set forth on EXHIBIT A to this Amendment.

4. All other terms and conditions in the Agreement that are not hereby amended are to remain in full force and effect.

5. This Amendment may be executed in two or more counterparts, including by facsimile or PDF signature pages, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

[Signature Page to Follow]

IN WITNESS WHEREOF, the Parties have caused this Amendment to be executed by their duly authorized representatives as of the Amendment Execution Date.

VOYAGER THERAPEUTICS, INC.	NEUROCRINE BIOSCIENCES, INC.
By: */s/ Andre Turenne*	By: */s/ Matthew Abernethy*
Name: Andre Turenne	Name: Matthew C Abernethy
Title: Chief Executive Officer, President, and Director	Title: Chief Financial Officer

Exhibit 10.6

CONSULTING AGREEMENT

THIS AGREEMENT (together with the attached Accounting of Services Form, the "Agreement"), is entered into as of June 28, 2019 (the "Effective Date"), by and between Dinah Sah, (the "Consultant") and Voyager Therapeutics, Inc., a Delaware corporation located at 75 Sidney Street, Cambridge, MA 02139 (hereinafter "Voyager").

WHEREAS, Voyager desires to retain the consulting and advisory services of Consultant with respect to certain activities as described in this Agreement, and Consultant is willing to so act.

NOW, THEREFORE, Consultant and Voyager agree as follows:

1. Description of Services. Voyager hereby retains Consultant as a consultant to Voyager and Consultant hereby agrees to use her best efforts to provide advice and assistance to Voyager in the area of Consultant's expertise from time to time as requested by Voyager (the "Services"). In particular, the Services shall include any specific activities described on the attached Accounting of Services Form attached hereto as Exhibit A, as well as a reasonable amount of additional advisory services to Voyager's personnel or designees by telephonic means, or in the form of reports and summaries, and such additional activities agreed to by the parties from time to time. Any changes to the Services (and any related compensation adjustments) must be agreed to in writing between Consultant and Voyager prior to implementation of the changes.

2. Term & Termination. The term of this Agreement shall be from the Effective Date through June 28, 2022, unless earlier terminated in accordance with this Agreement or extended by mutual written agreement (the "**Term**"). This Agreement may be terminated prior to its expiration in the following manner: (i) by Voyager at any time immediately upon written notice to Consultant if Consultant has materially breached this Agreement, the Retirement Agreement dated May 20, 2019 between Consultant and the Company (the "Retirement Agreement"), or the Restrictive Covenants Agreement referenced in the Retirement Agreement; (ii) by Consultant at any time immediately upon written notice if Voyager has materially breached this Agreement or the Retirement Agreement; (iii) at any time upon the mutual written consent of both parties; or (iv) automatically upon (x) Consultant's failure to timely sign the Additional Release attached to the Retirement Agreement as Attachment A (the "Additional Release"), (y) Consultant's revocation of the Additional Release, or (z) the death, physical incapacitation or mental incompetence of Consultant. Any expiration or termination of this Agreement shall be without prejudice to any obligation of either party that has accrued prior to the effective date of expiration or termination. Upon expiration or termination of this Agreement, neither Consultant nor Voyager will have any further obligations under this Agreement, except that (a) Consultant will terminate all Services in progress in an orderly manner as soon as practicable and in accordance with a schedule agreed to by Voyager, unless Voyager specifies in the notice of termination that Services in progress should be completed; (b) Consultant will deliver to Voyager all Work Product (defined below) made through expiration or termination; (c) Voyager will pay Consultant any monies due and owing Consultant, up to the time of termination or expiration, for Services properly performed and all authorized expenses actually incurred; (d) Consultant will immediately return to Voyager all Voyager Property (defined below) and other Confidential Information (defined below) and copies thereof provided to Consultant under this Agreement; and (e) the terms, conditions and obligations under Sections 2 and 4 through 14 will survive expiration or termination of this Agreement.

3. Payment of Fees and Expenses. Voyager will pay Consultant for fees, expenses and pass-through costs in accordance with each Accounting of Services Form, including reasonable and necessary travel, lodging and meals in connection with the Services, subject to Voyager's travel policy. Unless otherwise agreed in an Accounting of Services Form, the following shall apply:

(a) Voyager will pay Consultant monthly for retainer amounts.

(b) Consultant will invoice Voyager monthly for any additional fees, pre-approved expenses and pass-through costs relating to the Services. Invoices will reference the applicable PO number provided by Voyager,

and are to be sent directly to Accounts Payable, Voyager Therapeutics, Inc., 75 Sidney St., Cambridge, MA 02139 or submitted via e-mail to: ap@vygr.com;

(c) Voyager shall pay all undisputed amounts invoiced in accordance with the terms of this Section 3 within thirty (30) days of receipt of invoice.

Upon execution of this Agreement, Consultant shall submit a W-9/W-8BEN/W-8ECI (as applicable) to Voyager's Accounts Payable department at the address above. Invoices will not be paid without Voyager's receipt of Consultant's W-9/W-8BEN/W-8ECI information.

For the avoidance of doubt, it is understood that (i) any of Consultant's restricted stock unit awards and stock options will continue to vest and be exercisable, as applicable, in accordance with the terms of the applicable agreements and plan documents, as if Consultant had remained employed during the period during which Consultant is providing services under this Agreement, and (ii) vesting will cease immediately upon termination of this Agreement for any reason in accordance with Section 2 hereof.

4. Compliance with Laws. Consultant represents and warrants that Consultant will render Services in compliance with all applicable laws, rules and regulations, including but not limited to the U.S. Food, Drug and Cosmetic Act, as amended from time to time, and the highest professional standards. Further, Consultant represents and warrants that she has not been, and is not under consideration to be (a) debarred from providing services pursuant to Section 306 of the United States Federal Food Drug and Cosmetic Act, 21 U.S.C. § 335a; (b) excluded, debarred or suspended from, or otherwise ineligible to participate in, any federal or state health care program or federal procurement or non-procurement programs (as that term is defined in 42 U.S.C. §1320a-7b(f)); (c) disqualified by any government or regulatory agencies from performing specific services, and is not subject to a pending disqualification proceeding; or (d) convicted of a criminal offense related to the provision of health care items or services, or under investigation or subject to any such action that is pending.

5. Compliance with Obligations to Third Parties. Consultant represents and warrants to Voyager that the terms of this Agreement and Consultant's performance of Services do not and will not conflict with any of Consultant's obligations to any third parties. Consultant represents that Consultant has not brought and will not bring with Consultant to Voyager or use in the performance of Services any equipment, funds, space, personnel, facilities, confidential information, trade secrets or other resources of any third party which are not generally available to the public, unless Consultant has obtained written authorization for their possession and use, nor will Consultant take any other action that would result in a third party, including without limitation, an employer of Consultant, asserting ownership of, or other rights in, any Work Product, unless agreed upon in writing in advance by Voyager. To the extent Consultant is subject to any policy of her employer that requires approval of agreements governing external consulting services, Consultant represents that such approval has been given and covenants that such approval will be obtained prior to entering into any amendment to this Agreement requiring such approval. Consultant will notify Voyager immediately of any breach of this Section 5.

6. Work Product. Consultant will promptly and fully disclose in confidence to Voyager all inventions, discoveries, improvements, ideas, concepts, designs, processes, formulations, products, computer programs, works of authorship, databases, mask works, trade secrets, know-how, information, data, documentation, reports, research, creations and other products arising from or made in the performance of (solely or jointly with others) the Services (whether or not patentable or subject to copyright or trade secret protection) (collectively, the "**Work Product**"). Consultant assigns and agrees to assign to Voyager all rights in the United States and throughout the world to Work Product. Consultant will keep and maintain adequate and current written records of all Work Product, and such records will be available to and remain the sole property of Voyager at all times. For purposes of the copyright laws of the United States, Work Product will constitute "works made for hire," except to the extent such Work Product cannot by law be "works made for hire". Consultant represents and warrants that Consultant has and will have the right to transfer and assign to Voyager ownership of all Work Product. Consultant will execute all documents, and take any and all actions needed, all without further consideration, in order to confirm Voyager's rights as outlined above. In the event that Consultant should fail or refuse to execute such documents within a reasonable time, Consultant appoints Voyager as attorney to execute and deliver any such documents on Consultant's behalf.

7. Confidentiality & Non-Use. During the Term and thereafter, except as otherwise permitted as set forth below, Consultant agrees to (a) hold the Confidential Information in confidence; (b) exercise reasonable precautions to physically protect the integrity and confidentiality of the Confidential Information; (c) not disclose any Confidential Information to any third party without the prior written consent of Voyager; (d) not use the Confidential Information for any purpose except as may be necessary in the ordinary course of performing Services without the prior written consent of Voyager; (e) treat Confidential Information with no less than a reasonable degree of care; and (f) reproduce Confidential Information solely to the extent necessary to provide the Services, with all such reproductions being considered Confidential Information.

Voyager's "**Confidential Information**" means (i) all Work Product; (ii) all information contained in or comprised of Voyager Property (defined in Section 8); and (iii) all confidential and proprietary data, trade secrets, business plans, and other information of a confidential or proprietary nature in written, electronic or other media, belonging to Voyager or its subsidiaries or third parties with whom Voyager may have business dealings, disclosed or otherwise made available to Consultant by Voyager or on behalf of Voyager in connection with this Agreement and/or Consultant's services hereunder. Consultant's obligations of non-disclosure and non-use under this Agreement will not apply to any portion of Confidential Information that Consultant establishes by competent proof: (a) was in the public domain at the time of disclosure through no wrongful act on the part of Consultant; (b) after disclosure, becomes part of the public domain by publication or otherwise, except by a wrongful act on the part of Consultant; (c) becomes known to Consultant on a non-confidential basis through disclosure by sources other than Voyager having the legal right to disclose such Confidential Information; or (d) is independently developed by Consultant without reference to or reliance upon Confidential Information.

Nothing in this Agreement prohibits Consultant from communicating with government agencies about possible violations of federal, state, or local laws or otherwise providing information to government agencies, filing a complaint with government agencies, or participating in government agency investigations or proceedings. Consultant is not required to notify the Company of any such communications; provided, however, that nothing herein authorizes the disclosure of information Consultant obtained through a communication that was subject to the attorney-client privilege. Further, notwithstanding Consultant's confidentiality and nondisclosure obligations, Consultant is hereby advised as follows pursuant to the Defend Trade Secrets Act: "An individual shall not be held criminally or civilly liable under any Federal or State trade secret law for the disclosure of a trade secret that (A) is made (i) in confidence to a Federal, State, or local government official, either directly or indirectly, or to an attorney; and (ii) solely for the purpose of reporting or investigating a suspected violation of law; or (B) is made in a complaint or other document filed in a lawsuit or other proceeding, if such filing is made under seal. An individual who files a lawsuit for retaliation by an employer for reporting a suspected violation of law may disclose the trade secret to the attorney of the individual and use the trade secret information in the court proceeding, if the individual (A) files any document containing the trade secret under seal; and (B) does not disclose the trade secret, except pursuant to court order."

8. Voyager Property. All documents, data, records, apparatus, equipment and other physical property furnished or made available by or on behalf of Voyager to Consultant in connection with this Agreement ("**Voyager Property**") shall be and remain the sole property of Voyager and shall be returned promptly to Voyager if requested. In any event, Consultant shall return and deliver all Voyager Property, including any copies thereof, upon termination or expiration of this Agreement, irrespective of the reason for such termination. Consultant will use Voyager Property only as necessary to perform the Services and will not transfer or make available to any third party the Voyager Property without the express prior written consent of Voyager. Consultant recognizes that Voyager's facilities are private and Consultant will abide by Voyager's security requirements and conditions for access and usage and agrees that only those subjects, areas and programs designated by Voyager as necessary to fulfill Voyager's requirements will be accessed and/or perused Consultant. In no event will any Confidential Information, programs or other information be copied or removed without Voyager's express written approval.

9. Publication; Publicity. Work Product may not be published or referred to, in whole or in part, by Consultant without the prior express written consent of Voyager. Consultant shall not use the name, logo, trade name, service mark, or trademark, or any simulation, abbreviation, or adaptation of same, or the name of Voyager or its subsidiaries for publicity, promotion, or similar non-regulatory uses without Voyager's prior written consent.

10. Independent Contractor Relationship. Nothing contained in this Agreement shall be deemed to constitute Consultant an employee of Voyager, it being the intent of the parties to establish an independent contractor relationship, nor shall Consultant have authority to bind Voyager in any manner whatsoever by reason of this Agreement. Consultant shall at all times while on Voyager premises observe all security and safety policies of Voyager. Consultant is excluded from participating in any fringe benefit plans or programs as a result of the performance of the Services, without regard to Consultant's independent contractor status, including, but not limited to, health, sickness, accident or dental coverage, life insurance, disability benefits, accidental death and dismemberment coverage, unemployment insurance coverage, workers' compensation coverage, 401(k) benefit(s), and any other benefits provided by Voyager to its employees. Consultant agrees, as an independent contractor, that Consultant is not entitled to unemployment benefits in the event this Agreement terminates, or workers' compensation benefits in the event that Consultant is injured in any manner or becomes ill while performing the Services under this Agreement. Because Consultant is an independent contractor, Voyager will not make any withholdings, deductions, or contributions (e.g., social security, unemployment insurance, disability insurance) from Consultant's fees, and will report Consultant's fees and other payments to Consultant on a 1099 form. Consultant shall bear sole responsibility for paying and reporting its own applicable federal and state income taxes, social security taxes, unemployment insurance, workers' compensation, and health or disability insurance, retirement benefits, and other welfare or pension benefits, if any, and shall indemnify and hold Voyager harmless from and against any liability with respect thereto.

11. Notices. All notices required or permitted under this Agreement must be in writing. Any notice given under this Agreement shall be deemed delivered when delivered by hand, by certified mail, by air courier or via facsimile to the parties at their respective addresses set forth above or at such other address as either party may provide to the other in writing from time to time. Notices will be effective upon receipt or at a later date stated in the notice.

12. Assignment. The rights and obligations of the parties hereunder shall inure to the benefit of, and shall be binding upon their respective successors and assigns. This Agreement may not be assigned by Consultant, and Consultant's obligations under this Agreement may not be subcontracted or delegated by Consultant, without the prior written consent of Voyager. For clarity, this Agreement may be assigned by Voyager with prompt notice of such assignment to Consultant.

13. Specific Enforcement. Consultant acknowledges that Voyager will have no adequate remedy at law in the event Consultant breaches the terms of Sections 4 through 9. In addition to any other rights it may have, Voyager shall have the right to obtain in any court of competent jurisdiction injunctive or other relief to restrain any breach or threatened breach of this Agreement.

14. Prior Agreements; Governing Law; Severability; Amendment. This Agreement embodies the entire understanding between the parties with respect to the subject matter of this Agreement and supersedes any prior or contemporaneous agreements with respect to the subject matter of this Agreement; provided, however, for the avoidance of doubt, that Consultant's obligations pursuant to Sections 6, 7 and 8 hereunder are in addition to any and all similar ongoing obligations that Consultant has to Voyager pursuant to the Retirement Agreement and/or the Restrictive Covenants Agreement referenced therein. This Agreement shall be governed by and construed in accordance with the laws of the Commonwealth of Massachusetts, without regard to any choice of law principle that would dictate the application of the law of another jurisdiction, and Consultant submits to the jurisdiction and agrees to the proper venue of all state and federal courts located within the Commonwealth of Massachusetts. Each provision in this Agreement is independent and severable from the others, and no provision will be rendered unenforceable because any other provision is found by a proper authority to be invalid or unenforceable in whole or in part. If any provision of this Agreement is found by such an authority to be invalid or unenforceable in whole or in part, such provision shall 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 law. This Agreement may be executed in one or more counterparts, each of which will be deemed an original, and all of which together will be deemed to be one and the same instrument. A facsimile or electronic copy of this Agreement, including the signature pages, will be deemed an original. This Agreement may not be amended, and its terms may not be waived, except pursuant to a written amendment or waiver signed by both parties.

15. Insurance. Consultant shall maintain such insurance as shall be reasonably necessary to insure itself against any claim or claims for damages arising out of the Services or this Agreement.

16. Certain Other Conflicts of Interest; Trading in Voyager Securities.

(a) Consultant represents that, except as disclosed in writing to Voyager, Consultant: (i) does not own directly or indirectly five percent (5%) or more of the stock or other equity securities of any entity which is a present or prospective competitor, customer or supplier of Voyager; (ii) is not aware of any legal proceedings pending or threatened against Consultant, or any reasonable basis for such proceedings, which (1) would conflict with Consultant's obligations hereunder or question the validity of this Agreement; or (2) may materially or adversely affect the business or prospects of Voyager; and (iii) is not aware of any fact concerning Consultant (either professionally or personally) which may materially or adversely affect the business or prospects of Voyager.

(b) Consultant is aware that the United States and other applicable securities laws prohibit any person who has material, non-public information about a company from purchasing or selling securities of such company or from communicating such information to any other person under circumstances in which it is reasonably foreseeable that such person is likely to purchase or sell such securities. Consultant may gain access to information in connection with the provision of Services that could potentially subject Consultant to insider trading liability (as defined under the US federal securities laws and regulations adopted by the United States Securities and Exchange Commission) in connection with trading in Voyager securities. Consultant shall comply with all relevant laws respecting any trading in Voyager securities.

IN WITNESS WHEREOF, the parties hereto have entered into this Agreement as of the Effective Date.

DINAH SAHVOYAGER THERAPEUTICS, INC.

By: */s/ Dinah Sah* By: */s/ Allison Dorval*

Name: Allison Dorval, Chief Financial Officer

Exhibit 31.1

Certification

I, G. Andre Turenne, certify that:

1. I have reviewed this Quarterly Report on Form 10-Q for the period ended June 30, 2019 of Voyager Therapeutics, 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 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 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, 2019

/s/ G. Andre Turenne

G. Andre Turenne
Chief Executive Officer, President, and Director
(Principal Executive Officer)

Exhibit 31.2

Certification

I, Allison Dorval, certify that:

1. I have reviewed this Quarterly Report on Form 10-Q for the period ended June 30, 2019 of Voyager Therapeutics, 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 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 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, 2019

/s/ Allison Dorval
Allison Dorval
Chief Financial Officer
(Principal Financial and Accounting 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 on Form 10-Q of Voyager Therapeutics, Inc. (the "Company") for the period ended June 30, 2019, as filed with the Securities and Exchange Commission on the date hereof (the "Report"), each of the undersigned officers hereby certifies, pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002 that to his or her knowledge:

1) the Report which this statement accompanies fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended; and

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

Date: August 9, 2019

/s/ G. Andre Turenne
G. Andre Turenne
Chief Executive Officer, President, and Director
(Principal Executive Officer)

Date: August 9, 2019

/s/ Allison Dorval
Allison Dorval
Chief Financial Officer
(Principal Financial and Accounting Officer)